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Executive Summary

Title: A Fight for the Human Element of Marine Corps Offensive Air Support

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Thesis: The quick rise in popularity of the Unmanned Aerial System (UAS) in the last decade has touched off myriad debates about the future of military aviators and their usefulness in the combat arena. In order to best utilize technology and prove that the human element is still a necessary part of Marine offensive air support, one must study three things: American military history, U.S. Marine Corps doctrine, and John Boyd's theory of the OODA Loop.

Discussion: The latest evolution in aeronautical technology is the UAS. The UAS is threatening the future of manned aviation because civilian and military leaders are convinced of the myth that technology is the panacea for all battlefield problems. Military and civilian professionals generally fail to understand that armed conflict is fundamentally a human interaction in which man is the central character. In order to understand why there is a need to retain a human aviator in the cockpit, one must gain a general understanding of U.S. military history and Marine doctrine. Historically, the development of technology in war fighting has always triggered an effective and economical counter-technology movement; there has yet to be developed a technology that cannot be countered. There is no doubt that emerging threats, state and non-state actors, will exploit the limitations of the UAS. Recent U.S. military history is a good lesson in the pitfalls of assigning technology a grand stand in our military planning. Fundamental concepts such as John Boyd's Theory of the OODA Loop are relevant as well in understanding why the human element is still a fundamental foundation for attack aviation.

Conclusion: The human element, the individual Marine, is the overarching factor that will lead to success in war and technology will always be a capable aid. A mix of manned and unmanned aviation capability is still the best plan for the future of Marine aviation.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

Table of Contents

Page

EXECUTIVE SUMMARY 1

DISCLAIMER 2

INTRODUCTION 4

TECHNOLOGY – THE CALL OF THE SIRENS 7

HISTORICAL PRECEDENCE 11

LIMITATIONS OF THE UAS 13

THE HUMAN DIMENSION 16

THREATS AND CHALLENGES 20

CONCLUSION 22

CITATIONS 24

BIBLIOGRAPHY 29

Introduction

Claims are already being made for computers that can beat Grand Masters at chess. But chess is not the game that is played in the real world of a combat aircraft cockpit.

- **Michael Knight**, *Future of Manned Combat Aircraft*[1]

Although computers have beaten Grand Masters in the two decades since Knight's comment, chess has yet to become "the game that is played" in aerial combat. Whereas chess has mutually agreed upon and enforced rules of engagement, aerial combat does not.

Since the end of World War II the United States aviation industry has led the world in technology and innovation. The latest evolution in aeronautical technology is the Unmanned Aerial System (UAS). The quick rise in popularity of the UAS in the last decade has touched off myriad debates about the future of military aviators and their relevance in the combat arena. A key component of the ongoing debate has been the type of military the United States requires in an era of terrorism, hybrid warfare, low intensity conflict, and reduced fiscal resources for national defense. The concluding paragraph of the National Defense Strategy (NDS) of 2008 states that, "the people of our Total Force are the greatest asset of the Department [of Defense]."[2] Taken at face value, the NDS leads most observers to the conclusion that the human element is still important in the American military construct. Nevertheless, the Pentagon has routinely cut manpower in favor of technology – trading labor for capital – throughout our history when a reduction of the budget occurs: "it is part of the great American tradition of substituting technology for human beings."[3] UASs have become a very seductive answer to warfare because it offers the war fighters and the politicians, "gratification without commitment."[4]

Another school of thought tends toward the altruistic. The reason behind UAS operations is the simple mathematics of saving lives and reducing costs. The military risks the life of a pilot, who has become a national asset, every time it sends a combat aircraft into harms way. The UAS eliminates the risks associated with aircrew safety over hostile territory and are cheaper to manufacture and support than modern fighter aircraft. Therefore, lawmakers and Department of Defense (DOD) officials believe that the switch to UASs makes sense both fiscally and operationally. Indeed, the UAS has become the latest panacea for all battlefield dilemmas.

The crux of the debate is sometimes lost in the shadow of these gifts to modern warfare. DOD officials must ask themselves: Are the leaders really doing what is right for military aviation and the military as a whole or is the establishment, "seduced by technology and a perceived need to remove the man from the cockpit?"[5] That the military retains the ability and the technology to "remove the man from the cockpit"[6] does not mean that it is the right path for the future of aviation combat capability necessarily. The United States does a better job of employing technology than any other country in the world and our leaders are prone to believe that technology can solve every problem. The ultimate goal is to understand and avoid the pitfalls associated with this mindset and learn where the U.S. military can and cannot effectively apply technology on the battlefield.

This paper will examine the current and potential shortfalls of UASs in regards to Marine offensive air support.[7] The discussion is not an argument against the use of UASs nor is it a condemnation of modern technology. UASs are here to stay and no one can debate their utility on the modern battlefield. Instead, the paper is a psychological

presentation that brings to light some inconsistencies in DOD and Marine Corps doctrine and their practical application in relation to UAS operations.

The modern battlefield has created an environment in which UASs will routinely take on missions traditionally performed by manned aircraft. There are some high-risk missions and certain areas of the battle space that naturally lend themselves to UAS operations. [8] The systems are a good substitute for the missions characterized by the three Ds of combat aviation: dull, dirty, and dangerous. Dull, which are missions of long endurance (intelligence, surveillance, reconnaissance); dirty, which are missions within the nuclear, biological, and chemical environment; and dangerous, most notably suppression of enemy air defenses, offensive and defensive counter air, and deep air support.[9] The UAS may be a better fit for these missions than manned aircraft; the most obvious advantage is that they do not risk the lives of American pilots.

The UAS has a distinct disadvantage in other missions, such as close air support, because UAS operations lack the situational awareness and decision-making processes that only a human pilot can provide. Admittedly, the UAS is an attractive solution to today's battlefield dilemmas but it should compliment our current strike/fighter capability and not serve as a total replacement for manned aviation. There will remain a need for the human element in the cockpit for the foreseeable future. Therefore, it would be shortsighted of the Marine Corps to put absolute faith in the tools of our trade no matter how "smart" they may seem.

The Marine Corps' present dilemma is a logical conclusion to our society's rabid need for technology. Is it theoretically possible to incorporate technology into the modern battlefield while retaining the human element, or is the extermination of the

human aviator a foregone conclusion? One duty of the warfighter is to be aware of the debate and understand the positive and negative aspects to employing UASs in combat. In order to flesh out the current dispute it is necessary to look at a logical presentation of the five W's:

1) Why has technology become the cure all for the military?
2) Where has this country witnessed a historical precedence?
3) What are the limitations of the UAS?
4) Who will emerge to counter our technology?
5) When is the human dimension absolutely necessary in combat?

History and doctrine offer a guide in the fight for the human element of Marine offensive air support.

Technology – The Call of the Sirens

Technology is like "magic shoes" on the feet of mankind, and after the spring has been wound tightly by commercial interests, people can only dance along with the shoes, whirling rapidly in time to the beat that they set.

- **Qiao Liang**, *Unrestricted Warfare*[10]

Aviation experts and military officials across the globe are predicting that the Joint Strike Fighter (Lockheed Martin's F-35 Lightning II) could be the last manned combat aircraft in the history of aviation. Jerry Daniels, Boeing's Military Aircraft and Missile Systems President, released in an interview that, "unmanned systems are the future of aerospace."[11] Shlomo Tsach, director of advanced programs at Israeli Aerospace Industries stated that the F-35 JSF would be the last manned fighter, "UAVs will take over all of the missions before this aircraft will finish its operational life."[12] Not everyone is as bleak. Lockheed Martin's Aeronautics President does not believe that the JSF will be the last manned tactical platform. Conversely, he believes that UASs have a long way to go before they truly rival the manned tacair capability.[13] Of course, in any

debate, it is important to consider the perspective of each stakeholder. Lockheed Martin is presently the producer of the JSF while Boeing lost the bid for the largest DOD contract in history. With most combat aircraft having a service life of roughly thirty years, it is possible to predict that the extinction of the modern day aviator to be around 2045. Regardless, the defense community has fallen in love with technology, as if it was the Call of the Sirens, and is slowly eliminating the human from the aeronautical machine.

Technocrats perpetuate the myth that technology is the panacea for all battlefield problems and U.S. leaders, both civilian and military, have reacted as a moth to the flame. For example, there are presently eleven references to technology in the 2004 National Military Strategy, ten in the 2006 National Security Strategy, and nine in the 2008 National Defense Strategy.[14] In comparison, there are zero references to manpower in any of the three documents.[15] Guidance to substitute technology for manpower irrespective of mission, such as the following in the 2004 National Military Strategy, leave the service chiefs no option but to comply: "the Armed Forces *must* be able to …leverage innovation and technology and act decisively in the pursuit of national goals."[16] The Secretary of Defense's "Unmanned Aircraft Systems Roadmap, 2005-2030" outlines the future of UASs. In fiscal year 2005, the DOD budgeted $2 billion for UASs.[17] The current U.S. inventory is projected to rise from 250 (2005) to 1,400 in 2015.[18] Furthermore, the United States congress has mandated that one-third of future deep strike capability will be unmanned platforms by the year 2010.[19] In regards to future combat aviation, it is likely that the DOD will soon wonder why it still has pilots in the cockpits of attack aircraft.

What the technocrats fail to realize is the mission of offensive air support is not simply about systems, ordnance, and the laws of aerodynamics. The skies above a combat zone are an unpredictable, fluid realm that does not lend itself neatly to the systems approach. The military and civilian leaders continually approach Clausewitzian problems with Jominian solutions[20]. Arguably, it is not their fault. Human nature craves scientific solutions and continually desires to simplify and deconstruct complex problems. Karl Von Clausewitz' theory of friction aptly describes the nature of attack aviation. He states, "friction...is everywhere in contact with chance, and brings about efforts that cannot be measured".[21] In his book, *Decoding Clausewitz*, Jon Tetsuro Sumida states that Clausewitz is convinced that intuition is paramount in an environment plagued by friction. He also states that in Clausewitz' view, "deliberate reasoning...is insufficient in the face of complexity and incomplete information existing under conditions of contingency and danger;"[22] the actor with the best intuitive feel for the battlefield will make the best decisions[23]. Clausewitz himself says that the officer who possesses experience and intuition in warfare will be successful when the time comes to make hard decisions in a complex environment[24]. Hence, we begin to make the case that there clearly is no suitable replacement for the experienced human pilot in the cockpit of an attack aircraft. Intuition and experience is necessary to sift through the friction that exists in a combat environment.

A failure to grasp the Clausewitzian nature of combat aviation has forced the DOD to keep faith with what it knows best – the Jominian solution. The DOD is a microcosm of society and it is clear that the American public is rabid for technological development. To the average American, war has become a television reality series.

The ever-increasing incorporation of technology into our daily lives has spawned a generation of leaders and lawmakers that embrace DOD budgets that sustain the rapid development of technology. For example, in 2009 the base defense budget rose to $515.4 billion. Projections show that the budget will easily exceed that amount when emergency discretionary spending and supplemental spending are included.[25] The base budget does not include many military-related items that are lodged elsewhere in other lines of the Defense Department budget, such as nuclear weapons research, maintenance and production, Veterans Affairs, or the wars in Iraq and Afghanistan (which are largely funded through extra-budgetary supplements, ~$170 billion in 2007). The United States government is currently spending at the rate of approximately $1 trillion per year for all defense-related purposes.[26] As a benchmark, the 2005 U.S. military budget was almost as much as the rest of the world's defense spending combined at the time and is over eight times larger than the official military budget of China.[27]

The hunger for technology and its ever-increasing price tag has forced the United States military into a situation where it has adopted a mindset of Structural Disarmament. The theory, coined by Thomas Callaghan, Jr., "occurs when the market represented by a nation's defense budget plus exports is too small to bring armament development and production costs down to a level either politically acceptable for governments or, equally, affordable to industry."[28] A more well known explanation of the theory was introduced in 1980 by Norman R. Augustine, chairman and chief executive officer of Martin Marietta Corporation. He observed that the unit cost of high-technology equipment seemed to be increasing by a factor of four every decade. A trend like this is unsustainable and he argues that defense spending cannot infinitely increase to

accommodate the latest technology. A finite national defense budget plus the high cost of weapons systems causes the DOD to buy less and less of each system.[29] The alternative is to find weapons systems that cost less to provide similar capability or to cut other portions of the budget to release funds to feed the technological machine.

Since the DOD spends a majority of the defense budget on manpower and structural support, manpower is an always an easy target.[30] In order to limit the growth of the budget, senior leaders substitute technology in lieu of manpower; a process that has been used after every major conflict in United States history and is often referred to as "rightsizing the force". The reduction in manpower and the incorporation of technology thus fulfills two requirements - it succeeds in reducing an unsustainable defense budget in the long run and satisfies our love affair with technology by reducing the overall human cost in warfare.

Historical Precedence

> Progress, far from consisting in change, depends on retentiveness. When change is absolute there remains no being to improve and no direction is set for possible improvement: and when experience is not retained, as among savages, infancy is perpetual. Those who cannot remember the past are condemned to repeat it. In the first stage of life, the mind is frivolous and easily distracted, it misses progress by failing in consecutiveness and persistence. This is the condition of children and barbarians, in which instinct has learned nothing from experience.
>
> **- George Santayana**, *the Life of Reason, Volume 1* (1905)

History may be the best suggestion for the parameters of the future. Nonetheless, there are no crystal balls to predict how present and future weapons can prevent and win wars.[31] Recent history provides insight as to how technology made its grandstand appearance in U.S. military planning. The post-World War II generals and admirals learned a valuable lesson during their time in the European and Pacific theaters. They

witnessed first hand how new weapons and technology could determine the success or failure of a nation's fighting force. Once thought of as the bulwarks of conservative warfare, these leaders became some of the boldest innovators and advocates of technology.[32]

Armed with this knowledge, military leaders quickly realized that the strategic perspectives and interests of the individual services controlled the rate and direction of technological innovation. Hence, the leaders understood that a successful weapons development program could mean both additional money and missions for their service. The respective service chiefs recognized that technological innovation was a pre-requisite of their survival, which meant, "the criterion of success for a military service became the ability to conserve, develop, and to exploit efficiently the ever increasing rate of scientific advance."[33] Adding fuel to the fire, the 1947 nuclear tests in the Bikini Atoll ushered in an era of nuclear warfare that impressed upon the already impressionable leaders the importance of technological advances on the modern battlefield. In addition, the rapid growth of technology at the time convinced the same leaders that the amphibious invasion was outdated and that most, if not all, Army doctrine was obsolete.[34]

Indubitably, our technological memory is at best shortsighted. Repeatedly, military experts who assume that they possess a technological silver bullet or doctrinal formula are defeated when they underestimate the inventive nature of their adversary.[35] The United States has led the revolution in military technology for quite some time and our enemies are recently coming to grips with the old adage that necessity is the mother of all inventions. American military history gives clear warning to those that develop

modern technology that even the best tactics and doctrine turn obsolete when the enemy achieves a technological breakthrough.[36]

Limitations of the UAS

> Know your enemy and know yourself; in a hundred battles you will never be in peril. When you are ignorant of the enemy but know yourself, your chances of winning and losing are equal. If ignorant both of your enemy and of yourself, you are certain in every battle to be in peril.
>
> - Sun Tzu, *The Art of War*[37]

The inherent limitations of the UAS have been the hallmark abilities of aviators since the dawn of attack aviation. Pilots trained today are well versed in operating in environments that would be prohibitive to UASs. Jamming of communication systems and GPS denial operations are an every day part of an aviator's training. Pilots have the individual ability and training to independently identify and destroy targets in the absence of radio communications and GPS navigation. Aviators continue to use hand and arm signals today in order to facilitate "comm out" missions or to communicate in environments where radios might be inoperable. Developed over years of trial and error, these tactics remain relevant in today's combat environment.

In order to understand why there is a need to retain a human aviator in the cockpit of an attack aircraft, one must first look at the limitations of the UAS with respect to offensive air support. The UAS operators lack the situational awareness of the battlefield that is inherent in a manned aircraft. Command and control of the system is highly centralized and inflexible and the location of the operators prohibits close coordination with combat forces. Air superiority is an absolute necessity for UAS operations, as we know them today, and their Achilles heel is the communications links that are the lifeblood of the system.

First, the UAS does not have the same capacity to analyze and maintain situational awareness; the limited capacity to address a wide surveillance area limits the intake of information. It cannot absorb, process, and relay information as well as a pilot who enjoys 360-degree situational awareness. Instead of a narrow sensor evaluated by a team of detached operators, the pilot has a broad field of view of the battlefield and is able to analyze, interpret, and take the fight to the enemy simultaneously. As Dane Hancock, of Lockheed-Martin's Tactical Aircraft Systems, has noted that, "the situational awareness of the pilot, even when incomplete, is almost impossible to duplicate within a machine."[38] In order for the UAS to be able to operate in a hybrid combat environment with the same lethal effectiveness as a human, scientists would have to develop sensors that have a 360-degree field of view and a surrogate human brain for the system.

Second, because the UAS is "unmanned" it requires a team of professionals to operate it from a remote station. The remote stations are primarily located in centralized command and control centers where a military staff supervises the operators. In the author's experience, the stations trend toward the group think mentality, deriving most decisions by committee action, and rarely allowing freedom of action.[39]. These operations, as it stands today, are contrary to Marine Corps ethos and doctrine[40]. As General James Conway, Commandant of the Marine Corps, stated in *Marine Corps Vision & Strategy 2025*, "Marines at all levels must be prepared to excel in ambiguous and dangerous conditions, operate from a commander's intent, and with *minimal direct supervision.*"[41] The Marine Corps' foundational publication, Marine Corps Doctrinal Publication 1 (MCDP-1), supports the Commandant's comments in stating that, "in order to generate the tempo of operations we desire and to best cope with the uncertainty,

disorder, and fluidity of combat, command and control *must be decentralized.*"[42] Decentralized command is the key to successful combat operations. The individual war fighter must assess, evaluate, and act autonomously in order to effectively accomplish the mission. The lack of a human on the battlefield during UAS operations negates this advantage.

Third, the detached location of the team operating the system degrades the ability of the operators to coordinate with the supported ground forces. Throughout the last half of the twentieth century, aviation assets and their pilots have moved farther and farther away from their supported units and lack of close coordination has plagued the community as a whole. In the 1950s, tactical aviators became uneasy about the enemy's ability to destroy planes, airfields, and petroleum sites that were located close to the forward edge of the battle area. Hence, in order to deploy aircraft from the rear battle area they developed a robust air refueling capability. The movement of air bases and facilities away from the forward edge of the battle area increased the difficulties of close coordination with the supported ground units.[43] The most recent development in UAS technology has completed the loop and nearly taken the aviator (controller) completely away from the realities and close coordination of modern combat.

Lastly, the need for air superiority and a continuous interoperable communication system is necessary for the unfettered use of any UAS. The United States and its allies have had a distinct advantage in the combat zones in which UASs have operated since the 1990s; air superiority and the free flow of data has rarely been a problem. Commanders have risen through the ranks with a plethora of situational awareness with these systems. Hence, the U.S. military has trained a generation of combat leaders that are dependant on

large amounts of information in order to make crucial battlefield decisions. Warfare in the future may not be so kind. Without air superiority, and an unmolested communications environment, the U.S. military will not be able to employ its vast numbers of UASs. Combatant commanders, therefore, cannot expect the same level of intelligence and awareness as they have in past and present conflicts.

The Human Dimension

Because war is a clash between opposing wills, the human dimension is central in war. It is the human dimension which infuses war with its intangible moral factors. War is shaped by human nature and is subject to the complexities, inconsistencies, and peculiarities which characterize human behavior. Since war is an act of violence based on irreconcilable disagreement, it will invariably inflame and be shaped by human emotions.

- MCDP- 1 *Warfighting* [44]

Individual Marines are our most potent weapons and where we should continue to place our greatest emphasis. They are empowered by technology, but technology by itself is not a substitute for rigorously trained, highly disciplined, and well led warriors who are shaped by our core values and the Nation's ideals.

- General James Conway, *Marine Corps Vision & Strategy 2025*[45]

War is both an art and a science. Indeed, Clausewitz concludes that war is a, "part of man's social existence".[46] Armed conflict, then, is fundamentally a human interaction in which man is the central character. The human dimension produces an environment plagued by friction. Described by Clausewitz as "the force that makes the apparently easy so difficult," friction is not something with which technology copes easily. An essential means to overcome friction is the human will, which means combat leaders may prevail over friction through persistent strength of mind and spirit.[47] Humans conduct warfare by applying non-linear reasoning to counter the enemy's tactics and will. This reasoning and strength of mind is typical of the attributes of combat aviators; successful use of airpower requires flexibility, adaptability, and initiative. The

ability to quickly assess a military situation and act decisively is an inherent human quality and not an ability shared by the UAS. The Chief of Staff of the Israeli Air Force stated that, "the secret weapon of the Israeli Air Force is highly trained people – war is characterized by great uncertainty and the only system capable of the flexibility we require is the human pilot."[48] Author of "A Strategy Based on Faith: the Enduring Appeal of Progressive American Airpower," Mark Clodfelter aptly sums up the reason why the human dimension will always be a necessity in warfare. Clodfelter notes that, "the fundamental nature of war is constant, swirling mix of violence, hatred, and enmity; calculated reason; and probability and chance. No amount of technological wizardry can remove those components, no matter how sophisticated the technology or how sound the intention of those who apply it."[49]

In order to understand fully how the human contributes to the aviation equation, it is necessary to consider John Boyd's Theory of the OODA Loop.[50] The cycle involves both thinking and moving faster than the enemy. It inhibits the enemy's ability to adapt and causes confusion and disorder that in turn, causes an adversary to over-, or under-, react to a situation. In essence, "he who handles the quickest rate of change is the one who survives."[51] Our decision cycle must be faster than the enemy's to allow friendly forces to "exploit the advantages of speed, focus, tempo, shock, and surprise."[52]

The loop itself is not as important as what the human mind contributes. The mental aspects of the theory are diametrically opposed to UAS operations that are routinely centralized and managed. The procedures involved in operating a UAS are the proverbial "box" outside of which Boyd says the decision maker should operate in order

to maintain a faster decision cycle than the enemy. The existence of the box is limiting and creates a scenario that is sometimes referred to as "paralysis by analysis".[53]

According to Boyd, an action-reaction type situation occurs when humans interact with our environment. As an observer, humans manipulate information perceived by observation in two distinct ways: *analysis* and *synthesis*. According to Oxford's English Dictionary, *analysis* is the separation of a whole into its component parts while *synthesis* is the composition or combination of parts or elements in order to form a whole. Therefore, the observer is constantly breaking down information into its components and interactions and then rebuilding it into deductions that lead to understanding.[54] "The process not only shapes what is being observed, but feedback reshapes the observer's outlook."[55]

There is a relationship, however, that exists between the observer and the observed. The relationship is a vital part of how humans cope with our environment.[56] When one has a proper understanding of the environment, then the observer is able to bypass the "orientation and decision" phase of the cycle and begin to observe and act simultaneously. The intuitive understanding and knowledge of the battlefield is what allows a pilot to bypass parts of the cycle.[57] Intuition and experience is crucial when making split second decisions in mission sets such as close air support.

There exists a danger when the observer is isolated from the battlefield; one is more likely to depend on one's internal dogmas to shape the decision making process. The UAS operator will unknowingly create mismatches between reality and personal mental images that stem from limited experience.[58] A detached reality can exist in the mind of the operator who may be thousands of miles from the battlefield and the resultant

decisions and actions could be detrimental to the overall mission. The aviation community is treading very close to what Brian Burridge, writer for the RUSI Journal, refers to as the "Morality of Altitude" where reach back operations create a disconnect between the operator and the battlefield.[59] The combat infantryman has always had a greater understanding of the complexities and nature of warfare because he experiences it first hand. If the U.S. military removes pilots from the cockpit, then future UAS operators may have experienced neither combat nor actual flight.[60] UAS operations only take the pilot further from the battlefield and exacerbates the disconnect of airpower from the shared battle space; a problem that has plagued the aviation community ever since the birth of combat air support.[61]

In order to understand best the previous point, a recent historical example demonstrates why those who are involved intimately in the conflict will have better situational awareness than those geographically removed from the battlefield.

A flight commander led an eight ship of F-16 aircraft on a pre-planned strike in Iraq during Operation DESERT STORM. The initial target was a bridge over the Euphrates River. Before delivering his weapons, the flight lead noticed something that was not in the pre-flight briefing. He immediately broke off his attack and established separate targets for each aircraft. Once retargeted, the flight destroyed the bridge, four heavy lift cranes, one dozen bulldozers, several dump trucks, and four armored personnel carriers. Evidently, the Iraqis had anticipated an attack on the bridge and were in the process of moving the repair equipment to a safe location. The flight lead's quick decisions, initiative, and flexibility wiped out a significant amount of Iraqi heavy repair capability.[62]

Understanding the human dimension will allow leaders in the future to make wise decisions in the employment of technology on the battlefield. Marines must not forget that our own doctrine from MCPD 1 states: "Technology can enhance the ways and means of war by improving humanity's ability to wage it, but technology cannot and should not attempt to eliminate humanity from the process of waging war."[63] The human mind is, and will be for the foreseeable future, the most adaptable computer known to mankind. In order to maintain our air combat capability the military must keep trained minds in control of the missions until the commander can verify the success of the mission. "From that point we can leave terminal guidance, accuracy, and destructive power to the capabilities of technology."[64] The individual Marine has proven to be the most formidable weapon on today's battlefield and will remain so as long as the Corps exists.[65]

Threats and Challenges

Because of our conventional superiority, adversaries will seek more indirect forms of conflict. We expect opponents to blend different approaches and integrate various weapons, tactics, and technologies to deny us access and freedom of action....Non-state actors will also press to acquire...other advanced military technologies. These technologies will be employed to target key operating systems such as those supporting U.S. power projection capabilities.

- General James Conway, *Marine Corps Vision & Strategy 2025*[66]

Historically, the development of technology in war fighting has always triggered an effective and economical counter movement. There has yet to be developed a technology that cannot be countered. Countries that are not in alliance with the United States understand that they are not, at the present time, able to counter the United Sates in a force on force conventional war. Foes, potential and real, such as North Korea, China, Iran, and others are exploring asymmetric methods to bring down the world's only

superpower. With China, for example, U.S. national security studies document the current trend:

> The People's Liberation Army (PLA) is pursuing comprehensive transformation from a mass army designed for protracted wars of attrition...to one capable of fighting and winning short duration, high-intensity conflicts against high tech adversaries..." "As noted in the 2006 Quadrennial Defense Review Report, it "has the greatest potential to compete militarily with the United States and field disruptive military technologies that could over time offset traditional U.S. military advantages.[67]
>
> China is developing technologies to disrupt our traditional advantages. Examples include development of anti satellite capabilities and cyber warfare. Other actors...are developing asymmetric tactics, techniques, and procedures that seek to avoid situations where our advantages come into play.[68]

Moreover, even with this knowledge, DOD leaders are placing more and more confidence in systems that are vulnerable to the very attacks described above. The Chinese believe that superior strategies can help overcome technological deficiencies. They plan on jamming or sabotaging an enemy's information or information systems vice trying to match the capabilities.[69] After the 1991 Gulf War, the Chinese defense engineers realized the United States depended heavily on the sanctuary of space for military reconnaissance, targeting, and communication assets. They have since designed and tested weapon systems aimed at the neutralization of these space assets. The overarching doctrine has been coined the doctrine of "The Inferior Defeats the Superior". The weapons that have come from this doctrine are "Assassin's Mace Weapons" and target the opponent's most vital vulnerabilities, "his 'acupuncture points.'"[70] Recent reliance on and blind adherence to technology shows that our civilian and military leadership has forgotten a key fundamental tenant in war fighting - the operational

planner must always acknowledge that weather, terrain, and the enemy still "get a vote" in the conduct of warfare.[71]

Conclusion

If a man's trust is in a robot that will go around the earth of its own volition..., he is still pitiably vulnerable to the enemy who appears on his doorstep, equipped and willing to cut his throat with a pen knife, or beat him to death with a cobblestone. It is well to remember two things: no weapon is absolute, and the second of even greater import – no weapon, whose potential is once recognized as any degree of value, ever becomes obsolete.

- J. M. Cameron, *The Anatomy of Military Merit* [72]

The evolution of Marine aviation began in 1912 when the Marine Corps recognized the potential contribution of aviation to its emerging Advanced Base Force Concept. Throughout the twentieth century visionary leaders continued to foster the aviation arm of the Corps into a well-crafted Marine Air Ground Task Force.[73] Almost a century later, the same spirit of ingenuity and bold thinking is threatening the demise of manned aviation by relying too heavily on technology. In order to maintain our roots the leaders must focus on the very fundamentals that built the foundations of Marine Corps doctrine; the Corps cannot modify its doctrine to embrace technology.

Military and civilian leaders must understand the limitations and capabilities of how to employ technology and incorporate the human dimension first and foremost. There is danger in assuming that reliance on technology can eventually replace the individual war fighter. Therefore, the warfighter must be careful not to place too much confidence in unmanned UASs.

The following recommendations will allow for the best operational and tactical use of UAS's in Marine offensive air support while incorporating time honored Marine doctrine. (1) Marine aviation must retain a mix of manned and unmanned capability in

order to support all facets of offensive air support. (2) Integrate UASs into the table of organization and table of equipment within Marine Air Ground Task Force vice operating as a stand-alone function. (3) Co-locate and forward deploy operators and systems with the supported unit to ensure decentralized command and timely mission accomplishment. (4) Marine forward air controllers (ground or airborne) must retain terminal control of UAS operations in the assigned area of operations in order to retain the human element necessary to conduct close air support.

Technology has, and will always have, inherent weaknesses such as the inability to operate effectively in asymmetric and non-linear environments. Mark Clodfelter captures a key component of the debate:

> Despite the promise of pristine warfare, the combination of high technology aircraft, munitions, and intelligence gathering...cannot cure the great malady of friction that infects all military endeavors. Danger, exertion, uncertainty, and chance will forever compromise what Clausewitz called "the climate of war," and stealth, JDAMs, Predators, and Tomohawks cannot purify that environment.[74]

In closing, I reference the commandant's direction:

> We will pursue developments with unmanned aircraft systems (UASs) to widen the force-multiplying capabilities that these enhanced, multispectral systems bring to the fight. Newly emergent concepts for UAS employment will continue to **enhance the...capability of the MAGTF...** [75]

The human element, the individual Marine, is the overarching factor that will lead to success in war and technology will always be a capable aid.

NOTES

[1] Michael Knight, "Future of Manned Combat Aircraft." *NATO's Sixteen Nations*, Vol 34, no. 3, (Jun 1989): 30.

[2] National Defense Strategy of the United States (NDS), (Washington, DC: Department of Defense, June 2008), 22.

[3] Phil Patton, "Robots With The Right Stuff," *Wired*, Vol 4, Iss 3, (March 1996): 215.

[4] Mark Clodfelter, "A Strategy Based on faith: The Enduring Appeal of Progressive American Airpower." *Joint Forces Quarterly*, (issue 49, 2nd quarter 2008): 156.

[5] Brian Burridge, "Post-Modern Warfighting with Unmanned Vehicle Systems: Esoteric Chimera or Essential Capability". *RUSI Journal*, (October 2005): 21.

[6] Ibid.

[7] Headquarters United States Marine Corps. *Aviation Operations. MCWP 3-2.* (Washington, DC: Headquarters United States Marine Corps, May 9, 2000), 2-1. Offensive Air Support - OAS involves air operations that are conducted against enemy installations, facilities, and personnel in order to directly assist in the attainment of MAGTF objectives by destroying enemy resources or isolating enemy military forces. Its primary support of the warfighting functions is to provide fires and force protection through CAS and DAS. The application of OAS can sometimes be decisive by directly or indirectly affecting an enemy's center of gravity. OAS allows the commander to influence the battle by projecting firepower to shape events in time and space. It also allows the commander to shape the battlespace by delaying enemy reinforcements, degrading critical enemy functions, and manipulating enemy perceptions, which ultimately results in protection of the force. Marine fighter/attack squadrons (VMFAs), Marine fighter attack (all weather) squadrons (VMFA[AW]s), Marine attack squadrons (VMAs), Marine light/attack helicopter squadrons (HMLAs), and Marine unmanned aerial vehicle squadrons (VMU) provide OAS during OAS missions. OAS includes two categories: CAS and DAS.

[8] Vivienne Heines, "Unmanned Future: Pentagon sees 'UAS' replacing manned combat aircraft". Armed Forces Journal, Vol 143, No 3, (October 2005): 16.

[9] Sharon Holmes, "The New Close Air Support Weapon: Unmanned Combat Aerial Vehicle in 2010 and Beyond." (Master's Thesis, U.S Army Command and General Staff College, 1999), 67.

[10] Qiao Liang, Wang Xiangsui. *Unrestricted Warfare.* (Beijing: PLA Literature and Arts Publishing House, 1999), 8.

[11] Jeff Mustin, "Future Employment of Unmanned Aerial Vehicles." *Aerospace Power Journal*, (Summer 2002): 1.

[12] Arie Egozi, "Exploiting a Multiplier." *Flight International*, (February 12, 2008): 2.

[13] Michael Bruno, "Lockheed Martin Bullish on Aeronautics Future." Aviation Week's Aerospace Daily & Defense Report, Vol 216, No 42, (December 1, 2005): 3.

[14] NDS, National Military Strategy of the United States (NMS), (Washington, DC: Department of Defense, 2004), National Security Strategy of the United States (NSS), (Washington, DC: Department of Defense, 2006).

[15] Ibid.

[16] NMS, 15.

[17] Headquarters Office of the Secretary of Defense, *Unmanned Aircraft Systems Roadmap 2005-2030.* (Washington, DC: Headquarters Office of the Secretary of Defense, August 4, 2005), 37.

[18] Ibid, D-11.

[19] Keith Jacobs, "Manned and unmanned aerial vehicles: Right mix for future U.S. Navy aviation." *Naval Forces*, Vol 25, No 5, (2004): 38.

[20] Antoine Baron de Jomini, *The Art of War*, CPT G.H. Mendell, USA and LT W.P. Craighill, USA, trans. (Westport, CT: Greenewood Press, 1971), p 22-32, 91-120.

[21] Karl Von Clausewitz, *On War* (Princeton: Princeton University Press, 1976), 120.

[22] Jon Tetsuro Sumida, *Decoding Clausewitz*, (Kansas:University Press of Kansas, 2008), 183.

[23] J. Alex Vohr, "Is Clausewitz Still Relavent". *Marine Corps Gazette*, (March, 2009): 63.

[24] Clausewitz, 120.

[25] Headquarters Office of the Secretary of Defense, *FY 2009 Budget Request Summary Justification.* (Washington, DC: Headquarters Office of the Secretary of Defense, February 4, 2008), 6.

[26] Robert Higgs, "The Trillion-Dollar Defense Budget is Already Here". *The Independent Institute*, (March 15, 2007), 1.

[27] Anup Shah, "World Military Spending". Global Issues, (March 01, 2008):9.

[28] Alistair D. Edgar, David G. Haglund, *the Canadian Defence Industry in the New Global Environment.* (McGill-Queen's Press - MQUP, 1995): 45.

[29] Ibid.

[30] FY 2009 Budget Request Summary Justification, 9.

[31] Michael H. Armacost, *the Politics of Weapons Innovation: The Thor-Jupiter Controversy* (New York: Columbia University Press, 1969), 3.

[32] Ibid, 2.

[33] Ibid, 5,7.

[34] Ibid, 34.

[35] James T. Conway, *Marine Corps Vision and Strategy 2025.* PCN 50100654800. (Washington, DC: Headquarters United States Marine Corps, June, 2008), 22.

[36] Benjamin Franklin Cooling, *Case Studies in the Development of Close Air Support.* (Washington, DC:Office of Air Force History, United States Air Force, 1990), 555.

[37] Samuel B. Griffith, *Sun Tzu: The Art of War.* (London: Oxford University Press, 1963), 84.

[38] Robert Nolan, "The Pilotless Air Force? A Look at Replacing Human Operators with Advanced Technology." (Master's thesis, Air Command and Staff College, 1997), 31.

[39] Irving L. Janis, *Victims of Groupthink: A psychological study of foreign-policy decisions and fiascoes.* (Boston, Houghton Mifflin Company, 1973).

[40] Headquarters United States Marine Corps, *Warfighting, MCDP 1.* (Washington, DC: Headquarters United States Marine Corps, June 20, 1997), 57, 60, 78.

[41] Conway, 25.

[42] MCDP-1, 78.

[43] Armacost, 41.

[44] MCDP 1, 13.

[45] Conway, 53.

[46] Clausewitz,149.

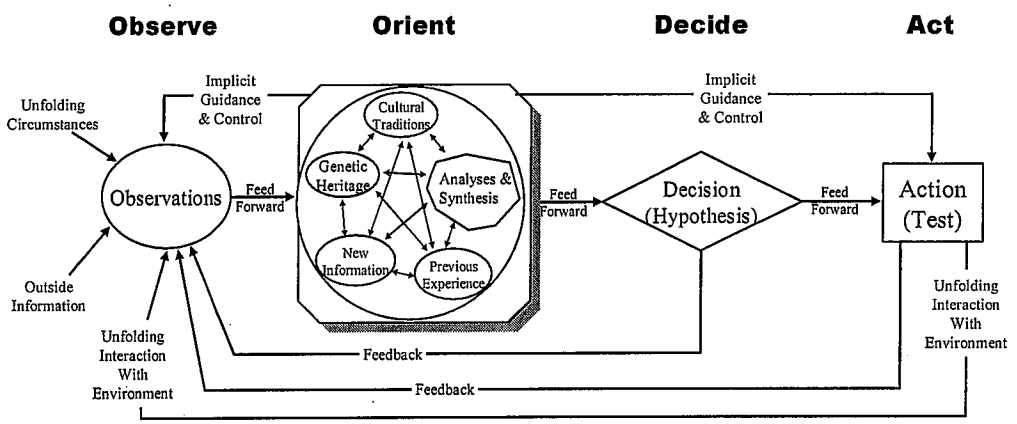
[47] MCDP 1, 5, 6.

[48] Lon Nordeen, *Fighters Over Israel.* (New York, N.Y.: Orion Books, 1990): 1.

[49] Clodfelter, 158.

[50] Robert Coram, *Boyd: The Fighter Pilot Who Changed the Art of War.* (New York: Little, Brown and Company, 2002), 327.

Boyd's OODA "Loop" Sketch



Note how orientation shapes observation, shapes decision, shapes action, and in turn is shaped by the feedback and other phenomena coming into our sensing or observing window.

Also note how the entire "loop" (not just orientation) is an ongoing many-sided implicit cross-referencing process of projection, empathy, correlation, and rejection.

From "The Essence of Winning and Losing," John R. Boyd, January 1996.

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[51] Ibid.

[52] Conway, 10.

[53] Coram, 324, 337.

[54] Ibid, 324.

[55] Ibid.

[56] Ibid, 325.

[57] Ibid, 336.

[58] Ibid, 326.

[59] Burridge, 21.

[60] Ibid.

[61] Ibid, 22.

[62] Nolan, 20.

[63] MCDP 1, 67.

[64] Knight, 23.

[65] Conway, 2.

[66] Conway, 22.

[67] Headquarters Office of the Secretary of Defense, *Annual Report to Congress: Military Power of the People's Republic of China.* (Washington, DC: Headquarters Office of the Secretary of Defense, 2007), 1.

[68] NDS, 22.

[69] Timothy L Thomas, "China's Electronic Strategies." *Military Review*, (May, June 2001): 1.

[70] Michael Pillsbury, "China's Military Strategy Toward the U.S.: A View from Open Sources," (November 2, 2001), 8.

[71] Conway, 23.

[72] Mustin, 1. COL J.M. Cameron, USA. Medical doctor and proponent of the application of natural law to military science. Author *of The Anatomy of Military Merit.* (1960).

[73] MCWP 3-2, 1-2.

[74] Clodfelter, 156.

[75] Conway, 43.

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