



**STRATEGY  
RESEARCH  
PROJECT**

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

**AIRBORNE COMMAND, CONTROL, AND COMMUNICATIONS:  
A STRATEGIC IMPERATIVE FOR THE  
MARINE, AIR, GROUND, TASK FORCE**

**BY**

**LIEUTENANT COLONEL MARK D. MAHAFFEY  
United States Marine Corps**

**DISTRIBUTION STATEMENT A:  
Approved for Public Release.  
Distribution is Unlimited.**

**USAWC CLASS OF 2000**

**U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050**



**20000420 141**

USAWC STRATEGY RESEARCH PROJECT

**Airborne Command, Control, and Communications:  
A Strategic Imperative for the Marine, Air, Ground, Task Force**

by

LtCol. Mark D. Mahaffey  
United States Marine Corps

Dr. Jerry Comello  
Project Advisor

The views expressed in this academic research paper are those of the author and do not necessarily reflect the official policy or position of the U.S. Government, the Department of Defense, or any of its agencies.

U.S. Army War College  
CARLISLE BARRACKS, PENNSYLVANIA 17013

DISTRIBUTION STATEMENT A:  
Approved for public release.  
Distribution is unlimited.



## ABSTRACT

AUTHOR: LtCol. Mark D. Mahaffey

TITLE: Airborne Command, Control, and Communications: A Strategic Imperative for the Marine, Air, Ground Task Force

FORMAT: Strategy Research Project

DATE: 15 February 2000

PAGES:42

CLASSIFICATION: Unclassified

The history of the Marine Corps is replete with examples of strategic, operational, and tactical development, innovation, experimentation and employment. From a very humble and austere beginning in the late 1700s, to becoming the creators of amphibious warfare doctrine in the late 1930s, and from the Corps' initial experimentations with aircraft, to becoming today, the world's foremost authorities on the tactics, techniques, and procedures of close air support, Marines have been at the forefront of developing our nation's warfighting doctrine. Today is no different. As our nation's military forces struggle with such issues as downsizing, asymmetrical threats, and issues associated with roles and missions, the Marine Corps is once again leading the way in the development of concepts and doctrine for future warfare. This concept, articulated in the recently released document, *Operational Maneuver From the Sea (OMFTS)*, highlights a requirement for highly mobile, extremely lethal, fully integrated, expeditionary forces capable of conducting operations across the spectrum of conflict. In simple terms, OMFTS seeks to capitalize on the inherent strengths of maneuver warfare combined with the strategic advantages afforded by our dominance at sea. Critical to the success of this concept is the ability to capitalize on emerging technological advances with regards to mobility, fire power, and information/command and control networking. Here is where the disconnect exists. While the Marine Corps has taken great strides in correcting deficiencies with regards to mobility and fire power issues, little has been done to correct deficiencies associated with the Corps' command and control system. If the Marine Corps is to reap the maximum benefit afforded by OMFTS, then efforts must be directed at developing and fielding an enhanced command and control system fully supported by an airborne command, control, and communications platform.



## TABLE OF CONTENTS

ABSTRACT .....	iii
LIST OF ILLUSTRATIONS.....	vii
AIRBORNE COMMAND, CONTROL, AND COMMUNICATIONS: A STRATEGIC IMPERATIVE FOR THE MARINE, AIR, GROUND TASK FORCE.....	1
HISTORY AND INNOVATION .....	3
OPERATIONAL MANEUVER FROM THE SEA.....	8
THE ABCCC SYSTEM ISSUE.....	17
THE ABCCC SYSTEM REQUIREMENT .....	21
THE ABCCC SYSTEM SOLUTION .....	24
ENDNOTES .....	29
BIBLIOGRAPHY.....	33



## LIST OF ILLUSTRATIONS

FIGURE 1 - USMC DH-4 BIPLANE.....	1
FIGURE 2 - USMC PITCAIRN AUTOGYRO.....	1
FIGURE 3 - USMC HOS3-1 HELICOPTER IN KOREA.....	2
FIGURE 4 - HIGGINS BOAT.....	6
FIGURE 5 - LPD-17.....	12
FIGURE 6 - LCAC.....	12
FIGURE 7 - MV-22 OSPREY.....	13
FIGURE 8 - AAV.....	13
FIGURE 9 - KC-130J.....	13
FIGURE 10 - DD-21.....	14
FIGURE 11 - JOINT STRIKE FIGHTER (JSF).....	14
FIGURE 12 - MV-22 LIFTING THE M-777 (LIGHTWEIGHT HOWITZER).....	15
FIGURE 13 - ARMY AIRBORNE COMMAND AND CONTROL SYSTEM (A2C2S).....	22
FIGURE 14 - USAF ABCCC III.....	23



## AIRBORNE COMMAND, CONTROL, AND COMMUNICATIONS: A STRATEGIC IMPERATIVE FOR THE MARINE, AIR, GROUND TASK FORCE

*Those who expect to reap the blessings of freedom must undergo the fatigue of supporting it.*

—Thomas Paine, 1777

Throughout history, the Marine Corps has been at the forefront of our nation's strategic, operational, and tactical warfighting doctrinal development. The amphibious landings conducted by both the Army and the Marines Corps during World War II were only possible because of the effort, energy, and zeal expended by Marines in the late 1930s and early 1940s. The employment of aircraft in a close air support role as well as the use of rotary wing aircraft in both a medical evacuation role and troop assault or assault support role can all be traced to the Marine Corps and Marine innovation. While bombing operations were conducted by all air services during World War I, true close air support (CAS) operations and procedures were developed by the Marine Corps, flying DH-4, two place, single engine, biplanes, as shown in figure 1, during contingency operations in

Haiti, Santo Domingo, and Nicaragua in the early 1920s. These procedures were continuously refined by the Corps throughout operations in WW II and had become synonymous with the term "Marine Air" by the start of the Korean conflict. Similarly, military rotary wing operations trace their beginnings back to the Marine Corps as well. Initial experimentations with rotary wing aircraft date as far back as 1932, when the Pitcairn Autogyro, depicted in figure 2, was

used by the Marine Corps in Nicaragua.<sup>1</sup> But, because it lacked a useful payload, further operations were eventually curtailed. These initial trials did however capture the interest of the Corps and in January 1948, following the development of a practical rotorcraft, the Marine Corps' first experimental helicopter squadron, HMX-1, was established.<sup>2</sup> The hard work and innovation of the Marines assigned to HMX-1 paid great dividends to the Corps when, nearly two years later, on Sunday, June 25, 1950, North Korean troops and armored units unexpectedly poured across the border of South Korea, starting the Korean War. In less than three weeks time from the initiation of hostilities, the First Provincial Marine Brigade, consisting of the Fifth Marines, three fighter-bomber

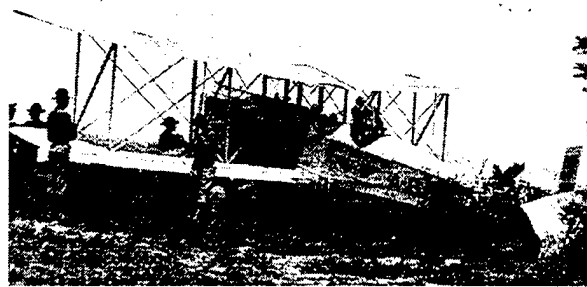


FIGURE 1 - USMC DH-4 BIPLANE



FIGURE 2 - USMC PITCAIRN AUTOGYRO

squadrons, and a light observation squadron, was assembled and headed towards the Korean peninsula. This light observation squadron, VMO-6, consisting of four Sikorsky HO3S-1 helicopters, shown in figure 3, and owing much to the efforts of those assigned to HMX-1, had the honor of being the first helicopter squadron in history to see combat.<sup>3</sup> Throughout the conflict, Marines assigned to VMO-6 pioneered new tactics and procedures associated with helicopter medical evacuation operations, artillery aerial spotting operations, and helicopter use in support of emergency resupply operations.

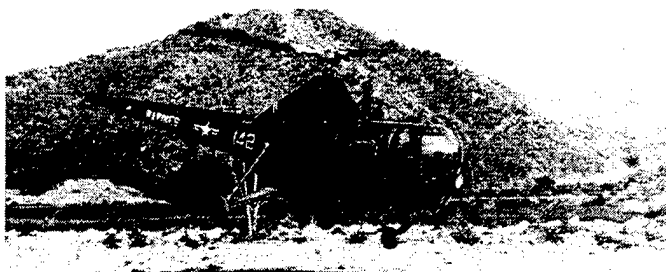


FIGURE 3 - USMC HOS3-1 HELICOPTER IN KOREA

During the lulls in conflict, while the other military services of our nation struggled with issues such as relevancy, debates over rolls and missions, and other parochial concerns, the Marine Corps quietly went to work identifying critical key concepts that had profound strategic impact on how our nation prepared for and waged war. Today is no different. With the end of the cold war and a shift in focus from a bi-polar world directed at Soviet Union and United States relationships, to a multi-polar world with a focused concern on an asymmetric threat, with increased anxiety over the potential for both state and non-state sponsored terrorism, brush fire wars, urban warfare, and war in the littorals, the services are once again wrestling with the key issues highlighted above. As this struggle and debate continues among our sister services, the Marine Corps, true to form, offers the nation a concrete concept on waging warfare in the next millennium. Recently published by the Marine Corps, this concept has been coined, *Operational Maneuver From the Sea* (OMFTS). While revolutionary in application, but evolutionary in design, this concept builds a framework where amphibious forces attempt to gain strategic leverage over any potential adversary by marrying the advantages of maneuver warfare; high operational tempo, focus on the enemy vice a focus on seizing key terrain, and attacking centers of gravity while simultaneously exploiting weakness and critical vulnerabilities, with the strategic advantages afforded by our dominance at sea; freedom of movement, strategic/operational surprise, force protection, and rapid logistics resupply. A cornerstone precept of this OMFTS concept is the fundamental idea of our ability to conduct *Ship to Objective Maneuver* (STOM) operations. This precept, STOM, focuses on thrusting combat units ashore in their fighting formations, to a decisive place, and in sufficient strength to ensure mission accomplishment, vice seizing a beachhead, gradually building up sufficient combat forces ashore, establishing a lodgment, and slowly and methodically seizing an objective, or series of objectives, inland. In simple terms then, *Operational Maneuver From the Sea* describes rapid maneuver by landing forces from their ships directly to objectives ashore, uninterrupted by topography or hydrography. Critical to the successful employment/implementation of this concept is our ability to capitalize on emerging technological advances as they impact and influence mobility, firepower and fire support, and command,

control, and communications systems. We have taken great strides programmatically and fiscally in two of the three critical areas noted. Our mobility concerns will be corrected soon with the delivery of the V-22 Osprey tilt-rotor aircraft as well as with the delivery of the advanced amphibious assault vehicle (AAAV). Fire power and fire support concerns are being rectified with the programmed delivery of the 155mm light weight howitzer, the Joint Strike Fighter (JSF), the Navy's Land Attack Destroyer (DD-21), and the upgraded Cobra attack helicopter, the AH-1Z. Yet remarkably, little has been done, or is being done, to correct deficiencies routinely identified with our ability, or more appropriately, inability, to command and control our current assets, let alone the assets and functions given the dynamics of the *Operational Maneuver From the Sea* concept. If we are to truly reap the maximum benefit afforded by OMFTS, then we must develop a concrete and coherent road map of required systems necessary to exercise organic command, control, and communications across the spectrum of conflict and geographic boundaries over our fielded forces, including those of our sister services as well as of our allies and potential coalition partners. Such a road map must include the requirement for an Airborne Command, Control, and Communications system if the Marine Corps is to remain strategically viable in the Joint/Combined warfighting world of the twenty first century.

## HISTORY AND INNOVATION

*They're after us! They're after us! Who's after us? The Army and the Navy, that's who!*

—Unknown Marine

On Friday, 10 November 1775 the First Continental Congress of the United States resolved that there should be "two battalions of American Marines, and that they should be so acquainted with maritime affairs as to be able to serve to advantage by sea when required."<sup>4</sup> So established the United States Marine Corps and, as they say, the rest is history. Throughout the illustrious history of the Corps however, many events have transpired, both remarkable and unremarkable, that have helped shape it into the organization it is today, simply, the worlds most preeminent amphibious warfighting force. The Marine Corps has fought at home and abroad in every major war in which this nation has participated, and in a number of lesser significant engagements as well. It is interesting to note, that the Marine Corps' first recruiting station was a roadhouse, Tun Tavern to be exact, and that the first leader of our Corps, Samuel Nicholas, managed a barroom. In the first two months of it's existence, the Corps acquired only ten officers and about two hundred rank and file. None of these recruits, officers or men, had much knowledge of war, for the officers were mostly artisans and merchants and the enlisted men were uneducated and largely unskilled immigrants. But an initial framework was being built and a strong foundation was being laid.

The initial mission of the Marine Corps was to provide security for the ships in which Marines were embarked. Additional tasks levied on the Marines included providing boarding parties, repelling enemy boarders, serving as snipers in the ships rigging during close action, leading landing parties, and serving as gun crews.<sup>5</sup> Their primary mission however, that of shipboard police, did not endear the Marines to their Navy associates, who realized quickly that they were there primarily to keep desertion minded sailors from jumping ship, to guard the rum supply, and to protect the officers against a mutinous crew. The Army, at that time, was also not enamored with the idea of a Marine Corps. General Washington let the Congress know that he saw the proposition of raising two battalions of Marines from his tiny army as a bad idea. He would have to pick over the entire army to find them, and this would not only cost the army time, anxiety, and pain, but would also weaken it.<sup>6</sup> In the end, General Washington had his way. By 30 November of 1775, he was relieved of the responsibility for finding the troops for the Marine units and, as it turned out, the two battalions provided for in the Congressional resolution were never formed, though several companies were. The Marines had experienced their first interservice conflict. It would not be their last.<sup>7</sup> A year later, with New York City in British hands and the Continental Army in retreat through New Jersey, with British forces in hot pursuit, Washington called for reinforcements; militia from Philadelphia, seamen from two frigates and three companies of Marines. In less than 72 hours, 131 Marines were mustered, provisioned, and started on their way to join General Washington's forces at Trenton. The Marine detachment from the privateer Hancock occupied Burlington, New Jersey, without bloodshed, and the battalion under Major Nicholas was engaged at Princeton, where they lost an officer and four Marines. Though not a key contributing force to the grand scheme of engagement on this occasion, the historically significant fact is that here, the Marines were called upon for the first time by the Army, and they responded promptly and willingly, as they have ever since.<sup>8</sup>

Since their first amphibious operations at New Providence in the Bahamas in early 1776, U. S. Marines had made more than 160 assault landings on hostile shores prior to the outbreak of World War II. They had seen action afloat as naval personnel, and they had operated ashore as ground troops, "Detached for service with the Army by order of the President," as the order read in accordance with the law: notably in the Mexican War and In World War I. The functions of the Corps have been many and varied but it was only with the gradual transition of the Navy from the sail to steam that a new emerging and long lasting mission of the Marine Corps began to evolve.<sup>9</sup> The advent of steam greatly compounded and complicated the Navy's supply problem. Steamships, unlike sailing ships, required fuel, vast quantities of fuel, and the quantities of fuel necessary to keep even a small squadron of steamships at sea for any reasonable period of time was obtainable only at well stocked and provisioned Naval bases. These bases in turn, had to be either ours or those of a friendly nation. Regardless of ownership, these bases had to be defended and from this basic principle, came a new mission for the Marine Corps, the defense of advanced Naval bases. As published in Executive Order 969 on 12 November 1908 and signed by President Theodore Roosevelt, "the Marines would thereafter, among other things, garrison

naval installations, provide the first line of defense of naval bases beyond the continental limits, as well as man the fixed defenses for those bases, garrison the Panama Canal Zone, and provide expeditionary forces as needed." Focusing once again on the mission of defending advanced Naval bases and continuing with the established logic of the time, the operating radius of the fleet was limited to a certain distance from its nearest source of supply, thoughts began to center on how best to extend the reach of our naval forces. Continuing with that thought process, if the enemy lay beyond the fleets radius, the only way to get at him was by obtaining bases farther advanced in his direction, by either seizing them before he got there or by taking them away from him if he got there first. And so, the prospect of yet a new mission for the Marine Corps began to arise, almost imperceptibly at first, but steadily none the less, the seizure of advanced Naval bases. The difficult question for the Corps thus became, how to do it.

Slowly over time, with many trials and tribulations, theory began to take root. Initial experiments and employment attempts were only partially successful at best and disastrous failures at worst. U.S. Marines experienced a small, but significant success, when a specially trained and organized battalion seized Guantanamo Bay, Cuba as an advanced Naval base for the United States Fleet operating against Admiral Cervera's squadron, then bottled up in Santiago Harbor during the Spanish-American War. But the capstone event impacting the future of amphibious operations was the British experiences at Gallipoli in 1915 during World War I. More than anything, this single event, served as the example of how not to conduct an amphibious landing. Most military organizations, experts and theorists around the world at that time highlighted this operation as the beginning of the end for amphibious operations. British military historian, B. H. Liddell Hart believed that amphibious assaults had become impossible. He wrote:

Offshore mines, beach obstacles, heavy artillery in fortified emplacements, integrated air defenses, aircraft for both observation and attack all favor the defense – so much so as to make such an assault difficult, indeed impossible.<sup>10</sup>

Likewise, United States Navy Captain, W. S. Pye had similar thoughts when he expressed these views on amphibious operations in a Naval Institute *Proceedings* article in 1926:

As a consequence of the greater effectiveness of modern weapons, modern ships, air scouting, and radio communication, and of the increase in the size of armies and of the complexity and amount of their equipment, large joint amphibious operations are becoming increasingly difficult. ... The chances for success of an invasion by forces transported overseas are becoming smaller and smaller.

In light of, and often in spite of these, as well as many other observations and writings, only the Marine Corps looked upon the failures of the British at Gallipoli for the answers in their search for the proper techniques and procedures required for the successful conduct of amphibious operations against an opposed beachhead. Throughout the early 1900s and through the 1920s the Marine Corps continued to refine techniques and procedures for amphibious operations. Exercises were held, schools were established and operational concepts as well as the first doctrinal visions began to take hold. In the early 1930s the Marine Corps published the document, *Tentative Manual of Landing Operations* (1934) which served as the doctrinal foundation of all Marine Landings in World War II. This manual, drawing heavily

on the lessons learned from the Corps' detailed study of the Gallipoli campaign, identified six points that required thorough consideration prior to the conduct of an amphibious operation. These six points were: command relations (a necessity for unity of command and precise allocation of subordinate responsibilities), Naval gunfire support (heavy support by naval guns would be required to suppress the defenders as much as possible), aerial support (especially necessary at the critical moment when the troops would touch ashore, when naval gunfire support would have to cease and the ground troops' artillery would not yet be in action), ship-to-shore movement (movement in tactical formation to lead directly into the assault; not a mere ferrying operation), securing the beachhead (the initial assault must capture a zone large enough to permit continuous landing of troops and supplies without serious interference), and logistics (referred to as combat loading; everything must be accessible at the time of landing in the order it would be needed for the amphibious assault).<sup>11</sup> Concurrent with the Corps' study of amphibious operations and the publishing of doctrine, Marines were equally busy developing the physical equipment necessary for transporting, or more appropriately, landing assault forces ashore. By far the greatest hurdle lay in the development of a craft suitable to embark both personnel and heavy support equipment (artillery) and transport them ashore through heavy surf onto an unimproved beach. The Marines found such a craft in the Louisiana bayous. Designed by a man named Andrew Jackson Higgins for use by oilman and fur trappers, as well as rum-runners during Prohibition, the "Eureka", or as it later became known, the "Higgins Boat" was a shallow draft, flat bottomed boat, that proved more than capable of satisfying the requirements identified by the Marine Corps (Figure 4).

Modified with a bow ramp and lengthened from thirty feet to thirty-six feet to accommodate the transport of tanks, the Higgins Boat served to revolutionize amphibious assault. In the words of General Holland M. Smith USMC: "the Higgins Boat, contributed more to our common victory than any other single piece of equipment used in the war."<sup>12</sup>

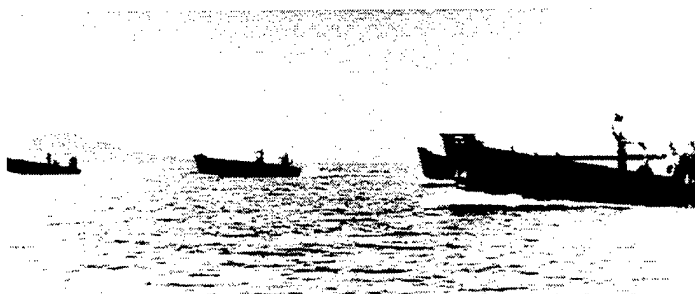


FIGURE 4 - HIGGINS BOAT

Finally, and by no means the least important contribution to the successful conduct of amphibious operations was the Marine Corps continued refinement and experimentation with its air component in a close support role. The art of dive bombing in close support of ground forces had its beginning in the Marines Central American "banana war" experience following World War I. The techniques, weaponry, and communications equipment and procedures were slowly acquired and perfected until World War II found Marine aviators confident in their ability to deliver ordnance in close proximity to friendly forces on the ground, and ground forces equally confident in their abilities to do so. Thus evolved the air/ground team that signifies a key distinction between the United States Marine Corps and all other military forces.

It was World War II that saw the Marine Corps come of age. Throughout its proud and illustrious history, World War II marks the crowning achievement that solidified the niche that the Corps' was and is to fill in our National Military Strategy. Every amphibious operation by the United States and its allies in World War II was to owe a large debt of gratitude to the Marine Corps. After Gallipoli, almost every armed service in the world felt pessimistic about the future of amphibious assaults. But simply by defining the specific problems into which amphibious operations divided themselves, and then working out solutions and fixes, the Marines proved that the preponderance of the issues were not insoluble. There is more truth than exaggeration in the statement made by General Alexander A. Vandegrift when he was Commandant of the Marine Corps after World War II had ended:

Despite its outstanding record as a combat force in the past war, the Marine Corps' far greater contribution to victory was doctrinal: that is, the fact that the basic amphibious doctrines which carried Allied troops over every beachhead in World War II had been largely shaped by U.S. Marines. Had Marines never fired a shot in this war, had they never sent a man overseas, their existence would have been more than justified by their original and unparalleled contribution to the field of prospective military theory in the development of the development of the amphibious art.<sup>13</sup>

Following World War II, the Corps was not idle. While many had once again predicted the end of amphibious operations, as exemplified in the remarks of General Omar Bradley, "I am wondering whether we shall ever have another large-scale amphibious operation." The Marines continued to pursue new strategies, improve techniques, and lobby for support. Only eleven months after General Bradley's remarks, the Marines were once again conducting an amphibious operation off the hostile shores of Korea, in a place called Inchon. And so it went.

Throughout the end of the 1940s to the present, the Marine Corps has grown in capabilities, solidified its place among the nations military forces, and has continued to develop and implement new operational concepts. The National Security Act of 1947, signed by President Truman on July 25th, not only established a safeguard for the continued existence of the Marine Corps, but provided a new and expanded mission for the Corps as well:

The Marine Corps shall be organized, trained, and equipped to provide fleet marine forces of combined arms, together with supporting air components, for service with the fleet in the seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign.<sup>14</sup>

Public Law 82-416, signed by President Truman on June 28<sup>th</sup>, 1952, provided that the Corps shall be so organized as to include not less than three combat divisions and three aircraft wings and placed the Commandant of the Marine Corps in a co-equal status with members of the Joint Chiefs of Staff when matters directly concerning the Marine Corps were under consideration.<sup>15</sup> In October 1978, the Congress enacted and the President signed legislation formally making the Commandant of the Marine Corps a member of the Joint Chiefs of Staff.<sup>16</sup> With regards to strategic and operations development, the Corps looked to new ways to enhance their expertise in the amphibious arena. Expanding on lessons learned

from their experiences in World War II and Korea, Marines began to wrestle with new ideas and to postulate new strategies for conducting amphibious operations. In the late 1980s and early 1990s, with a shift away from a cold war posture with the former Soviet Union to a focus on war in the littoral areas of the world, questions were quickly arising on how best to deal with this new emerging threat. True to form, the Marines got to work and began to act. In 1992, a collaborative Navy and Marine Corps white paper entitled "*From the Sea*" was published and a new vision of warfare focused on the littoral regions of the world began to emerge. Shortly on the heels of this document, as refinements and critiques were captured, identified and validated, the Department of the Navy published a follow on manual titled, "*Forward ...From the Sea.*" Both documents were attempts to articulate new concepts and approaches to naval operations, to identify closer, more intimate requirements between forces afloat and forces ashore, and were the first documents to introduce the concept of naval expeditionary forces. Each were profound in their articulation of requirements, concepts, and focus, and in combination, they laid the foundation for the Marine Corps 21<sup>st</sup> Century Warfighting Concept recently released, called, *Operational Maneuver From the Sea*.

#### **OPERATIONAL MANEUVER FROM THE SEA**

*Get there fastest with the mostest!*

—Nathan Bedford Forrest

Just as their predecessors had attempted to respond to emerging threats and capitalize on key opportunities when they first started exploring with the concepts and ideas associated with amphibious doctrine nearly seventy years before them, the Marines of today are trying to respond to the dangers facing us as we move into the next millennium and capitalize on the opportunities that new and advanced technology may afford us. The dangers and threats our nation will face are many and varied but can be characterized by religious, ethnic, social, and cultural intolerance and hatred, environmental clashes, economic competition in global markets, state and non-state sponsored terrorism, brush fire wars, urban warfare and war in the littorals. Almost every nation is becoming interdependent in the global marketplace. They compete for increasingly scarce resources; principally oil, to maintain economic expansion. Such growth is increasing the ability of emerging states to respond to security threats militarily with high tech systems and weapons of mass destruction. History has repeatedly proven that this mix of highly charged competing economics, limited natural resources, and weapons proliferation is a recipe for regional instability. Additionally, threats are increasingly multidimensional and are not limited to the power and authority of nation-states. Multinational corporations, non-government organizations, and bodies such as the United Nations, International Monetary Fund, and the World Trade Organization have acquired influence over a domain once controlled by governments.<sup>17</sup> More often, traditional lines of sovereignty are becoming blurred. The disintegration of the Soviet republics and Yugoslavia, the

tragedies in Somalia and Rwanda, and the conflict in Liberia signify the trend toward splintering nations along ethnic, racial, religious, and tribal lines.<sup>18</sup> The threat in the coming years of the next century will not be the sequel of "Desert Storm", but instead will in all probability be the stepchild of the Russians' experiences in Chechnya.<sup>19</sup> Our most dangerous enemy will not attempt to match us tank for tank or plane for plane as was the case during the Cold War, but will instead challenge us asymmetrically in ways against which we are today least able and prepared to combat. Events that have unfolded in only the last few years magnify this observation. On the 23<sup>rd</sup> of February in 1993, terrorists Ramzi Ahmed Yousef and Eyad Ismoil drove a bomb laded Ryder rental van into the basement parking garage of the World Trade Center in New York City, where they detonated it killing six Americans and injuring over 1000 others. The motive for this attack, as later reveled by statements the two attackers made following their capture, was to punish the United States for its support of Israel.<sup>20</sup> In August 1998, terrorists bombed two United States embassies in Africa, one in Kenya and one in Tanzania. The bombing in Kenya killed nearly 200 people and injured more than 5000, while the bombing in Tanzania killed ten people and injured more than 70. In 1998 alone, factional and small-scale conflicts raged out of control in more than 25 countries.<sup>21</sup> Lastly, existing and forecasted geopolitical dynamics strongly suggest that many of the threats the United States will face in the future will be associated with the littorals, those areas characterized by great cities, well-populated coasts, and the intersection of trade routes where land and sea meet. While representing a relatively small portion of the earth's surface, littorals provide homes to over three-quarters of the world's population, locations for over 80 percent of the world's capital cities, and nearly all of the marketplaces for international trade. Because of this, littorals are the place where most of the world's important conflicts are likely to occur.<sup>22</sup> Clearly our victory in the Cold War has not brought about a time of tranquility or the need for United States disengagement abroad. Threats to U.S. lives, property, interests, and economic well being are increasing worldwide, and potential threats to the United States homeland, as noted previously, could become an uncomfortable reality.

To best mitigate the threats we see emerging and materializing in the coming years, we are looking at how we can best couple changes in existing doctrinal and warfighting concepts with the rapid advances and breakthroughs we are experiencing with regards to technological innovation. Specifically, the technological advances that offer the greatest prospect for combating the dangers highlighted, as well as minimizing other potential and still evolving threats, can be linked directly to continued enhancements in the fields of information management and communications connectivity, battlefield mobility, and the improved accuracy and lethality of conventional weapons. Put more simply, continued technological enhancements with regards to our ability to shoot, move, and communicate will be far reaching and will have a significant impact on our ability to dominate any battlefield. These two competing challenges then, a new threat and enhanced opportunity afforded by advances in technological innovation, become significant when we visualize how we intend to fight in the 21<sup>st</sup> century. While neither have an appreciable effect on the nature of war, nor on our fundamental doctrine of maneuver warfare, they will

have a profound effect on where we fight, who we fight, and how we fight.<sup>23</sup> This in turn, will impact greatly how we organize our units, how we equip them, and how we exercise command and control over them. These issues then, are the challenges facing the Marine Corps as it refines the concept known as Operational Maneuver From the Sea.

Our naval services will play a pivotal role in the next century. Being strategically and operationally mobile, and free from relying on host nation support, basing rights and agreements, or permission to operate in theater, naval forces, and more precisely naval expeditionary forces, offer our CINCs as well as our Joint Force Commanders a multitude of flexible response and deterrent options not afforded by other military forces. Given these options, it is safe to suggest that naval expeditionary forces will therefore constitute the leading edge of our nations military response to any crises or conflict that may materialize in the coming years. If this is to be the case, we can no longer field naval expeditionary forces prepared to fight the battles of tomorrow with doctrine and weapons designed for the wars and conflicts of yesterday. We must adapt our forces to the realities of this new era and emerging threat that now faces us. We must field a naval force that can respond to a wide array of contingencies across the spectrum of conflict; from disaster relief and humanitarian operations to full-fledged sustained combat operations at sea and ashore. These forces must be organized, trained, and equipped with weapons and doctrine to simultaneously meet multiple challenges throughout this spectrum.<sup>24</sup> The centerpiece of the Marine Corps preparations for the future is an approach to expeditionary, littoral, and amphibious warfare known as Operational Maneuver from the Sea. In its simplest form, Operational Maneuver from the Sea is a marriage between maneuver and naval warfare. From maneuver warfare comes an understanding of the nature of conflict, the imperative of decisive objectives, and the requirement for high tempo operations conducted by well-trained and skillful leaders. Maneuver warfare is not mere movement of forces across the battlefield. It is by definition, warfare that is focused on the enemy, vice warfare focused on seizing enemy/key terrain. More specifically, it is warfare that is directed at an enemy's center of gravity, an objective such as a unit, capability, or system, that if seized, destroyed, or neutralized, will significantly and profoundly impact an opponent's capability to effectively continue the struggle. From naval warfare we gain the strategic and operational advantage afforded by our dominance as a sea power. Foremost among these advantages are our abilities to conduct unrestricted movement, achieve both strategic and operational surprise, conduct sea based resupply and logistics sustainment, provide force protection, and provide accurate long range fires and fire support. Thus, Operational Maneuver from the Sea is distinguished from all other forms of operational maneuver by the extensive use of the sea for operational advantage. The sea serves as an unhindered avenue for friendly movement and acts simultaneously as a barrier to the enemy.<sup>25</sup> Concurrently, unhindered movement about the sea gives our forces a mechanism for avoiding disadvantageous engagements. Naval expeditionary forces can simply move, relocate, or delay operations until suitable advantageous conditions are satisfied or a more favorable environment is found. Lastly, dominance of the seas provides our forces with safe assembly areas, attack

positions, and secure logistics sites. Theoretically then, Operational Maneuver from the Sea will couple doctrine with technological advances in speed/mobility, fire support, and information/communications systems to seamlessly and rapidly identify and exploit enemy weaknesses across the entire spectrum of conflict. When properly united, these elements of Operational Maneuver from the Sea will provide the United States with naval expeditionary forces that, while deployed unobtrusively in international waters, are instantly ready to help any friend, defeat any foe, and convince potential enemies of the wisdom of keeping the peace.<sup>26</sup>

Operational Maneuver from the Sea is not merely a way of introducing an expeditionary force onto foreign soil, but of projecting expeditionary power directly against an enemy center of gravity or exploiting enemy critical vulnerabilities or weaknesses. By capitalizing on our sea power advantage, naval expeditionary forces will be able to turn the operational maneuver space offered by the sea, as well as the associated littoral areas, into vulnerable flanks for potential enemies that are assailable at the time and place of our choosing. Conceptually, Operational Maneuver from the Sea envisions making the beach transparent to amphibious warfare through employment of a supporting mechanism known as ship-to-objective maneuver. True ship-to-objective maneuver is not aimed at seizing a beach, establishing and protecting a lodgment, and building up combat power ashore, but rather thrusting combat units ashore in their fighting formations, directly to a decisive place, and in sufficient strength to ensure mission accomplishment.<sup>27</sup> Operational Maneuver from the sea seeks to generate high operating tempo by combining our historic amphibious operations, ship-to-shore movement with what has traditionally been called subsequent operations ashore, into a single decisive maneuver directly from amphibious shipping. Revolutionary in application, but evolutionary in development, we have been previously unable to conduct ship-to-objective maneuver operations due to the physical limitations of our equipment (size, weight, reliability, etc.) and a corresponding inability to provide requisite sustainment and rapid resupply. As with the physical limitations of our equipment, difficulties associated with sustainment can be largely attributed to equipment design, materials utilized in their design, reliance on older technologies (analog vs. digital, tube vs. transistor, data cards vs. microchips), high petroleum, oil, and lubrication requirements, and reliance on heavy volume fires to achieve necessary suppression or neutralization of known and suspected threats/targets. Today, technological advances are solving these, as well as other problems/deficiencies at astonishing rates. Our ability to conduct ship-to-objective maneuver operations are being positively effected by recent and emerging technological advances in three principle areas; speed/mobility, fires/fire support, and command, control, and communications systems.

The successful conduct of operational maneuver requires mobility at the strategic, operational, and tactical levels of war. To function as an operational maneuver element, the Marine Air Ground Task Force must have the strategic mobility to reach the theater, the operational mobility to strike across the entire area of operations, and the tactical mobility to gain a positional advantage over the enemy once

ashore.<sup>28</sup> The introduction of new equipment, along with its technological enhancements, is affording us this capability. Carbon fiber composite technologies, advances in turbine engine design, reductions in fuel utilization, ongoing development of alternate fuel source engines, and navigation enhancements (GPS) have had a profound effect on our strategic, operational, and tactical mobility. Platforms have become lighter, stronger, faster, more maneuverable, and more survivable. More important, the Department of the Navy has moved quickly to take advantage of these revolutionary enhancements. Newly acquired systems, as well as those programmed for acquisition, are impacting or soon will impact, mobility concerns relevant to our ability to conduct ship-to-objective maneuver operations.

Strategic concerns are being reduced through the recent introduction of the Wasp class LHD, large deck Amphibious Assault Ships, to our Amphibious Ready Groups. These ships provide state-of-the-art sealift and amphibious assault capabilities to our naval expeditionary forces only dreamed of by our forces of yesterday. Planned introduction and programmed procurement of the San Antonio class Amphibious Assault Ship (LPD-17) will further enhance and expand our strategic as well as our operational mobility. The LPD-17, shown in figure 5, will carry 700 embarked troops and two landing cushion air craft (LCAC) in its well deck, while providing 25,000 square feet of vehicle stowage space, 36,000 cubic feet of cargo space and the capacity to accommodate four CH-46 equivalent aircraft.<sup>29</sup>

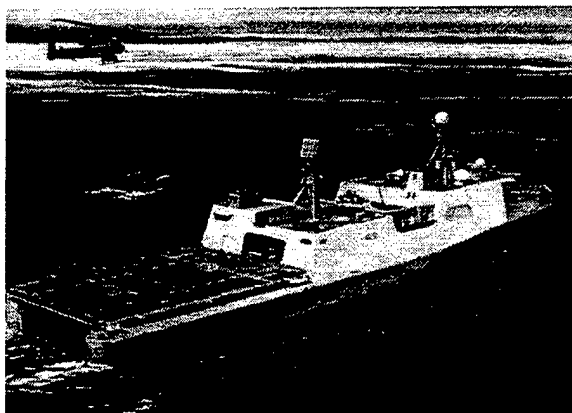


FIGURE 5 - LPD-17

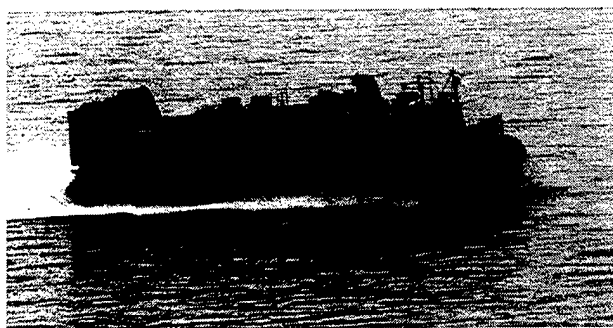


FIGURE 6 - LCAC

Operational and tactical mobility problems are also being addressed and remedied. The LCAC, shown in figure 6, is the first leg of our amphibious operational mobility triad. This craft has now been in fleet service for over ten years and provides unique surface assault options as well as over the horizon launch capabilities to our amphibious forces. Upgrades to these platforms

that will provide enhanced capability to transport people, supplies, and equipment are planned and funded. Other systems are coming, and soon. The MV-22 Osprey tilt-rotor aircraft, the second leg of our amphibious mobility triad, is being introduced to the Marine Corps today and will achieve an initial operational capability with Fleet Marine Forces in 2001. Depicted in figure 7, this revolutionary new platform is a key contributor to the realities and viabilities of the ship-to-objective maneuver concept. Capable of in flight refueling and self-deployment, the MV-22 has a flight ferry range of over 2,100

nautical miles. Additionally, the MV-22 is capable of transporting 18 fully equipped Marines in an aerial raid/assault configuration, a distance of over 200 nautical miles at a cruise speed of 240 knots.<sup>30</sup> In a nutshell, the procurement and introduction of the MV-22, with its range, speed, and payload capabilities, nearly triples the current area of influence of our naval expeditionary forces. The third leg of our enhanced amphibious triad is the programmed procurement of the advanced amphibious assault vehicle (AAAV), shown in figure 8. When delivered in 2008, the AAAV will



FIGURE 7 - MV-22 OSPREY

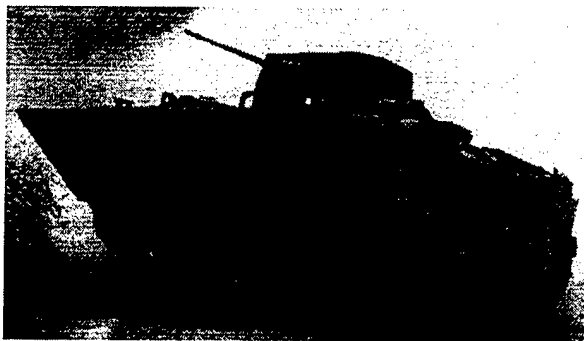


FIGURE 8 - AAAV

provide our amphibious forces with an over the horizon surface assault capability while carrying 18 combat equipped Marines. In developmental tests, the AAAV has demonstrated an over water speed of greater than 30 knots and an over land speed of over 55 mph. Additionally, the AAAV affords enhanced armor protection to the crew and Marines being transported to the battle area. Rounding out the Marine Corps operational mobility enhancements will be the planned procurement of the KC-130J refueling/assault support aircraft. Procurement of this aircraft will significantly impact our force sustainment and in-theater organic support capabilities. The KC-130J, shown in figure 9, brings to our aging refueling fleet critical enhancements in speed, range, endurance, and payload, while simultaneously correcting reliability concerns and operational readiness rates that fleet squadrons are currently struggling to manage.



FIGURE 9 - KC-130J

Tactical mobility concerns are also being aggressively addressed. The Marine Corps has, or will soon have, funded programs in place to remanufacture their 5-ton trucks, to procure a new 7-ton truck and a new fast attack vehicle (FAV), that is being designed from the ground up, for internal transport in the MV-22. Programs are also being structured to upgrade currently fielded high mobility multipurpose-wheeled vehicles (HMMWVs) while concurrently procuring a new enhanced version of the HMMWV as well.

Fire and fire support issues are being addressed by all warfighting agencies within the Department of the Navy (DoN). New ships, new weapons and new capabilities have been programmed, funded, and are being or soon will be, delivered. Naval surface fire support, historically referred to as naval gunfire support, has, since the decommissioning of our Battleships, been a missing component in our ability to provide requisite fire support to amphibious forces ashore. Routinely dismissed in the Navy POM, it is a requirement that Marine forces have, over the years, strongly lobbied for. The hard fight, and the shift in focus of our naval forces from "blue water" operations to the likelihood of war in the littorals, has finely had an effect and will soon bear fruit. The Navy's 21<sup>st</sup> Century Land Attack Destroyer, DD-21, as depicted in figure 10, is being designed from the keel up to provide support for forces ashore.<sup>31</sup> Enhancements over existing systems include incorporation of advanced major caliber gun systems, expanded precision weapons delivery capability, signature reduction, and increased survivability.



FIGURE 10 - DD-21

Fire delivery and fire support systems organic to the Marine Corps are also being modified, replaced, and procured in order to provide an enhanced capability to support amphibious forces. Because it is a relatively light force, the Marine Corps looks to its aviation combat element (ACE) to provide a preponderance of its deep and close in heavy fire support requirements. Given the age and technical obsolescence of many of the Corps current inventory of aircraft, Marine Aviation has developed a series of both long and short range plans designed

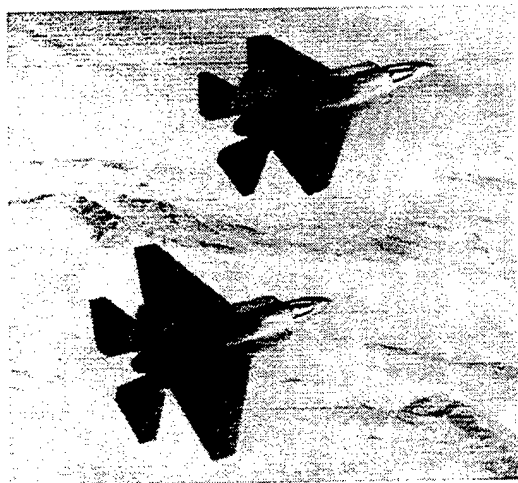


FIGURE 11 - JOINT STRIKE FIGHTER (JSF)

to modernize and enhance the ACE's capability. Programmed and budgeted, this road map establishes a clear path for all to see. Long-range plans within Marine aviation call for the replacement of currently fielded F/A-18C&D Hornet and AV-8B Harrier aircraft with a new Joint Strike Fighter (JSF) aircraft, shown in an artist depiction in figure 11. This aircraft will provide Marine aviation with a superior performance, state-of-the-art, multi-mission jet aircraft that can operate with full mission loads from amphibious ships or austere expeditionary airfields. The Marine Corps JSF will be a short takeoff and vertical landing capable, supersonic, stealthy, fighter/attack aircraft designed to surpass the combined strengths and

capabilities of the two aircraft it is slated to replace. Marine aviation has also identified near term enhancements that will positively impact fire and fire support requirements. Principle among these is the

programmed upgrade of our current inventory of AH-1W Cobra attack helicopters. Critical upgrades to the Cobra include replacement of the two bladed, teetering rotor system with a four bladed, bearingless, hingeless, rotor system, incorporation of glass cockpit technology, redesign of the weapons delivery system to incorporate six universal weapons stations, and the inclusion of enhanced aircraft survivable systems. So significant are the upgrades and modifications, that the aircraft has been given a new alphanumeric designation, the AH-1Z.

Planned upgrades and replacement of legacy systems are also underway within the Corps' ground combat element (GCE). The M-198, 155mm towed howitzer will soon be replaced with a new, lightweight, 155mm howitzer recently designated the M-777. This new artillery piece will provide Marine forces with a howitzer that offers a higher rate of fire, increased range, quicker response time, and most importantly, enhanced mobility. Due to a significant reduction in weight, mobility across the spectrum of conflict is enhanced both on the battlefield and in transport to and from the battlefield. Nearly 7,000 pounds lighter than the M-198, the enhanced mobility that the M-777 provides our operational forces is highlighted in Figure 12. Today, the only helicopter in the Marine Corps inventory that is capable of lifting/transporting the M-198 is the CH-53E. Once the M-777 is delivered to the fleet, both the CH-53E and the MV-22, will be capable of transporting it. Once ashore, the M-777 is capable of traversing 20 percent rougher ground and can more easily be moved off the beach if delivered by surface, vice helicopter, means. With regards to strategic mobility, the smaller size and footprint of the M-777 means that more guns can be transported to the contingency area via strategic lift. Aircraft such as the C-130 and C-17 can carry twice as many M-777s as M-198s, and the C-5 can carry 12 of the lightweight howitzers as opposed to eight M-198s.<sup>32</sup> Additionally, a new mortar system is being evaluated by the Corps, as is a new assault gun variant of the light armored vehicle (LAV). Lastly, while the AAV will certainly provide enhancements in operational and tactical mobility, the new 30mm gun system designed for this vehicle will contribute markedly to the Marine Corps fire support capabilities as well.

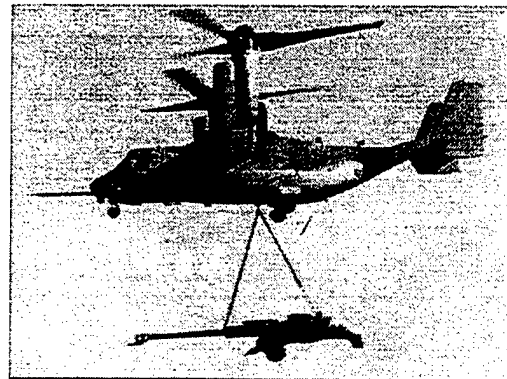


FIGURE 12 - MV-22 LIFTING THE M-777 (LIGHTWEIGHT HOWITZER)

Weapons, ordnance, and munitions upgrades and improvements are also here, or on the horizon. Though inventories are at times, alarmingly low, the introduction of new precision guided weapons systems have revolutionized the nature of war. No longer are large volumes of fire required to achieve desired/necessary threat suppression, neutralization, and destruction effects. Single weapons now provide the force commander with the capability to successfully engage point /fixed targets with what use to require hundreds, if not thousands, of rounds of ammunition or loads of bombs. The new nature,

improved accuracy, and enhanced lethality of weapons such as the surface launched Tomahawk Land Attack Munition (TLAM), the air launched Stand-off Land Attack Munition (SLAM), the Joint Direct Attack Munition (JDAM), and the Joint Stand-Off Weapon (JSOW), as well as the helicopter launched Hellfire II missile, all contribute exponentially to our ability to conduct fire and fire support operations.

Nowhere have the effects of technology been more profound, nor more revolutionary in their effects on how we conduct business, than in the field of information management and communications connectivity. Fax machines, cell phones and E-Mail, have, for the most part, replaced the standard communications systems of yesterday such as the military message, the written letter, and the telephone. Today, we can communicate and transmit not only voice but secure, digital, real time/near real time, video images via a satellite link to any location of our choosing. We can talk to ships at sea and communicate to space probes on the surface of Mars, but sadly, Marine forces can not routinely communicate with higher, adjacent, or subordinate elements when separated by a ridge line at 29 Palms, California, during the conduct of a Combined Arms Exercise (CAX). Quoting from a Marine Corps Lessons Learned System (MCLLS) document, dated 23 August 97:

Mountainous terrain throughout the Twenty-nine Palms range complex and potential areas of future conflict dictate the necessity for enhanced communications connectivity Throughout [sic] the MAGTF. A major deficiency that exists within the MAGTF is the lack of an organic ABCCC platform capable of providing "long haul" (SATCOM), secure, reliable communications connectivity, to our force commanders, regardless of terrain, distance, or area of operation.

This is not an isolated incident, but a problem routinely articulated and identified in hot-wash-ups and after action reports generated by Marine Corps units following field exercises, training evolutions, and MEU (SOC) deployments. The inability to communicate with the lead elements of our assault forces while enroute to the objective, given an over the horizon, at sea launch scenario, as envisioned during an OMFTS evolution, could prove disastrous to the conduct of the mission. Even more critical to the success of a mission however, is the ability to establish and maintain contact with one's forces once they have arrived on the objective and have disembarked or off-loaded from their assault platforms (LCAC, V-22, or AAV). The current inability to exercise requisite command, control, and communications over/with our units unnecessarily hazard our forces and places into question the overall feasibility of the OMFTS/STOM concept. Recall, the three pillars supporting the Operational Maneuver From the Sea concept, reside in our ability to leverage technological enhancements in the areas of mobility, fires/fire support, and communications connectivity. Programmatic initiatives are underway and have been highlighted that will correct deficiencies and shortfalls identified with regards to mobility and fire/fire support concerns. Similar corrective actions are required to correct deficiencies routinely identified with our inability to exercise command, control, and communications over/with our forces. Regrettably, these actions have not been taken.

Ship-to-objective maneuver is a tactical concept for the conduct of amphibious operations in support of Operational Maneuver From the Sea. It applies maneuver warfare concepts to the littoral battlespace. By doing so, a landing force will be capable of seamless maneuver from over the horizon directly against objectives inland.<sup>33</sup> But, this concept is only viable if we can communicate with this force, and exercise command and control over it! Here than is one of the Marine Corps biggest hurdles. If the Corps is to truly reap the maximum benefit afforded by the OMFTS concept, a concrete and coherent road map of requisite systems necessary to exercise organic command, control, and communications over the force must be developed. Such a road map must include the requirement for an airborne command, control, and communications system if the Marine Corps is to see the OMFTS concept through to fruition and remain strategically viable in the Joint/Combined warfighting world of the 21<sup>st</sup> century.

### **THE ABCCC SYSTEM ISSUE**

*The only excuse for aviation in any service is its usefulness in assisting troops on the ground to successfully carry out their operations.*

—Alfred A Cunningham (The Marine Corps first aviator)

The requirement for an airborne, command, control and communications (ABCCC) system for the Marine Corps is not, nor should it be viewed by either those in or outside of the Marine Corps, as an attempt to undermine or usurp sister service responsibilities. Nor should addressing this requirement degenerate into a roles and missions debate. The requirement to provide an enhanced command and control capability for Marine forces is best stated in the 1997, National Military Strategy document of the United States:

The ability to gather, process, and disseminate an uninterrupted flow of reliable and precise information under any conditions is a tremendous strategic and military advantage. A secure C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) architecture must be designed and developed from the outset for rapid deployment and with joint and multinational interoperability in mind.<sup>34</sup>

Nowhere is the current capability more lacking and enhancements more greatly required, than in the United States Marine Corps. Additionally, nowhere does the procurement of such enhancements offer our nation a greater return on the investment.

In accordance with guidelines and directions from the Secretary of Defense, each Military Department or Military Service, as appropriate, has the following common functions and responsibilities pertaining to joint operations:

- a. To provide interoperable and compatible C4 systems, warfighters, and reserves of equipment and supplies for the prosecution of war and to plan for the expansion of peacetime communications to meet the needs of war.

- b. To provide, organize, and train C4 systems personnel and provide interoperable and compatible C4 systems equipment for joint operations.
- c. To install, operate, and maintain assigned facilities of Defense Information Systems Network (DISN), including the capability of meeting the provisions of applicable standards. The Service responsible for operation and maintenance of the DISN facility will be responsible for providing the conditioning equipment required to effect the DISN or non-DISN interface.
- d. To maintain mobile, transportable C4 systems assets, which are controlled by the Chairman of the Joint Chiefs of Staff, in a high state of readiness.
- e. To cooperate with and assist other Services in accomplishing their C4 system functions, as determined by proper authority.<sup>35</sup>

With this in mind, an examination of the Marine Corps command and control system is warranted. All Marine Corps operational forces are organized, trained, and equipped to fight as Marine Air Ground Task Forces (MAGTFs). Regardless of size, each MAGTF consists of a command element (CE), a ground combat element (GCE), an aviation combat element (ACE), and a combat service support element (CSSE). Within each of these elements, resides a resident capability to conduct command and control functions. These functions can be exercised between higher, adjacent, and subordinate elements of the MAGTF, between higher, adjacent, and subordinate organic units of each element of the MAGTF, and between higher, adjacent, and subordinate elements of joint/combined forces. By design, the Marine Corps exercises command and control through an intricate network involving all forms of communications connectivity; land line, radio, microwave, and satellite links to name a few. Disappointingly, the Marine Corps has failed to modernize its command and control system sufficiently to keep pace with the increased demands of the modern battlefield, or sufficiently to handle the increased complexities associated with joint and coalition warfare. If not corrected, this failure or reluctance to modernize, could have a significant impact on the Corps' futuristic warfighting concepts as we begin to move into the 21<sup>st</sup> Century.

The Marine Corps continues to place an over reliance on obsolete, line-of-sight, communications equipment. While frequency hopping radios (Have Quick and SINCGARS) are beginning to be fielded, interoperability issues between ground and aviation units have been left unresolved and the management and distribution of training frequency fills, have not been adequately addressed. Satellite communications systems and devices have not been procured in sufficient quantities, nor distributed in proper amounts, to provide necessary intelligence dissemination and communications connectivity down to the battalion/squadron headquarters. Aviation platforms equipped with satellite communications systems, lack the requisite capability to communicate with their parent commands over these "nets" because the necessary down link stations have not been procured nor distributed to the squadron level. Moreover, Marine Air Group (MAG) headquarters also lack the requisite hardware necessary to effect satellite communications connectivity. Likewise, table of equipment (TE) allowances for principle aviation support

agencies such as the Direct Air Support Center (DASC) and Air Support Liaison Teams (ASLT), though change and upgrades have routinely been requested and solicited, remain void of any satellite communications systems or capabilities. One could make a strong and compelling argument that these agencies would benefit most from such additions/enhancements. Communications "stove piping," lack of networking capabilities, and the challenges associated with interoperability, both within and outside of the MAGTF, compound the Corps command and control problems. Additionally, "fairy dusting" communications repeater stations and administratively inserting radio retransmission sites, during the conduct of field training exercises, has had the unintended consequence of hiding problems and covering up deficiencies. Only when these stations become inoperative do we begin to understand the seriousness of our command and control problems. When these systems do fail, or when it is not possible to administratively insert repeater stations, as is most often the case during real world contingency situations, the operators look first to Marine aviation for assistance.

Unfortunately, Marine aviation is plagued with similar, if not more severe, problems. Elimination of the OV-10 Bronco aircraft from Marine Corps inventories in the early 1990s, and the failure to replace this platform's capability in the C&C arena, could be argued as an initial step backwards in Marine aviation's ability to exercise organic command and control functions. Additionally, a planned replacement aircraft for the OV-10, coined the VMAO, has taken a back seat to other, higher priorities within the Marine Corps and future procurement decisions for this platform have been delayed or terminated. Today, the principal mechanism for providing airborne command and control to USMC forces is through a 1960s vintage system called the AN/ASC-26 communications package. Usually configured in the back of a UH-1N (Huey) helicopter, the AN/ASC-26 package provides a four-station system, outfitted with one UHF radio and two VHF radios, from which commanders can exercise command and control. As can be seen, problems abound given today's environment. Since both UHF and VHF radio frequencies must rely on line of sight for maintaining communications connectivity, the system is woefully inadequate in providing the Marine Corps with a much needed long haul communications capability. The four station, three radio capability of the AN/ASC-26 package is at worst, incapable of providing the necessary command and control functions given the complexities of the modern battlefield and at best, only marginally capable of providing these functions. Furthermore, the vintage UHF/VHF radios procured for this system are not able to interface with modern, state of the art, frequency hopping radios, such as Have Quick and SINCGARS, and additionally, are not capable of either transmitting or receiving digital information. Finally, due to age, obsolete design, and lack of adequate supply support and spare parts inventory, reliability problems have begun to impact this communications suite. Upgrades to the UH-1Ns internal communications suite have been implemented as an interim solution to command and control deficiencies noted. Incorporation of three ARC-210, full frequency spectrum radios, into the Huey's architecture have gone far in alleviating some deficiencies and enhancing some capabilities, but fall short of solving the Corps command and control problems. Two of the three ARC-210 radios are usually

required for use by the aircrew and the third radio, though reserved for dedicated use by the designated commander, just does not provide the degree of flexibility and latitude of control required of an airborne C&C platform. Additionally, other work-arounds and quick fixes have been initiated and attempted in order to minimize or mitigate deficiencies. The Marine Corps often assigns its two seat, F/A-18D platforms, to act as radio relay and tasks the aircrew to conduct air control operations. But these aircraft do not routinely support amphibious ready group (ARG) operations and their limited on-station times and inadequate communications suite, as compared to a command and control platform, prohibit it from assuming a primary command and control function. Marine Corps AV-8B aircraft assigned to MEU (SOC) squadrons have also been used as radio relay platforms. These aircraft have even shorter on-station times than do the F/A-18s and their single man cockpit and even less capable communications system negate them from assuming a primary role as a command and control platform as well. Lastly, the Marine Corps possesses a Direct Air Support Center (Airborne) (DASC (A)) system. Within Marine aviation's command and control system, the DASC, in simple terms, is the agency responsible for assisting the Tactical Air Commander (TAC) in fighting the ground war with aircraft. Because the ground DASC has no radar capability, it exercises control of aircraft via procedural methods (check points, reporting points, air routes) and continuous communications. When this type of control is exercised over long distances and in mountainous terrain, with aircraft flying tactical, nap-of-the-earth (NOE) flight profiles, control, more often than not, breaks down. For these reasons, the Marine Corps fielded a DASC (A) platform. The airborne DASC is a self-contained communications package designed for installation in the back of USMC KC-130 aircraft. Much like the AN/ASC-26 package however, the system has not been modernized sufficiently to provide the enhanced capabilities required of modern warfare, nor have sufficient quantities been procured to provide requisite support to the MAGTF. While upgrades are sorely needed for the Corps' DASC (A) system, the KC-130 is not the optimal platform required to provide dedicated support to deployed amphibious/expeditionary forces. Its size, logistics support footprint, and shore basing requirements are principle factors impacting this aircraft's ability to provide dedicated support to amphibious forces and hence, solutions to the Marine Corps command and control problems must be sought elsewhere.

Procurement and distribution of additional satellite communications systems is essential, but increasing our reliance on already scarce satellite resources would seem imprudent and failure to seek other options and solutions would be unwise. Additionally, while satellite systems certainly provide adequate communications connectivity, they do not afford the flexibility or utility of an airborne platform. They cannot give the commander a feel of the battle nor can they transport him to or get his eyes on the battlefield. Only an airborne system can do this. Clearly, as the Marine Corps begins to fully embrace the 21<sup>st</sup> Century warfighting concept, Operational Maneuver From the Sea, an enhanced capability is required. Several compelling factors highlight the need for the Marine Corps to field an airborne, command, control, and communications (ABCCC) system. Foremost among these factors is the

requirement to field a system that would most easily and most expeditiously correct deficiencies today while concurrently providing an optimized capability to exercise command and control functions over a modernized force of tomorrow. Additionally, an airborne system would provide the greatest flexibility and utility to a commander given the spectrum of conflict we are most likely to face in the 21<sup>st</sup> century. And finally, an airborne system would provide the USMC with an optimized capability to exercise command and control over joint and/or combined forces.

## THE ABCCC SYSTEM REQUIREMENT

*We will have to make hard choices to achieve trade-offs that will bring the best balance, most capability, and greatest interoperability for the least cost.*

— Joint Vision 2010

As the nations forward deployed, "911" force, the Marine Corps has an obligation to be the most prepared for conflict when the nation is least prepared, to be the best trained, the most capable, and the best equipped force possible. First tasked to kick in the door, provide disaster relief, or humanitarian assistance, because the Corps is most often the first force capable of responding to such crisis, brings with it certain necessary capabilities. Inclusive in these capabilities is the requirement for effective command, control, and communications. To best provide the capability required, the Marine Corps must develop a plan to replace the aging and obsolete AN/ASC-26 communications package with a state of the art, airborne, command, control, and communications system. Such a system would provide an enhanced capability for the Marine Corps to exercise command and control over organic forces, as well as provide an enabling capability to exercise C&C in the joint/combined arena, either as a Joint Force Commander, or as a component of a Joint Task Force. One needs only a cursory review of lessons learned from recent military operations to gain an appreciation for what an ABCCC system can provide an expeditionary force. Perhaps the capabilities an ABCCC system offers a force commander was best summarized following the *Provide Relief* Operation in Somalia:

One important innovation during this phase of the operation was the use of the Airborne, Command, Control, and Communications System (ABCCC). The use of ABCCC aircraft in a primitive operating environment provided a range of critical capabilities – especially communications relay and airlift coordination - that may well suggest a model for future operations in similar areas.<sup>36</sup>

If the Marine Corps is correct in the assumption that future crisis and conflict will most often occur in the littorals of the world, and that the essentials of responding to that crisis or conflict are limitations in time, mobility, fires/fire support, and information management, than clearly the most pressing problem for the Marine Corps today, if not the nation, is the need to correct the limited capability of our forward deployed, expeditionary forces, to conduct C&C functions. Foremost among the measures to be taken is the necessity to develop, procure, and field an ABCCC system for the Corps.

To remain strategically viable, now and in the future, the Marine Corps requires an airborne system capable of providing long range, secure, reliable communications connectivity to the MAGTF. The system must provide a networking capability via digital data link, to all elements of the MAGTF, to other joint command and control systems and platforms, such as the Joint Surveillance and Target Attack Radar System (JSTARS), the Airborne Warning and Control System (AWACS), to Rivet Joint platforms, to reconnaissance systems such as remote piloted vehicles (RPVs) and unmanned aerial vehicles (UAVs), and to AEGIS Cruisers. As required, the system must be capable of operating and interfacing with coalition force C&C systems and civil agencies. Specifically, the new system must provide multiple and redundant workstations, each configured with high definition, night vision goggle compatible, multi-functional displays. These workstations must provide modern communications links necessary for commanders, staff officers, and/or their designated representatives, to conduct command and control functions (full frequency spectrum radios, anti-jam/ frequency hopping functions, satellite links, and keyboard communications capabilities). These displays must provide templated scratch pad functions to assist in airspace control operations, fire support coordination functions, and battlespace management. The ABCCC system must provide moving map displays, interfaces with mission planning systems and have a mission data loading capability. Additionally, the system must be able to transmit and receive both still as well as video pictorial images and be capable of passing and receiving digital/burst information. The ABCCC system must be fully supported within the Marine Corps logistics system and sufficient assets must be fielded to support routine MEU deployments, Air Contingency Force (ACF) commitments, and scheduled training exercises while also having sufficient on hand systems to provide a surge capability given an unexpected contingency situation. While such a system is not in service today, both the Army and the Air Force have systems that offer desired capabilities if modifications and weight reductions could be achieved.

Based on lessons learned in the Persian Gulf war, concerning the inability of communications links to keep up with the fighting forces, the United States Army began investigating ideas and concepts that would provide an enhanced C2 capability to their major subordinate commanders. Today, based on the results of their study, they are in full-scale development of an Army Airborne Command and Control System (A2C2S). Depicted in figure 13, this airborne command post, being designed for installation in the back of



FIGURE 13 - ARMY AIRBORNE COMMAND AND CONTROL SYSTEM (A2C2S)

a UH-60 Black Hawk helicopter, will have five workstations to accommodate a commander and four staff officers – typically an operations intelligence, and fire support officer and a systems administrator.<sup>37</sup> Central to A2C2S is a new technology, referred to as software programmable radios, which will permit eight radios to do the work of 30 conventional ones. The software generates waveforms and reconfigures radios for a mix of voice, data, and video communications. It is designed to be capable of simultaneously transmitting, receiving, encrypting, decrypting, and processing transmissions from all current and planned military data links, broadcasts, and voice channels.<sup>38</sup> Taking advantage of advances made in the commercial world, the system relies heavily on commercial-off-the-shelf hardware and an open system, shared network, architecture. When fielded, the A2C2S system will provide the Army with a seamless sensor-to-shooter connectivity capability and will serve as a relay when the distance between higher, adjacent or subordinate elements is too great to effectively communicate via existing systems or when their radios are not interoperable, as is often the case during joint/combined operations. The Army envisions using the A2C2S for corps, division, and brigade commanders, and hopes to initially buy six for each division, or 12 per corps. A decision to enter full production will follow ongoing operational test and evaluation and is currently slated for first quarter of Fiscal 2002.<sup>39</sup>

The United States Air Force also continues to upgrade, modify, and enhance their airborne command and control capabilities. An airborne battlefield command control center phase III (ABCCC III) system was delivered to the Air Force just prior to Operation Desert Shield and had profound effects on the Air Force's ability to exercise command and control over joint and coalition forces. At a press conference in Washington, D.C. in late March of 1991, General Fornell heralded the system as a linchpin in turning the tide of battle. "This aircraft provided [U.S. commanders] real-time control of the battle,"

General Fornell said.<sup>40</sup> The nerve center of this system, shown in figure 11, is a capsule housing 15 automated workstations that is slid into the back of a modified C-130 aircraft, and containing sophisticated communications technology.<sup>41</sup> The system is capable of displaying up to 1000 air and ground targets in real time, can electronically, via computer

interface, track and coordinate the air tasking order (ATO), and each operator has access to

a communications suite of 23 frequency hopping Have Quick voice radios and two teletype circuits, including eight UHF, four VHF/AM, four VHF/FM, and four HF radios, plus three satellite communications links.<sup>42</sup> The high resolution consoles are capable of displaying digitized maps, battlefield overlays, friendly and enemy situations, and can interface with common mission planning and communications

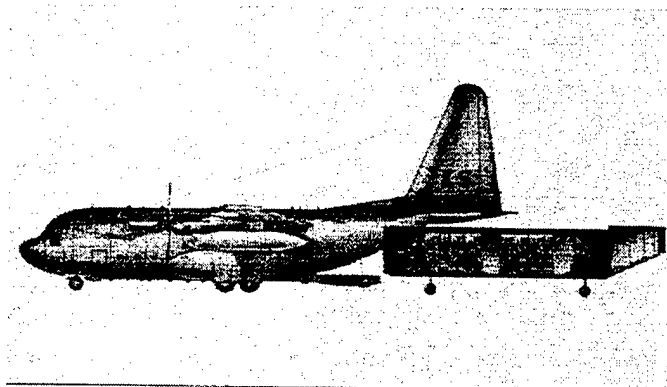


FIGURE 14 - USAF ABCCC III

networks. Finally, the system is fully supported by a ground-based map support station that can regenerate new digitized maps, of any location in the world, of scales ranging from 1:500,000 to 1:50,000, to meet any mission need.

As can be clearly seen, while both the Army and the Air Force continue to modernize and reap the benefits of the technological advancements being achieved by the commercial world, the Marine Corps lags behind and runs the risk of lacking strategic viability due to interoperability concerns, as our sister services adapt to the command, control, and communications requirements of future warfare.

### **THE ABCCC SYSTEM SOLUTION**

*Command and control is essentially about effective decision-making and effective execution. The sole measure of effectiveness of any command and control component – technology, organization, procedure, whatever – is whether it facilitates timely decision-making and execution. Stripped to its essentials, this is what command and control is all about.*

— LtGen. Paul K. Van Riper USMC

Essential to the conduct of Operational Maneuver From the Sea is the necessity to develop, procure, and field a fully functional command and control system that is capable of exercising these functions, across the spectrum of conflict and in any geographic region of the world. An integral part of this system, must be the fielding of an airborne, command, control, and communications system. The Marine Corps must capitalize on the ongoing efforts within the Army and the Air Force related to their C&C modernization programs, and where appropriate, integrate similar/identical capabilities into an airborne system designed to support the MAGTF. Timing could not be better. Over the next four to six years, the Marine Corps will be fielding three new aviation platforms, the UH-1Y, the MV-22, and the KC-130J. Each of these platforms offers a window of opportunity for the Marine Corps to seize the moment, and begin integration efforts of a modular ABCCC system.

The UH-1Y, an upgraded version of the currently fielded UH-1N, and scheduled for IOC in 2004, affords the Corps an ideal platform from which to conduct C&C functions. The increased payload capability of the "Yankee" coupled with an expanded on-station time, would provide the necessary performance enhancements required of a "low-end" command and control platform. Additionally, as with the UH-1N, the UH-1Y is being fielded in sufficient quantities to support all elements of the MAGTF as well as routinely serving with USMC MEU (SOC) squadrons.

The MV-22, as previously discussed, offers a wide range of performance and operational enhancements to the Marine Corps not provided by any other fielded or proposed aircraft. When the OMFTS concept is viewed in its entirety, one would be hard pressed to identify a better platform from

which command and control could be performed. It's unique capabilities to function as both a rotorcraft and a fixed wing aircraft, coupled with its long range, extended time on station, airborne refueling capability and large payload, ideally suite it for filling the C&C role for our amphibious/expeditionary forces.

The KC-130J, also previously discussed, offers unique opportunities for the Marine Corps to enhance C<sup>2</sup> functions. Expanded performance with regards to speed, range, endurance, payload, and reliability make the KC-130J well suited to perform the Marine Corps "high-end" command and control functions during sustained operations or in operations where other assets are overly committed or better tasked to conduct missions other than C&C.

While timing is good, it is also of the essence. If the Marine Corps is to maximize the benefit in the command and control arena with the planned arrival of the aircraft mentioned, much ground work is yet required. To take full advantage of the wide diversity and performance characteristics of these aircraft, the Marine Corps needs to develop and procure a modular, universal system, that can be tailored for given/specific missions as well as for installation in any/either of the above aircraft. While this concept is specifically directed toward providing an airborne capability for the Marine Corps, because of the inherent advantages (strategic/operational mobility, range, line of sight, flexibility) offered by an airborne platform, there would be much utility in fielding a common, modular system, for employment across the MAGTF. Where feasible, this conceptual mission suite/kit could be installed in the command variants of the LAV, the AAV/AAAV, as well as the HMMWV. Fielding a universal system would, over time, provide a cost savings with regard to common logistics support, training/schools (both supporter and operator) and technical publications procurement. At the lower end of the modular C&C system, would be the fielding of a mission suite similar in concept and capability to the U.S. Army A2C2S package. This system would replace the AN/ASC-26 package, and be configured for primary use/installation in the back of a UH-1Y. Operationally, this system would serve as the primary airborne C&C system for supporting battalion and regimental sized units. Given today's operational tempo, scheduled unit deployment cycles, and lessons gathered using the AN/ASC-26 communications package, the Marine Corps would need to procure and distribute four complete systems to each HML/A squadron, to provide sufficient support to the MAGTF. To support regimental and division sized operations, an expanded version of this modular system, similar in capability to a cross between the Army's A2C2S package and the Air Forces ABCCC III system, could be developed and then employed from the back of MV-22 aircraft. Procurement quantities sufficient to provide four systems to each USMC rotary wing air group should be pursued. At the high end of the C&C mission kit would be the procurement, or rounding out, of the entire modular package. The complete C&C suite, once fully assembled in the back of a Marine Corps KC-130J aircraft, would be similar, if not identical, in capability, to the Air Force's ABCCC III package. This system would fully replace the Marine Corps currently fielded DASC (A) system and would be employed to provide support to division and/or

Marine Expeditionary Force (MEF) operations. Providing each USMC KC-130 squadron with two fully functional mission kits would appear to be optimal. Coupled with the design and fielding of this modular system, comes much associated work with regards to system support, airframe integration, electromagnetic interference testing, training concerns and training support package introduction, to name just a few. But such efforts and work, while indeed laborious and intensive, are required if the Marine Corps is to remain responsive to our nations needs. And most importantly, these efforts and actions are required now.

The Corps has made great strides in crafting a future vision of warfare for the coming years and decades ahead. Additionally, the Marine Corps has already begun the process of providing enhanced capabilities to force commanders in the areas of mobility and fires/fire support. Concrete enhancements that will revolutionize our abilities to wage war against potential adversaries or provide assistance to our allies, or those in need, have been identified, are being developed, and will soon be fielded. More so than their sister services, the Corps' has articulated a vision that is sound and based on realistic objectives and fiscally achievable goals. Only moderate rudder steers or small adjustments in the master plan are required. An increased focus on and a better understanding of what enhancements are required with regard to the Corps' command and control capabilities is one of the areas that needs such refinement. In order to see the job through to fruition, action is required, and soon, lest the Marines miss the window of opportunity that currently presents itself. Nowhere is the potential for gain more profound for the Marine Corps than in capitalizing on the technological advancements being achieved everyday in the field of information management. On the asymmetric battlefield, the difference between victory and defeat may well be in the ability to command, control, and communicate with ones forces, over vast distances, and in a variety of geographic or topographic environments (urban sprawl, vast desert, rugged mountains, coastal plains, arctic tundra). Perhaps the importance of command and control is best stated in Fleet Marine Force Manual 3:

War is a process that pits the opposing wills of two commanders against each other. Great victories of military forces are often attributed to superior firepower, mobility, or logistics. In actuality, it often is the commander who makes good decisions at a superior tempo who leads his forces to victory. Therefore, victory demands that commanders effectively link decision making to execution through the concept of command and control. Warfare will continue to evolve and command and control processes, organization, and support systems will continue to change, but the basic concept of command and control will remain the key to the decisive application of combat power. More than ever before, a command and control system is crucial to success and must support shorter decision cycles and instantaneous flexibility across vast distances of time and space.<sup>43</sup>

Nothing with regards to this issue could be more true.

While the history of the Marine Corps is filled with examples of study and experimentation, the real legacy of the Corps is that of action and application. Clearly, now is the time for action, a time for the

debates to stop, and for decisions to be made. Yet still we wait and frustration mounts. We wait for our leaders to make important decisions, we wait for the budgeters to identify necessary funds, we wait for industry to respond to requests for proposals, and we wait for operational tests and evaluations to occur and be completed. While we wait, as Marines in the field stand vigilant, ever in harms way, ready to answer the nations call, it is important for all parties to remember the words of Commander John B. Nichols, in his book *On Yankee Station*, "And the next time is one day closer with every sunrise."<sup>44</sup> Lest we forget.

WORD COUNT=12,692



## ENDNOTES

- <sup>1</sup> Peter B. Mersky, U.S. Marine Corps Aviation: 1912 to the Present (The Nautical & Aviation Publishing Company of America, 1983), 124.
- <sup>2</sup> Ibid., 125.
- <sup>3</sup> Ibid., 130.
- <sup>4</sup> LTGEN. Victor H. Krulak, First To Fight (New York, N.Y.: Pocket Books, 1991) 2.
- <sup>5</sup> Russell F. Weigley, The American Way of War: A History of United States Military Strategy and Policy (New York, Indiana University Press by arrangement with Macmillan Publishing Co., 1977) 255.
- <sup>6</sup> Krulak, 7.
- <sup>7</sup> Ibid.
- <sup>8</sup> Ibid., 8.
- <sup>9</sup> Major Frank O. Hough, The Island War, The United States Marine Corps in the Pacific (J. B. Lippincott Company, Philadelphia and New York, 1947) 4-5.
- <sup>10</sup> Krulak, 85.
- <sup>11</sup> Weigley, 260-261.
- <sup>12</sup> Krulak, 108.
- <sup>13</sup> Weigley, 264.
- <sup>14</sup> Krulak, 58
- <sup>15</sup> Historical Division Joint Secretariat Joint Chiefs of Staff, Organizational Development of the Joint Chiefs of Staff 1942-1989, November 1989, 31
- <sup>16</sup> Ibid, 52.
- <sup>17</sup> Charles C. Krulak, "Operational Maneuver from the Sea," Joint Forces Quarterly, (Spring 1999): 79.
- <sup>18</sup> Ibid.
- <sup>19</sup> Ibid.
- <sup>20</sup> "2 Guilty of Bombing World Trade Center," linked from The Salt Lake Tribune, available from <[http://www.sltrib.com/97/nov/111397/nation\\_w/6914.htm](http://www.sltrib.com/97/nov/111397/nation_w/6914.htm)>; Internet; accessed 3 January 2000.
- <sup>21</sup> Richard Danzig, C.C. Krulak, and J.L. Johnson, 1999 Posture Statement, America's 21<sup>st</sup> Century Force, (Washington, D.C.: U.S. Department of the Navy, 1999), 5.

<sup>22</sup> Marine Corps Combat Development Command, United States Marine Corps Warfighting Concepts for the 21<sup>st</sup> Century, (Concepts Division, Marine Corps Combat Development Command, Quantico, Virginia), I-4

<sup>23</sup> Ibid, I-3.

<sup>24</sup> C.C. Krulak, 81.

<sup>25</sup> Marine Corps Combat Development Command, I-10.

<sup>26</sup> Ibid. I-22.

<sup>27</sup> Ibid. II-7.

<sup>28</sup> Ibid. IV-14.

<sup>29</sup> Danzig, Krulak, Johnson, 61.

<sup>30</sup> United States Marine Corps Fact File, "MV-22 Osprey," 30 December 1997, available from <<http://www.hqmc.mil/factfile.nsf>>. Internet; accessed 3 January 2000.

<sup>31</sup> Danzig, Krulak, Johnson, 41.

<sup>32</sup> Kevin Kaley, "BIG BANG New light howitzer fires farther, faster. Is it better?" Marine Corps Times, 14 February 2000, 15.

<sup>33</sup> Marine Corps Combat Development Command, II-24.

<sup>34</sup> John M. Shalikashvili, National Military Strategy of the United States of America (Washington, D.C.: Chairman of the Joint Chiefs of Staff, September 1997), 28-29.

<sup>35</sup> John M. Shalikashvili, Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations, Joint Pub 6-0, 30 May 1995, IV-2.

<sup>36</sup> Kenneth Allard, Somalia Operations: Lessons Learned (National Defense University Press, Ft. McNair, Washington, D.C., 1995), 46.

<sup>37</sup> Bruce D. Nordwall, "Software Radios Give Army Helo C2 System," Aviation Week & Space Technology, 13 September 1999, 85.

<sup>38</sup> Ibid.

<sup>39</sup> Ibid. 86.

<sup>40</sup> Myron Struck, "Airborne C<sup>2</sup> Platform Proves Indispensable In Gulf War," Defense Electronics, May 1991, 22

<sup>41</sup> Ibid.

<sup>42</sup> Ibid. 23.

<sup>43</sup> John M. Shalikashvili, Joint Pub 6-0, I-1.

<sup>44</sup> Cdr. John B. Nichols and Barrett Tillman, On Yankee Station, The Naval Air War over Vietnam, (Naval Institute Press, 1987), 86.



## BIBLIOGRAPHY

- "2 Guilty of Bombing World Trade Center," Linked from The Salt Lake Tribune. Available from <[http://www.sltrib.com/97/nov/111397/nation\\_w/6914.htm](http://www.sltrib.com/97/nov/111397/nation_w/6914.htm)>. Internet. Accessed 3 January 2000.
- "Africa Bombing suspects held." Linked from BBC News. Available from <[http://news.bbc.co.uk/hi/english/world/africa/mewsid\\_148000/148595.stm](http://news.bbc.co.uk/hi/english/world/africa/mewsid_148000/148595.stm)>. Internet. Accessed 3 January 2000.
- Allard, Kenneth. Somalia Operations: Lessons Learned. National Defense University Press, Ft. McNair, Washington, DC.
- Clinton, William J. A National Security Strategy for a New Century. Washington, D.C.: The White House, October 1998.
- Cohen, William S. Annual Report of the Secretary of Defense to the President and the Congress. 1999.
- Cohen, William S. Report of the Quadrennial Defense Review. May 1997.
- Concepts Division Marine Corps Development Command, United States Marine Corps Warfighting Concepts for the 21<sup>st</sup> Century, Quantico, Virginia.
- Danzig, Richard, Krulak, C.C. and Johnson, J. L. 1999 Posture Statement, America's 21<sup>st</sup> Century Force, Washington DC. U. S. Department of the Navy, 1999.
- Delatte, Major, USMC. "Airborne Command, Control, & Communications (ABCCC)," MCLLS Long Report, HML/A-269, CAX 9-97, 23 August 1997.
- Denning, Major, USMC. "Airborne Command, Control, & Communications (ABCCC)," MCLLS Long Report, HMLA-167, CAX 3-96, 6 February 1996.
- Historical Division Joint Secretariat Joint Chiefs of Staff. Organizational Development of the Joint Chiefs of Staff 1942-1989, November 1989.
- Holzer, Robert. "New Marine boss seeks expanded role; Will Jones try to steal Army thunder?" Army Times, 27 September 1999, p.4.
- Hough, Frank O. Major, USMCR. The Island War, The United States Marine Corps in the Pacific. J.B. Lippincott Company, Philadelphia and New York, 1947.
- Hurst, Jack. Nathan Bedford Forrest. Alfred A. Knopf, Inc., 1993.
- Kaley, Kevin. "BIG BANG New light howitzer fires farther, faster. Is it better?" Marine Corps Times, 14 February 2000, 14-16.
- Krulak, Charles C. "Operational Maneuver From the Sea." Joint Forces Quarterly, Spring 1999.
- Krulak, Victor H. LTGEN. USMC (Ret). First to Fight. New York, NY. Pocket Books, 1984.
- McCorkle, Fred, LTGEN. USMC. "Howgozit in Green," Wings of Gold, Spring 1999, 17.
- McCorkle, Fred, LTGEN. USMC. "Howgozit in Green," Wings of Gold, Fall 1999, 19.
- Mersky, Peter B. U.S. Marine Corps Aviation: 1912 to the Present. The Nautical & Aviation Publishing Company of America, 1983.

- Moorehead, Alan. Gallipoli. The Nautical & Aviation Publishing Company of America, 1982.
- Nichols, Cdr. John B., and Barrett Tillman. On Yankee Station, The Naval Air War over Vietnam. Naval Institute Press, 1987.
- Nordwall, Bruce D. "Software Radios Give Army Helo C2 System," Aviation Week & Space Technology, 13 September 1999, 85-86.
- Report of the National Defense Panel. Transforming Defense, National Security in the 21<sup>st</sup> Century. Arlington, Virginia. December 1997.
- Shalikashvili, John M. "Doctrine for Command, Control Communications, and Computer (C4) Systems Support to Joint Operations," Joint Pub 6-0, 30 May 1995.
- Shalikashvili, John M. National Military Strategy of the United States of America. Washington, D.C.: Chairman of the Joint Chiefs of Staff, 1997.
- Steele, Robert David. "C<sup>4</sup>I The New Linchpin," Proceedings, July 1992, 35-40.
- Struck, Myron. "Airborne C<sup>2</sup> Platform Proves Indispensable In Gulf War." Defense Electronics, May 1991, 22-23.
- United States Marine Corps Fact File, "MV-22 Osprey," 30 December 1997. Available from <<http://www.hqmc.usmc.mil/factfile.nsf>>. Internet. Accessed 3 January 2000.
- Weigley, Russell F. The American Way of War: A History of United States Military Strategy and Policy. New York, Indiana University Press by arrangement with Macmillan Publishing Co., 1977.