STRATEGY RESEARCH PROJECT

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SUN TZU: THE ART OF NETWORK CENTRIC WARFARE

BY

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ABSTRACT

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To meet the challenges of the future, the United States must have a strategy to ensure the joint force of tomorrow will be able to achieve full spectrum dominance. Joint Vision 2020 (JV2020) provides the Chairman, Joint Chiefs of Staff's vision of 21st century military operations and describes America's future military capability objectives. As our long-term objectives are evolving, however, so is our ability, from a technological and organizational perspective, to meet those objectives. Network Centric Warfare (NCW) provides the potential for significantly enhanced resources and instruments through which these objectives can be achieved. However, organizations (especially military organizations) often find it difficult to translate radically new resources into required capabilities. For this, we need a roadmap linking the development of future capabilities to future objectives. Sun Tzu, the ancient Chinese military philosopher, provides this necessary linkage. This paper examines the realization of JV2020 future military capability objectives (ends) by using Sun Tzu's timeless warfighting principles (ways) to guide the use of evolving NCW technologies and organizations (means).

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SUN TZU: THE ART OF NETWORK CENTRIC WARFARE

Invincibility depends on one's self; the enemy's vulnerability on him.

—Sun Tzu

To meet the challenges of the future, the United States (U.S.) must have a strategy to ensure the joint force of tomorrow will be able to achieve full spectrum dominance. Joint Vision 2020 (JV2020) provides the Chairman, Joint Chiefs of Staff's vision of 21st century military operations and describes America's future military capability objectives. As our long-term objectives are evolving, however, so is our ability, from a technological and organizational perspective, to meet those objectives. Network Centric Warfare (NCW) provides the potential for significantly enhanced resources and instruments through which these objectives can be achieved. However, organizations (especially military organizations) often find it difficult to translate radically new resources into required capabilities, as evidenced by the longbow[1] and blitzkrieg.[2] For this, we need a roadmap linking the development of future capabilities to future objectives. Sun Tzu, the ancient Chinese military philosopher, provides this necessary linkage. This paper examines the realization of JV2020 future military capability objectives (ends) by using Sun Tzu's timeless warfighting principles (ways) to guide the use of evolving NCW technologies and organizations (means).

BACKGROUND

For clarification, it is appropriate to establish a framework for examining this issue. This paper will use the future strategy framework shown in Figure 1. "A successful information age security strategy requires that we balance the *ends, ways, and means* of knowledge strategies."[3]

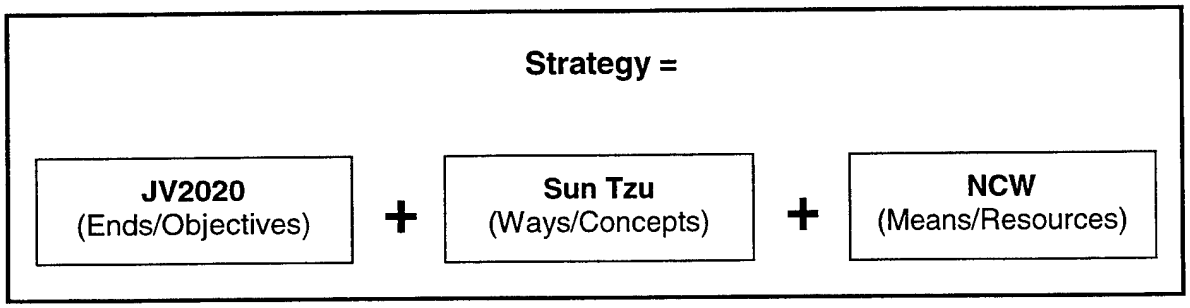

FIGURE 1. FUTURE STRATEGY FRAMEWORK

Strategy is comprised of three integrated and balanced concepts – ends, ways, and means. Ends are the overall goals of the strategy, what it is the strategy means to accomplish. This paper uses JV2020, the clearest and most authoritative statement of America's future military, to provide the objectives for tomorrow's military capability. Ways are the methods and concepts to be used in reaching the strategic goals. This answers the "how we do it" issue. The writings of Sun Tzu provide us a concise collection of methods needed to succeed in warfare. The last part of the strategy triad is the means. These are the resources required to fulfill the concepts expressed by the ways. This paper uses the technologies and organizations made possible within the context of NCW.

This paper is divided into five sections beginning with the background (including JV2020, NCW, and Sun Tzu), JV2020 integrating concepts (including information superiority and innovation), JV2020 operational concepts (including dominant maneuver, precision engagement, focused logistics, and full dimensional protection), NCW concerns, and a conclusion.

JOINT VISION 2020

JV2020 provides an evolving strategic vision of "full spectrum dominance" -- supported by information superiority and innovation – and achieved through dominant maneuver, precision engagement, focused logistics, and full dimensional protection. [4] These objectives are shown in Figure 2.

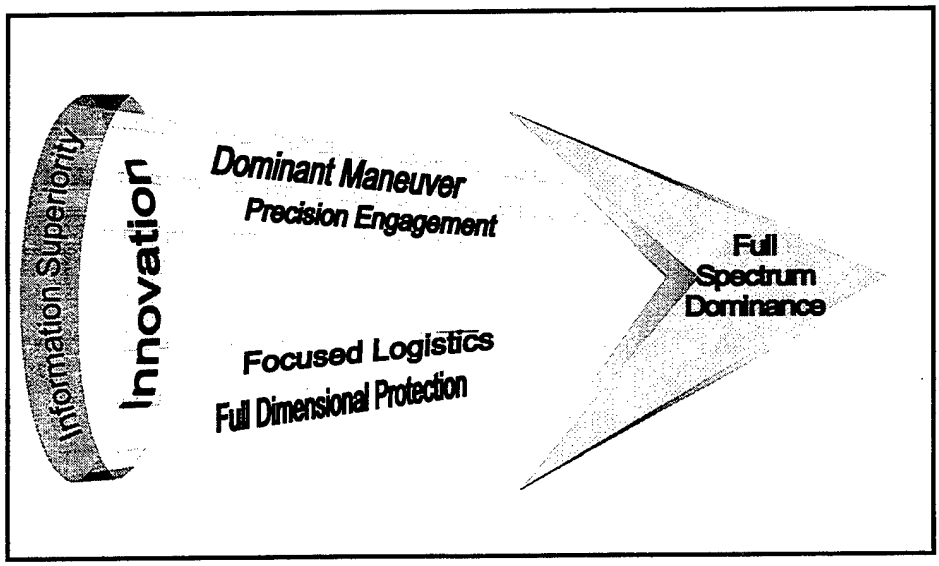

FIGURE 2. JOINT VISION 2020 OBJECTIVES

The overall goal is the "creation of a force dominant across the full spectrum of military operations -- persuasive in peace, decisive in war, preeminent in any form of conflict."[5] Achieving this full spectrum dominance will not be easy. The future force will face great challenges to the JV2020 objectives, such as danger; uncertainty and chance; unpredictable actors; technology and information problems, and humans. To meet these technological and organizational challenges, we must transform future warfare.[6]

NETWORK CENTRIC WARFARE

NCW is a new approach to how we might conduct future warfare that consists of networking the warfighting enterprise – shooters, decision makers, and sensors – to translate information superiority into combat power by "effectively linking knowledgeable entities in the battlespace."[7] This approach is shown in Figure 3.

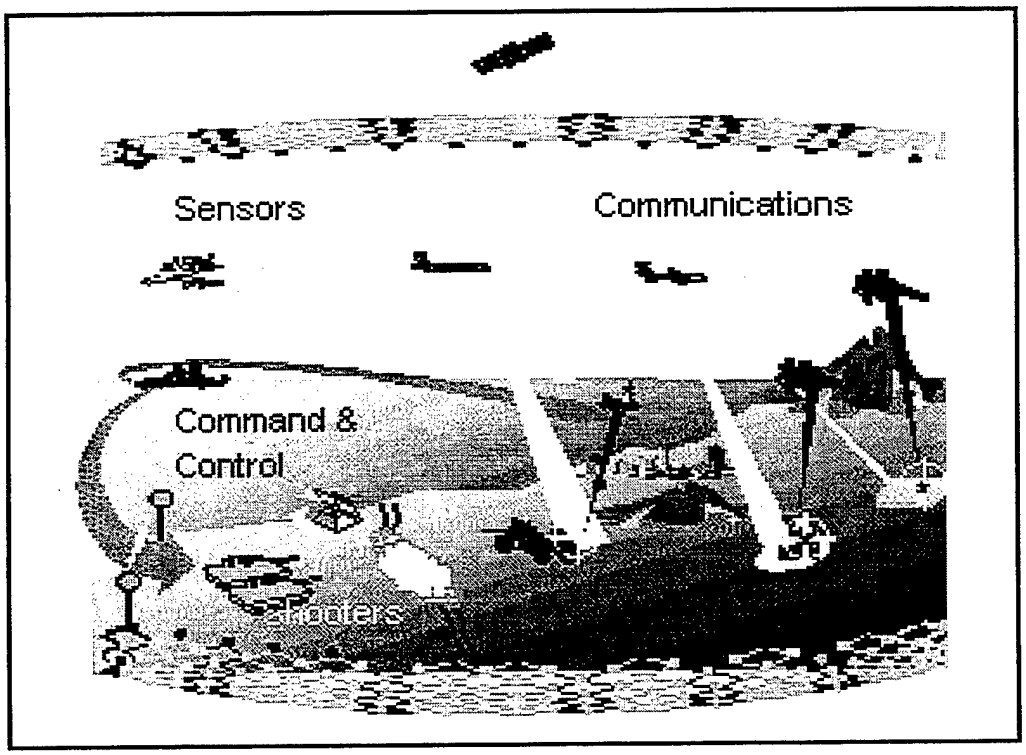

FIGURE 3. NETWORK CENTRIC WARFARE

Its purpose is to "achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization."[8] Generally, the NCW architecture can be thought of as an integration of three functionally separate, but interoperable "grids." Mr. Fred Stein, Network Integration Analyst at Evidence Based Research, describes these grids as (1) The Information Grid: The physical

infrastructure providing the linking, processing, storage, flow and protection of information used to enable NCW, (2) The Sensor Grid: The collection of sensors that contribute to battlespace awareness by feeding data into the information grid, and (3) The Shooter Grid: The planning and execution of combat operations based on information gained from the information grid. [9] These grids are shown in Figure 4.

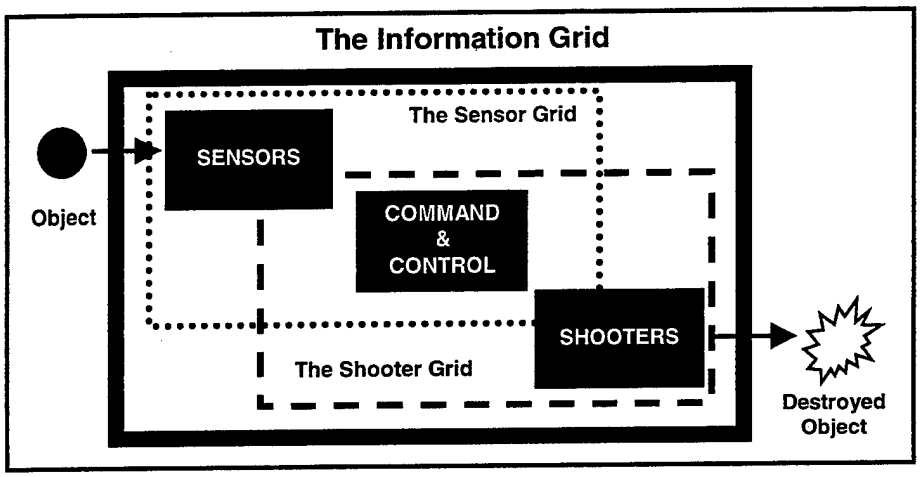

FIGURE 4: NETWORK CENTRIC WARFARE GRIDS

NCW is more about "networking" knowledgeable, hierarchically or geographically dispersed entities -- enabling information and collaboration -- than about networks. Simply having the information is not enough. NCW is based on not only developing good information, but also sharing that information to ensure a shared awareness. In other words, translating a superior information position into a competitive advantage involves turning information into awareness and sharing it, managing the knowledge, and then applying the understanding to the situation by effective command and control (C2) and execution.[10] But, how do we translate this advantage into the required capabilities to support the JV2020 objectives?

SUN TZU

Sun Tzu was a great military strategist that lived over 2500 years ago and wrote The Art of War. Sun Tzu wrote this book in approximately 500 B.C., and his theories form some of the earliest known thoughts on war. Two of his major concepts are shown in Figure 5.

"Strategy is the great work of the organization. In situations of life or death, it is the Tao of survival or extinction. Its study cannot be neglected."

"Know the other and know yourself:
One hundred challenges without danger;
Know not the other and yet know yourself:
One triumph for one defeat;
Know not the other and know not yourself:
Every challenge is certain peril."

FIGURE 5. SUN TZU: THE ART OF WAR

The reason Sun Tzu's ideas still exist today lies in the continued applicability of his timeless theories; an applicability stemming from Sun Tzu's objective analysis of military issues. His ideas have been handed down through the ages with a reputation virtually untarnished and text intact.[11] These ideas are still relevant today and provide a roadmap for how the evolving capabilities of NCW can effectively be used to fully support JV2020 objectives.

JOINT VISION 2020 INTEGRATING CONCEPTS

Over the next two decades, information superiority will be critical as information technology continues to change the very nature of military operations. In addition, the U.S. will continue to need innovation, both technological as well as organizational. These two major areas are the key integrating concepts at the heart of JV2020.

INFORMATION SUPERIORITY

The first JV2020 integrating concept is information superiority. In the JV2020 context, this means that our own access to, and use of, information is significantly superior to that of our enemy. Note that information superiority is much more than simply maintaining information flow. JV2020 specifically addresses using our ability to collect, process, and move information as a competitive advantage *only when it is effectively translated into superior knowledge and decisions.* The flip side of the coin is reducing the enemy's ability to use information.

Sun Tzu says the commander needs three fundamental types of information: knowledge of self, the enemy, and the battlespace. The commander uses this information to make superior

decisions about the conduct of warfare. At the same time, the commander denies the enemy valuable information through the use of deception.

Specifically, what critical information does Sun Tzu require of the commander's intelligence system? He outlines with the classic passages "Know the 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 or losing are equal. If ignorant both of your enemy and yourself, you are certain in every battle to be in peril,"[12] and "Know the enemy, know yourself; your victory will never be endangered. Know the ground, know the weather; your victory will then be total."[13] As far as hiding your own information from the enemy, Sun Tzu says, "All warfare is based on deception."[14]

These passages form the foundation of Sun Tzu's information superiority guidance. First, know yourself. Commanders must have detailed knowledge of their own forces -- their troops' and equipment's combat readiness, training, leadership, location, morale, supply situation, maneuver ability, and a wealth of other information. Are the troops under fire? Do they need support in order to advance? Can they react quickly to time-critical targets in their immediate operational area? What are the strengths and weaknesses in their overall operational structure?

Second, know the enemy. For every question you must answer about your own forces you should be able to answer the same about the enemy's forces. Additionally, though you (hopefully) understand your own plan and intentions, you must understand the plan and intentions of your adversary leader. What is the enemy's intent? Are his forces positioned and capable of carrying out that intent? What are his strengths and weaknesses? Can he be exploited? The commander must understand what the enemy plans to do in order to evaluate friendly courses of action. In Sun Tzu's words, "Determine the enemy's plans and you will know which strategy will be successful and which will not."[15] War is not conducted in a vacuum by only one side -- you must know the enemy.

Third, what is the battlespace? Sun Tzu's first two admonitions deal with separate forces, while the third requires the commander to synthesize a picture of the opposing forces integrated into the operational environment. The commander must understand the "play" of the battlespace, the interaction between the physical characteristics of the operational area and the two opposing forces. He characterizes this interplay in the following verse:

> If I know that my troops are capable of striking the enemy, but do not know that he is invulnerable to attack, my chance of victory is but half. If I know that the enemy is vulnerable to attack, but do not know that my

> troops are incapable of striking him, my chance of victory is but half. If I know that the enemy can be attacked and that my troops are capable of attacking him, but do not realize that because of the conformation of the ground I should not attack, my chance of victory is but half. Therefore when those experienced in war move they make no mistakes; when they act, their resources are limitless.[16]

In addition to understanding the operational environment and forces, the commander must prevent the opposing force from gaining that same insight. This is the province of deception. Although there are many deception practices a force may undertake in order to gain an operational advantage, Sun Tzu is very specific about the four most important goals of a deception operation. The commander must fool the opposition in the areas of friendly capability, activity, location, and maneuver.

These instructions are clearly stated in, "When capable, feign incapacity; when active, inactivity. When near, make it appear that you are far away; when far away, that you are near,"[17] and "He changes his methods and alters his plans so that people have no knowledge of what he is doing. He alters his camp-sites and marches by devious routes, and thus makes it impossible for others to anticipate his purpose."[18]

Thus, Sun Tzu offers precise guidance on the natural goals of information superiority. The question becomes how to implement his philosophy.

NCW can provide a detailed understanding of the competitive space -- this includes not only the battlespace, but also yourself and the enemy.[19] This is the type of information NCW operations can provide. This is the fundamental Infosphere of the theater, the central theme of NCW. Vice Admiral Arthur Cebrowski, the spearhead behind the NCW revolution, observes:

> At the strategic level, the critical element for both [business and the military] is a detailed understanding of the appropriate competitive space -- all elements of battlespace and battle time. Operationally, the close linkage among actors in business ecosystems is mirrored in the military by the linkages and interactions among units and the operating environment. Tactically, speed is critical. At the strategic level, the critical element for both [business and the military] is a detailed understanding of the appropriate competitive space -- all elements of battlespace and battle time.[20]

NCW brings the commander the ability to achieve a significant advantage in the knowledge areas Sun Tzu specifies as critical in achieving the information superiority goals of JV2020 -- knowledge of yourself, the enemy, and the environment. In addition, NCW gives the commander the capability to mask important information from the enemy. One important caveat

regarding NCW's information superiority focus should be made at this point. NCW is about information integration, not some archaic bureaucratic process or technological demonstration. Mr. George Stein, Chairman of the U.S. Air War College's Conflict and Change Department, expresses this concept this way:

> It would be a strategic mistake of historical proportions to focus narrowly on the technologies; force the technologies of information warfare to fit familiar, internally defined models like speed, precision, and lethality; and miss the vision and opportunity for a genuine military revolution. Information warfare is real warfare; it is about using information to create such a mismatch between us and an opponent that, as Sun Tzu would argue, the opponent's *strategy* is defeated before his first forces can be deployed or his first shots fired.[21]

There is an enormous number of individual data points needed to shape the commander's understanding of the forces and environment. The NCW concept does not try to list them all. Instead, NCW brings the ability to focus *all* information management efforts along three critical paths. Admiral Cebrowski sees these paths as the value-added component of any networked system, whether they are commercial or military nets, and describes them as the content, quality, and timeliness of the interactive nodal information on the net.[22] In this view, information is only valuable if its content is relevant to the situation, is accurate, and is available when it is needed.

Information operations should be conducted to disrupt the enemy's use of information. Although the commander may want to disguise or hide everything about his forces from the enemy, this may not always be possible or prudent. It may be enough to fool the enemy about only one part of the operation, whether it is the "time, location, method, or weight of an impending attack," but the advantages of gaining surprise dictate that at least one of these factors should be attacked. [23] George Stein describes a fully integrated method of conducting information operations against the enemy's decision-making structure. "Offensive counterinformation, like offensive counterair, could be seen as involving information exploitation through psychological operations, deception, electronic warfare, or physical attack." [24]

INNOVATION

The second JV2020 integrating concept is innovation. Not only does JV2020 address technological innovation, but it calls for organizational and conceptual innovation as well.

Sun Tzu says to use the best available technology, but use it when and where it makes sense and not in an arbitrary manner. Also, the organization must be flexible; an organizational

structure that allows for innovative combinations of units. Even though technological advancement moved at a much slower pace in Sun Tzu's age, he still saw the necessity in emphasizing the "why" of using a certain technology in a specific combat situation. This demonstrates his understanding of the importance of thinking through the technical issues while keeping the end result always in mind, rather than using technology for technology's sake. For example, in his discussion of C2 problems during a battle he says, "As the voice cannot be heard in battle, drums and bells are used. As troops cannot see each other clearly in battle, flags and banners are used."[25] It would be easy to stop here, but Sun Tzu expands this idea to get to the heart of the matter -- using C2 technology to mold his forces into one united entity. He explains it this way:

> Now gongs and drums, banners and flags are used to focus the attention of the troops. When the troops can be thus united, the brave cannot advance alone, nor can the cowardly withdraw. This is the art of employing a host. In night fighting use many torches and drums, in day fighting many banners and flags in order to influence the sight of our troops.[26]

Thus, Sun Tzu says that we must first understand the underlying issues we are trying to address, and only then look toward the technical solution.

Although the term "innovation" often means "technology" to the modern reader, JV2020 clearly calls for innovative organizational structures as well. Sun Tzu, in his dialogue on organization, clearly demonstrates his mastery in this area of the military art. He opens with, "By doctrine I mean [flexible] organization and control."[27]

He continues this thought by explaining, "He who understands how to use both large and small forces will be victorious,"[28] and "Generally, management of many is the same as management of few. It is a matter of organization. And to control many is the same as to control few. This is a matter of formations and signals."[29] These ideas seem familiar to military students. However, Sun Tzu's view of organization, formations, and signals are a far cry from the rigidly structured C2 processes of a modern military.

Sun Tzu is not interested in building a standard organization with hierarchical C2 processes. He instead embraces an organizational structure so flexible it seems to cross the boundary into total chaos. Why? Because Sun Tzu envisioned the magnificent freedom of action possible under a constantly morphing organization, where units that are continuously rearranging become the dominant force on the battlefield. He provides a lasting example of this

fluid process in his discussion on managing ordinary and extraordinary forces. Note his emphasis on the endless combinations of forces this structure allows.

> That the army is certain to sustain the enemy's attack without suffering defeat is due to operations of the extraordinary and the normal forces. Generally, in battle, use the normal force to engage; use the extraordinary to win. Now the resources of those skilled in the use of extraordinary forces are as infinite as the heavens and earth; as inexhaustible as the flow of the great rivers. For they end and recommence; cyclical, as are the movements of the sun and moon. They die away and are reborn; recurrent, as are the passing seasons. In battle there are only the normal and extraordinary forces, but their combinations are limitless; none can comprehend them all. For these two forces are mutually reproductive; their interaction as endless as that of interlocked rings. Who can determine where one ends and the other begins? [30]

NCW would not be possible without technological innovation -- its very name derives from the networking power of brilliantly designed computer and communications technologies. However, more and better technology is not enough. The possible changes to organizations -- virtual organizations, virtual collaboration, and virtual integration -- are the real keys to achieving Sun Tzu's vision of constantly evolving organizations.

Major General Robert Scales, former U.S. Army War College Commandant, describes the German victories against French forces at the Meuse River in 1940 as "a triumph, not of overwhelming mass or firepower, but of both applied in harmony using intellect, foresight, imagination and will." [31] Admiral Bill Owens, an early proponent of the network concept as the Vice Chairman, Joint Chiefs of Staff, sought to bring the same harmony to the evolving capabilities in computing, communications, and precision guidance. He saw this relationship as an "emerging system-of-systems [that] represented a qualitatively new way of using military power." [32] However, to fully realize and integrate these new capabilities, the standard military hierarchical C2 structure must change. The new organization must allow, even encourage, a very fluid organizational approach. Mr. Jim Blaker, Research Professor at National Defense University and former special assistant to the Vice Chairman of the Joint Chiefs of Staff, points to two reasons the present hierarchy was developed in the first place. First, it ensured large numbers of troops would get, and respond to, orders passed down through the chain of command. Second, it served a psychological purpose. You might not understand what was going on around you (except that you were at great risk of being killed or maimed), and you might not know what was going to happen next, but because of the hierarchy you could at least

assume that someone in the chain did know. [33] NCW changes the underlying need for this structure. Blaker consolidates this changing need in the following:

> Hierarchy was the glue that held human organizations together in highly stressful situations...The price of hierarchy, however, was what the Prussian military theorist, General Carl von Clausewitz, called friction: growing confusion and misinterpretation as information passed upward through the command echelons, and delay, misinterpretation, and tardiness as orders passed downward. The friction of war was the indirect result of the fog of war, stemming from the efforts of hierarchical structures to cope with it. Remove the fog of war—give everyone situational awareness—and the underlying need for steep hierarchy is gone. Reduce hierarchy and the friction of war is also reduced. Reduce friction and military effectiveness goes up. Reduce friction differentially, and it becomes possible to operate within the opponent's decision-reaction cycle. And, therefore, to win. [34]

Absent a historical need for rigid structure, NCW can provide the capabilities for achieving Sun Tzu's innovative organization. Many writers point to the near organic functionality of modern information-intensive organizations -- that in fact this is the most natural path of networked operations. [35] Cebrowski shows that the most effective and efficient commercial moves toward network-centric operations have occurred when the organizations involved have developed new organizational processes at the same time they were introducing the new technology. [36] One could stand on tradition, but traditional organizations cannot exploit emerging technology. As Mr. Thomas Adams, political-military strategist and retired U.S. Army lieutenant colonel, observes, "One important outcome of this revolution may be the destruction of the long-standing, traditional military hierarchy." [37]

It is difficult to doubt the seriousness of combining a huge increase in operational information, a fluid C2 structure, and the intense lethality of tomorrow's battlefield. The exploitation of these new concepts, and the resulting increase in combat effectiveness, are the subject of the following operational concepts section.

JOINT VISION 2020 OPERATIONAL CONCEPTS

There are operational capabilities necessary for the future joint force to succeed across the full spectrum of military operations. These capabilities include dominant maneuver, precision engagement, focused logistics, and full dimensional protection.

DOMINANT MANEUVER

The first operational concept, dominant maneuver, is the ability to "gain positional advantage with decisive speed and overwhelming operational tempo in the achievement of assigned military tasks."[38] This positional advantage can be achieved not only through the massing and maneuver of forces, but more importantly by massing and maneuvering the potential effects of dispersed forces. Additionally, by putting the right forces in the right place at the right time, the commander is able to "shape the battlespace" and disrupt the enemy's Observation-Orientation-Decision-Action Cycle (OODA Loop). The results of dominant maneuver can force the enemy to act at a disadvantage and expose enemy forces to attack, or even paint so bleak a picture in the enemy's mind that they surrender after only token resistance (dominant maneuver relies heavily on information superiority for Intelligence and C2).

To Sun Tzu, the most important combat leadership capability is also to win without fighting. This means putting the enemy into an impossible situation -- forcing concessions or surrender. Sun Tzu is adamant about this point. "For to win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill," [39] is an admonition he repeats throughout his text. In fact, actual combat ranks only number three out of the four possible ways of winning a war -- the first two being, attacking the enemy's strategy and his alliances, while the fourth is attacking cities (the worst policy).[40]

Whether the battle is won before the fight, or an actual engagement is needed, Sun Tzu sees victory coming from the commander's ability to maneuver troops. He says, "Nothing is more difficult than the art of maneuver. What is difficult about maneuver is to make the devious route the most direct and to turn misfortune to advantage." [41] Sun Tzu describes a key concept the commander must employ in achieving dominant maneuver.

This concept is maneuver using an indirect approach. This requires a form of deception to prevent the enemy from learning how the commander intends to use his troops -- the key to positional warfare. According to Sun Tzu, "The ultimate in disposing one's troops is to be without ascertainable shape." [42] This does not always mean completely hiding the troops position or movement from the enemy -- but that the enemy cannot understand what their purpose is, when and where they will strike, with what strength, and their objective. He emphasizes the point by, "Although everyone can see the outward aspects, none understands the way in which I have created victory." [43]

Once the friendly troops are established in a situation where they can strike anywhere, in various combinations of force, and with different objectives, the enemy may find its situation so hopeless that they capitulate. Sun Tzu hopes to arrive at the following point. "The enemy

must not know where I intend to give battle. For if he does not know where I intend to give battle he must prepare in a great many places. And when he prepares in a great many places, those I have to fight in any one place will be few." [44] This then is Sun Tzu's ultimate aim of maneuver warfare -- the ability to strike out of a seemingly shapeless deployment. This requires a degree of understanding of the environment and the enemy, as well as one's own forces and their coordination, such that positions and movement take on an organically fluid form. The fluid nature of this situation was certainly not lost on Sun Tzu, as he observes, "Now an army may be likened to water, for just as flowing water avoids the heights and hastens to the lowlands, so an army avoids strength and strides weakness. And as water shapes its flow in accordance with the ground, so an army manages its victory in accordance with the situation of the enemy. And as water has no constant form, there are in war no constant conditions." [45]

NCW allows the battlespace knowledge and coordination necessary to achieve Sun Tzu's goals. In addition to the aspects of information superiority discussed earlier (knowledge of the battlespace), NCW forges new linkages between combat units, coordinating units, and the combat environment. This gives the commander the ability to quickly understand how forces (and potential effects) can best be deployed. The forces themselves have a significant understanding of where they need to be and what they need to be doing. Also, the speed of NCW operations can effectively destroy an enemy's OODA Loop. These capabilities can significantly contribute to "winning without fighting." NCW can provide this capability primarily through applying the emerging concept of self-synchronization.

Self-synchronization refers to a unit's ability to interact directly with other friendly units, using a commonly shared understanding of the battlespace and commander's intent, to manage its own maneuver and targeting issues. Actions coordinated in an organic fashion, between various combat and support forces at the unit level, are bounded only by the commander's objectives and rules of engagement. The units are enabled to immediately "create and exploit opportunities." [46] Thomas Adams calls this a spontaneous process that takes place between the units themselves, without the control of an outside influence -- resulting in an enormous increase in possible actions.[47] Admiral Owens sees this as the most effective and natural method of controlling the maneuver within the modern battlespace. By removing the burden of a centralized, constraining C2 system, forces can quickly adjust to the operational environment he views as "characterized by complexity, apparent randomness, and sensitivity to initial conditions. War is not a mechanistic system that can be subjected to precise, positive control or synchronized, centralized schemes. Instead it is a highly complex interactive system

characterized by friction, unpredictability, disorder, and fluidity."[48] A system, in other words, best organized at the lowest possible level -- by independent but interacting forces.

This ability to cross-coordinate actions at a very low organizational tier is indicative of the power of network-centric operations. Units can self-synchronize because they can see each other, as well as the battlespace environment and objectives, in the digital world.[49] This allows some interesting twists to the maneuver concept. Where at one time a unit was supported by those forces directly on its flanks, it is now possible for that same unit to be supported by forces in widely dispersed locations acting in coordination.

Self-synchronization, in addition to increasing units' ability to coordinate the best mutual course of action, allows a stunning increase in operational tempo. This concept, called speed of command, strives to deny the enemy any chance to determine what is actually happening throughout the operational area. Through self-synchronization, individual force elements can compensate for differences in operational tempo inherent between units -- or components. These differences, traditionally the source of an operational step function (the operate-resynchronize-operate-resynchronize cycle), produce rest periods during which the enemy can evaluate a more static situation. Units synchronizing at the lowest level can escape this cycle and present the enemy with an operational tempo "where the step function becomes a smooth curve, and combat moves to a high-speed continuum. The OODA Loop appears to disappear, and the enemy is denied the operational pause." [50] This speed, along with the ability to coordinate dispersed forces, denies the enemy the chance to formulate strategy -- he is "locked out" of his decision process. [51] All of this depends on a fundamental shift in the hierarchical decision structure.[52]

Early experiments with self-synchronization have proven successful for both the U.S. Army and the U.S. Marine Corps (USMC). At Fort Hood, platoons and companies have exercised the concept of using autonomous action to follow commander's intent -- leading to division and corps interest in the process.[53] The USMC Sea Dragon program is based on doing away with the command hierarchy and letting individual units coordinate an intensely lethal, high-speed style of combat.[54]

NCW gives a military force the tools and capabilities needed to execute Sun Tzu's maneuver goals -- strike out of a formless mass (through self-synchronization) and deny the enemy the operational picture (through speed of command) -- thus dominating the maneuver contest within the operational area. However, this only brings the *potential* of destruction to the enemy. The tools required to transform this potential into reality are explained in the following section -- precision engagement.

PRECISION ENGAGEMENT

While dominant maneuver was primarily concerned with shaping the battlespace and reducing the enemy's options, the second operational concept, precision engagement, is all about turning dominant maneuver's "potential" combat effects into reality. This is the commander's ability to orchestrate the conduct of combat operations throughout the theater with speed and lethality. To do this effectively the commander must understand the entire battlespace, be able to quickly determine the most critical targets, mass combat effects on these targets (including massed effects of geographically dispersed units), evaluate the results of these strikes, and revise the attack plan as necessary -- all at an accelerating operational tempo.

Little in Sun Tzu's writing is more emphatic than the necessity of high-tempo, lethal operations. He understands that after the maneuvering and deception comes the combat -- and the combat must be violently and decisively focused on immediately breaking the enemy. Sun Tzu does not call for a preponderance of force, a significant advantage of one side over the other. He dictates a totally devastating, crushing attack -- an operation so one-sided as to be almost immeasurably unbalanced at the point of impact.

His analogies describe the effect of the attack. "Thus a victorious army is as a hundredweight balanced against a grain; a defeated army as a grain balanced against a hundredweight," [55] and "Troops thrown against the enemy as a grindstone against eggs is an example of a solid acting upon a void" [56] are vivid examples of Sun Tzu's version of strike warfare.

Sun Tzu saw the actual engagement as a naturally flowing result of intense pre-combat preparation and brilliant maneuver, if the engagement is needed at all. Thus, we get his concise presentation of combat. There is little need in his eyes to go beyond the obvious -- follow these directions and the commander reaches the situation where the enemy must yield or be destroyed. This is the thread that reaches from initial planning to final victory. He ties this all together with:

> When torrential water tosses boulders, it is because of its momentum. When the strike of a hawk breaks the body of its prey, it is because of timing. Thus the momentum of one skilled in war is overwhelming, and his attack precisely regulated. His potential is that of a fully drawn crossbow; his timing, the release of the trigger.[57]

The evolution of NCW allows the commander to finally get beyond historical American military reliance on attrition warfare to a high tempo, theater-wide integrated massing of combat

power on immediately decisive enemy targets. By linking the sensor grid (providing the operational picture and location of specific key nodes and targets) directly with the C2 and shooting grids (instant access to and control of the best possible "shooter") the commander, and subordinate units using the self-synchronization concept, can develop an intensely lethal and coordinated attack, achieving Sun Tzu's breaking the back of the prey.

This is accomplished under NCW by shifting from fighting with massed forces to fighting with massed effects. Massing our forces will give the enemy indications of our intent, not allowed within the concepts of information superiority and dominant maneuver and certainly not condoned by Sun Tzu. Therefore, the commander following Sun Tzu's rules of maneuver will seek to deploy in the "shapeless mass." How then does one fight from such a position with the necessary lethality? By focusing power and effect, rather than mass.

> That the enemy will see our forces almost as well as we see theirs will require that we attack from dispersed or remote positions with stunning speed. Knowledge and speed will allow us to achieve "the near simultaneous application of combat power against key elements within the enemy's entire zone of operations." The result will be the disintegration of the enemy's forces. [58]

Indeed, massing of forces may no longer be a tactic worth considering in the NCW context. If we move toward the massing of combat effects -- allowed by the networking of long-range precision strike weapons with a sensor grid able to locate and identify the majority of targets within the battlespace -- the greatest dispersal of forces possible is a valid goal. Massing of effects, especially in extremely short periods of time, replaces the massing of forces in the killing power equation.[59] The speed at which NCW operations evolve is key to massing in time.

Linking all friendly forces together, including sensors and targeting data, enables forces to quickly identify and allocate targets, then engage with the best possible weapon system.[60] Moving to a network-centric rather than a platform-centric form of engagement makes *all* shooters available for this speedy concentration of firepower. Cebrowski points to an attempt to suppress a surface-to-air missile (SAM) site as an example. Traditionally, SAM suppression aircraft would escort air strikes and attack active SAM sites with high speed, anti-radiation missiles (HARM). The SAM operators would take a few shots, then quickly shut their radars off if they were targeted by the HARMs. While this may suppress the sites momentarily, they are still a threat because they have not been killed. Fighter aircraft must still be allocated to suppressing the sites during each and every strike, bleeding off combat resources. If *all* forces

were networked and instantly exchanging targeting data the sites could be attacked from a distance by non-traditional weapons -- such as Army Tactical Missile System (ATACMS) -- permanently destroying the threat.[61] This integration of weapon systems across traditional "roles and mission" boundaries provides the instantaneous power Sun Tzu requires.

Whatever the advantages of conducting high-tempo, highly lethal engagements, at least one issue remains. A military force needs "stuff" to operate. Getting the right "stuff" to the right place at the right time is the job of the third JV2020 operational concept, focused logistics.

FOCUSED LOGISTICS

Logistics is an extremely important concept, since nothing happens without logistics. The right people and things have to be at the right place at the right time. JV2020's third operational concept, focused logistics, takes this concept to a new level. We have to ensure our visibility into, and control over, the logistics system is such that not only are the right things at the right place at the right time -- but that they are not needlessly duplicated at the wrong places at the wrong times. Our previous reliance on redundant systems is no longer affordable (and they have never been efficient).

Even ancient China suffered from the costs of supplying an army in the field. Sun Tzu's estimated costs (in "pieces of gold" per thousand troops) may not translate well into today's currency, but his intent of reducing these costs through more efficient logistic management is critical to the conduct of modern warfare. Sun Tzu cautions the commander against even starting to raise an army before raising the money for staff, combat equipment, supplies, transportation, and maintenance spares.[62] Lack of command expertise in combat may lose a battle, but poor planning of campaign logistics will drive the state into bankruptcy.[63] The biggest problem associated with logistics, according to Sun Tzu, is the cost of transportation -- especially in having to move supplies to distant operational areas.[64]

Sun Tzu provides insight on how to reduce the logistical strain on an army. He breaks the issue into two parts. First, the force arrives with what it needs to fight. This is the equipment it brings from home. Second, sustainment (provisions, supplies, etc.) is delivered to the force "in theater." [65] To be fair, Sun Tzu advocates plundering the countryside to get provisions, an option perhaps not open to modern logisticians. However, he understands the importance of carrying only what was essential and resupplying exactly when necessary.[66] To efficiently manage logistics, Sun Tzu proposes, as part of his basic doctrine, that the commander should appoint a single officer to oversee the supply system.[67] This single agent,

having visibility into the entire logistics system, could better determine what, where, and when the system needed to provide support.

NCW's key logistic concept is the ability to trade "footprint" (the lift and in-theater storage/transportation needed to satisfy a multitude of logistical requirements) for "information" (the operational picture and logistic linkages required to get precisely the right thing to the right place at the right time). This idea, if properly executed, supports Sun Tzu's concept of a single picture management of theater logistics.

Once again it is the sharing of information across the network that produces an efficient logistics management system. For starters, information processing technology such as that used by Federal Express, United Postal Service, and other commercial shipping firms gives dynamic, in-transit visibility of every part of the system. Mr. David Alberts, Research Director at the Office of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (OASD (C3I)), observes, "For many customers, this information component of the transportation service often makes or breaks their ability to succeed." [68] This expands the role of transportation far beyond simply moving things. For example, picture a strike aircraft exiting the target area and returning to its base. If the flight were long enough, an air refueling would be scheduled sometime after the strike to give the fighter enough gas to get home. But, things can happen on a combat sortie to change the fighter's fuel situation. It may have had to spend more time in the target area or go into afterburner (quickly emptying its fuel tanks) to avoid enemy action. Perhaps the scheduled refueling tanker could not takeoff due to maintenance. Traditionally in this situation, the fighter, tanker schedulers on the ground, and air controllers would have communicated by radio, often at length, to locate and launch a spare tanker. Such coordination wastes time (the coordination could take many minutes), resources (schedulers and air controllers have to concentrate on this problem rather than the on-going combat picture), and ramp space (more tankers are required in theater to cover like contingencies around the clock). Imagine instead, the same scenario under NCW. Detailed real-time data exists on the network regarding this fighter's fuel situation as it is evolving, the fighter's location and flight path, all available refueling assets both airborne and on the ground – as well as *the fuel situation of all other aircraft in the air.* This allows a much more focused allocation of refueling resources, the logistic equivalent of precision engagement.

Alberts argues the same is true of ground operations, but adds the element of self-synchronization. He says, "One can easily envision a situation in ground operations where near real time information on consumption of fuel and ammunition in weapons platforms combined with an agreed-to rule set could significantly improve logistical support." [69]

When logistics can be focused to the degree NCW allows, through a single integrated view of the overall system -- Sun Tzu's single logistics officer -- not only is combat enhanced, but the footprint can be greatly reduced. This is especially true of support functions. Each support unit brings parts, supplies, communications gear, field chow halls, trucks, etc. to the theater. This "baggage train" may be necessary for the unit to act alone, but this is rarely the case during a theater operation. Within the NCW concept, these units add their capabilities to the overall effort -- capabilities known and tracked by other units through the net. This greatly reduces redundancy through the network enabled sharing of assets and resources.[70] Reduced redundancy means reduced requirements. This in turn leads to fewer cargo tons being lifted into the theater. NCW capability thus satisfies Sun Tzu's logistics directions.

FULL DIMENSION PROTECTION

This last JV2020 operational concept is simply the reverse side of the offensive coin developed in the first three concepts. If we are to conduct effective combat operations and ensure a favorable outcome to hostilities, our forces must be protected from both symmetrical and asymmetrical attacks. This requires an understanding of, and ability to respond to, a wide range of threats.

Sun Tzu discusses, of course, the proper force disposition to prevent a successful direct enemy attack against the fielded army. This is the physical security of the personnel and equipment involved in combat. Sun Tzu also addresses, at a more philosophical level, the effects of a campaign on the soldier. This concept of how support from home (and other non-battlefield issues) influences the soldier's effectiveness in combat is crucial to Sun Tzu's evaluation of an army's ability to conduct operations. He says to defend the force, "One may know how to win, but cannot necessarily do so. Invincibility lies in the defense; the possibility of victory in the attack," [71] and, "It is a doctrine of war not to assume the enemy will not come, but rather to rely on one's readiness to meet him." [72]

This readiness must be maintained on three levels. First is the physical protection of the force. Second, the organizational structure that allows the forces to shape the battlefield must be preserved against attack, and communication links between the various forces must be protected. Sun Tzu advises, "He whose ranks are united will be victorious." [73] Third, forces must be protected from psychological attacks. Sun Tzu understands the demands placed on the soldier by the operational environment and the effects of ties to home.

> Now an army may be robbed of its spirit and its commander deprived of his courage. During the early morning spirits are keen, during the day they flag, and in the evening thoughts turn toward home. And therefore those skilled in war avoid the enemy when his spirit is keen and attack him when it is sluggish and his soldiers homesick. This is control of the moral factor.[74]

The integration of a "common picture of the battlespace," with an enhanced appreciation of the overall effects of "publicity" warfare, will enable the commander to not only protect the troops from direct physical attack -- but to mitigate the effects of psychological attacks or other more subtle efforts to undermine the soldier's ability to fight.

Merging NCW's sensor grid throughout the entire theater produces a heightened awareness of all things within the battlespace. The fog of war may not be entirely erased, but the uncertainty about potential enemy actions will be greatly reduced. In the information environment, friendly units can tailor their physical security processes to defend against the most likely attack scenarios. Focusing defensive efforts against what will probably happen instead of spreading resources out in an effort to defend against an almost infinite number of possible actions, offers more effective and economical force protection activity. [75] This is the key to physical defense under NCW.

Protecting the actual network, the NCW "force unifier," is another critical action necessary to meet Sun Tzu's challenges. Mr. Joseph Cipriano, Executive Director for Warfare Systems at the Naval Sea Systems Command, observes, "The network itself becomes mission-essential, and therefore must be protected as one of the most valuable assets of the force. The network's vulnerabilities must be understood -- and defenses developed -- to offset and/or minimize those vulnerabilities even as improved capabilities are studied and implemented." [76]

George Stein, discussing the methods of protecting the network, likens the defensive counterinformation mission to defensive counterair and suggests similar protective activities including "physical defense, OPSEC, communications security, computer security, counterintelligence, and public affairs." [77] However, just as trying to protect troops against all possible attacks is inefficient due to the vast resources required for the job, so is trying to protect all of the military's networks. It would be much better, argues Lieutenant Colonel Jeffery Horne, in his U.S. Army War College Strategy Research Project, to understand the difference between those networks that manage the day-to-day "business" of the military -- those that serve the same management purposes as corporate management nets -- and those combat related nets critical to NCW function on the battlefield. In his view, lacking a "silver bullet" to protect all systems, the military should concentrate their defensive efforts on what is critical to

combat success and perhaps not routine email systems. He adds, "We could accomplish the task by assessing the situation, educate our people on how they can contribute to enhanced protection against information network attacks, and prioritize the limited resources available to address the situation." [78]

The third protection issue Sun Tzu raises, protecting the troops from psychological attack, can also be addressed within the network context. The information age provides our adversaries the data mining capability with which to conduct "tailored" propaganda attacks -- as George Stein notes, "Every credit card purchase adds data to someone's resources, and not everybody is selling just soap or politicians." [79] A determined enemy could play havoc with troop morale with "edited" photos or personal emails. Or, on a larger scale, wholesale fabrications of events either in theater or back home. These attacks could easily contain enough realistic detail, mined from available sources, to give the appearance of truth. Stein summarizes this issue with:

> Contemporary public and commercial databases and the constantly expanding number of sources, media, and channels for the transmission of information, essentially available to anyone with a bit of money or skill, have created the opportunity and "target sets" for custom-tailored information warfare attacks on, to take just one example, the families of deployed military personnel. Think about the morale implications of that for a minute. [80]

In the information age, does the individual soldier's electronic links to home, and their loved ones' home and office computers, become one of George Stein's "critical combat networks?" Possibly. At the very least, some method must be used to mitigate the effects of attacks on these systems. Perhaps, in the end, this problem is best handled through education and training (of both service member and family if possible), providing secure communications links, and aggressive public relations campaigns that go far beyond today's "press release" mentality.

NETWORK CENTRIC WARFARE CONCERNS

Network-Centric Warfare, like other revolutionary process and organizational change concepts, is not free from criticism. Dr. Thomas Barnett, Professor and Senior Decision Researcher at the U.S. Naval War College, provides the most concise collection of these concerns in his article, "Seven Deadly Sins of Network-Centric Warfare." [81] Although the

purpose of this research paper is to demonstrate how NCW *can* work to achieve a quantum leap in combat capability, issues raised in critical works should nevertheless be addressed.

The first two of Barnett's NCW Sins are lust (NCW longs for an enemy worthy of its technological prowess) and sloth (NCW slows the U.S. military's adaptation to a military operations other than war (MOOTW) world). [82] This view assumes NCW is unsuitable for any type of conflict other than a head-to-head engagement between forces possessing a relatively equal technological base. This criticism grew from a rather narrow focus on offensive counter-information operations, and projects a situation in which U.S. forces cannot fight an enemy who does not also rely on combat networks. This view misses a central theme of NCW -- that NCW is about how *our own* forces interact and operate, not on how the U.S. will attack an enemy's networks. It is difficult to imagine a military operation where NCW capabilities (integrated intelligence, knowledge of the battlespace, coordinated maneuver, and fires, etc.) would not significantly enhance friendly force mission effectiveness.

The third NCW Sin is avarice (NCW favors the many and cheap, the U.S. military prefers the few and costly).[83] The argument between "many and cheap" versus "few and costly" is not new, and certainly not limited to the province of NCW. Within the NCW framework, this discussion assumes a greater survivability of a network comprised of numerous small nodes rather than fewer large ones. This assumption holds to the pre-NCW concepts of monolithic C2 nodes and ignores the distributed cooperation capable under NCW. It mentally pictures large "platforms" -- ships, C2 centers, logistics distribution areas and the like -- as nodes of specific networks. Is an aircraft carrier any more of an inviting target because it is an NCW node? Not if that function can easily be carried out in many other places on the integrated net. NCW, in the truest sense, brings "many" (number of network nodes) to the battlefield of the "few and costly" (combat platforms).

The fourth NCW Sin is pride (NCW's lock-out strategies resurrect old myths about strategic bombing).[84] In other words, can a U.S. attack on the enemy's information technology centers of gravity win the conflict? Again, this criticism misses the mark by focusing on the enemy's network -- or lack thereof -- and our ability to conduct a successful information operation against it. This is the same argument raised in lust and sloth. NCW's "lock-out" concept is based on conducting maneuver and massing combat effects so quickly and decisively that the enemy's ability to effectively respond is destroyed. Although this capability may be enhanced by information operations, it is not the fundamental cause of "lock-out" as the argument suggests. Although attacks on an enemy's network may be a part of future

operations, U.S. forces using NCW concepts derive operational advantage primarily through revolutionary changes in friendly coordination and integration.

The fifth sin, anger (NCW's speed-of-command philosophy can push us into shooting first and asking questions later), and sixth, envy (NCW covets the business world's self-synchronization), are directly tied to our ability to get inside the enemy's OODA loop using NCW.[85] Barnett's basic question, "Once inside the opponent's OODA loop, what do we do then?" raises a valid concern. What happens when the enemy's OODA loop is so compromised that he is feebly responding to actions our own forces took many cycles ago? Will our forces understand this or continue to accelerate operational tempo, well past what is needed to fulfill objectives. In the future, will our own OODA loop collapse along with the enemy's? The answer is to ensure doctrinal checks and balances are developed as NCW organizations, techniques, and procedures co-evolve with technical capability, and are fully integrated into training and operational rules of engagement.

Barnett's final sin, gluttony (NCW's common operating picture (COP) could lead to information overload), is also valid up to a point.[86] If the COP were fully developed, the Air Force F-22 pilot, USMC platoon leader, supply sergeant, and theater CINC would all have access to the same operational information. However, their information needs are significantly different at any point in time. Any system which forces the user to differentiate between the millions of data points to dig out what is actually relevant, will definitely lead to data overload. However, the idea of an F-22 pilot having to sift through the entire enemy land order of battle before seeing updates on the SAMs along the flight path pushes the limits of common sense. Different people, even in the same position, can integrate different amounts of data, and rationally designed information architectures will allow the user to only see what the user wants. One cannot, however, totally discount the possibility of NCW architecture design and acquisition shortsightedness.

One significant NCW concern has yet to be fully discussed in the available literature, but deserves mention here. NCW allows the theater commander to see the entire battlespace, maneuver each unit into a superior position, identify targets and assign strikes against these targets anywhere in the operational area. It also allows small units, or individuals in the most extreme cases, to perform almost identical C2 activities. This creates a major doctrinal issue -- who "has the stick" during operations. Either the units engage in "self-synchronization" or the higher chain-of-command directs everything. These seem to be mutually exclusive efforts. Perhaps the reason this conflict has not been fully debated is the NCW community, both supporters and critics, have for the most part only addressed parts and pieces of the larger

NCW idea. It is a question whose answer will ultimately drive the shape of evolving NCW systems, organizations, and doctrine.

CONCLUSION

The U.S. faces many challenges as it enters into the 21st century. The pace of social change, fueled by the information revolution of the late 20th century, will continue to accelerate and spread to even more parts of international life. Businesses will challenge traditional forms of competitive advantage, education services will reach the most remote villages, and global partnerships will continually shift alliances between states and economic centers. Many see this as a progression toward an integrated utopian world. A more realistic reading of historical trends would demonstrate otherwise. Competition for scarce natural resources, centuries old ethnic rivalries, flexing of political muscle, or simple lust for power will not evaporate with the introduction of new technologies. There will always be conflict.

The U.S stands at the center of these future conflicts. Whether defending vital national interests, establishing peace between warring ethnic factions, or protecting humanitarian relief efforts, America's military forces will be called on to fight on the battlefields of this future world. To do this effectively, we must have a strategy, not just a strategy for a particular place or a specific budget cycle, but an overarching sense of how we plan on winning tomorrow's battles. This paper has provided an insight into how that strategy should develop.

Strategy is comprised of balanced ends, ways, and means. JV2020's objectives provide the ends for tomorrow's military capability; Sun Tzu, the ancient Chinese military philosopher, provides the ways needed to succeed in future warfare; and NCW provides the means to accomplish this. This paper demonstrated that by adopting the technologies and organizations made possible within the context of NCW, Sun Tzu's concepts can be realized and JV2020 can become reality.

Throughout the centuries, innovative ideas have often been discounted or entirely ignored. Like these, NCW has its critics. The U.S., however, must boldly move forward in implementing NCW. Holding onto tradition will see us left vulnerable -- for who knows who is already designing the next longbow.

WORD COUNT = 9300

ENDNOTES

[1] Barbara W. Tuchman, A Distant Mirror: The Calamitous 14th Century (New York: Ballantine Books, September 1979), 70-71, 519, 563, 585. Even though gunpowder had been 'militarized' in Europe by the French development of a simple cannon in 1325, the French military structure refused to adapt its use to the battlefield. Even more striking was the French failure to incorporate the longbow, first used by the English to destroy the French forces at Sluys in 1340 and a much more decisive weapon than early firearms, into French tactical deployments. Because of this, the French, firmly trusting in the invincibility of the mounted knight, saw their forces repeatedly crushed during the late 14th and early 15th centuries by more innovative armies.

[2] Jacob W. Kipp, "The Russian Military and the Revolution in Military Affairs: A Case of the Oracle of Delphi or Cassandra?" 6-8 June 1995; available from <http://call.army.mil/call/fmso/fmsopubs/issues/rusrma.htm>; Internet; accessed 27 December 2000. The same lack of innovative technological integration left the allies ill-prepared for the German Blitzkrieg at the outbreak of World War II.

[3] Neilson, Robert E., ed., Sun Tzu and Information Warfare. (Washington D.C.: National Defense University Press, 1997), 3.

[4] Chairman, Joint Chiefs of Staff, "Joint Vision 2020," June 2000; available from <http://www.dtic.mil/jv2020>; Internet; accessed 23 October 2000, 3.

[5] Chairman, Joint Chiefs of Staff, 1.

[6] Ibid., 1-3.

[7] David S. Alberts, John J. Garstka, and Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd Edition (Revised) (Washington, D.C.: DoD C4ISR Cooperative Research Program, August 1999), 2.

[8] Ibid.

[9] Fred P. Stein, "Observations of the Emergence of Network Centric Warfare;" available from <http://www.dodccrp.org/steinncw.htm>; Internet; accessed 22 October 2000, 3.

[10] Alberts, 6-7.

[11] Sun Tzu, The Art of War, trans. Samuel B. Griffith, (New York: Oxford University Press, 1971), Foreword and Preface.

[12] Ibid., 84.

[13] Ibid., 129.

[14] Ibid., 66.

[15] Ibid., 100.

[16] Ibid., 129.

[17] Ibid., 66.

[18] Ibid., 137.

[19] Arthur K. Cebrowski and John J. Garstka, "Network Centric Warfare: Its Origin and Future," January 1998; available from <http://www.usni.org/Proceedings/Articles98 /PROcebrowski.htm>; Internet; accessed 13 July 2000; 6. Cebrowski uses the term "competitive space," a term emerging in the business world to define both the competitive environment and associated players, in the military sense.

[20] Ibid.

[21] Alan D. Campen, Douglas H. Dearth, and R. Thomas Gooden, eds., Cyberwar: Security, Strategy and Conflict in the Information Age (Fairfax, VA: AFCEA International Press, May 1996), 176. This quote is by George J. Stein.

[22] Cebrowski, 5.

[23] Jeffrey O'Leary, "Surprise and Intelligence: Towards a Clearer Understanding," Spring 1994; available from <http://www.airpower.mazwell.af.mil/airchronicles/apj/apj/apj94/oleary.html>; Internet; accessed 21 September 2000; 4-5.

[24] Campen, 181. This quote is by George J. Stein.

[25] Sun Tzu, The Art of War, 106.

[26] Ibid.

[27] Ibid., 65. Griffith translates the organization passage as "By doctrine I mean organization and control." Sun Tzu, The Art of Warfare, trans. Roger T. Ames, (New York: Ballantine Books, January 1993), 102-103. Although not included in the Griffith translation, the Chinese character **qu** (nonlinear flexibility) in this passage indicates Sun Tzu's recommendation for a flexible organization and doctrine. He expands this idea in his discussion on the control of different size forces. Ames translates the passage as "organizational effectiveness."

[28] Sun Tzu, The Art of War, 82.

[29] Ibid., 90.

[30] Ibid., 91-92.

[31] Robert H. Scales, Jr., Future Warfare (Carlisle Barracks, PA: U.S. Army War College, May 1999), 60.

[32] Jim Blaker, "The Owens Legacy: The Former Vice Chairman of the Joint Chiefs Laid the Groundwork for a Revolution," Armed Forces Journal International (July 1996): 20.

[33] Ibid., 20-21.

[34] Ibid.

[35] Thomas K. Adams, "The Real Military Revolution," Parameters XXX (Autumn 2000): 56.

[36] Cebrowski, 5.

[37] Adams, 55.

[38] Chairman, Joint Chiefs of Staff, 26.

[39] Sun Tzu, The Art of War, 77.

[40] Ibid., 77-78.

[41] Ibid., 102.

[42] Ibid., 100.

[43] Ibid., pp 101.

[44] Ibid., 98.

[45] Ibid., 101.

[46] "Network Centric Operations: A Capstone Concept for Naval Operations in the Information Age," Draft for Global 2000 (Washington, D.C.: 4 August 2000), 9.

[47] Adams, 59.

[48] Mackubin T. Owens, "Technology, the RMA, and Future War," Strategic Review XXVI (Spring 1998): 65.

[49] Robert R. Leonhard, The Principles of War for the Information Age (Novato, CA: Presidio Press, 1998), 112.

[50] Cebrowski, 8-9.

[51] Ibid., 7.

[52] Future Joint Force Working Group, Future Joint Force Concept, prepared for the Chairman, Joint Chiefs of Staff (Washington, D.C.: Joint Staff, 21 August 2000), 21.

[53] Alberts, 177-178.

[54] Blaker, 21.

[55] Sun Tzu, The Art of War, 88.

[56] Ibid., 91.

[57] Ibid., 92.

[58] David Tucker, "The RMA and the Interagency: Knowledge and Speed vs. Ignorance and Sloth?" Parameters XXX (Autumn 2000): 67.

[59] Leonhard, 94-103.

[60] Charles Jewett and David Narkevicius, "A Synergistic Increase in Combat Capabilities—NAVAIR (Naval Air Systems Command): Shaping the Air Node for NCW (Network Centric Warfare)," Sea Power 42 (March 1999): 43.

[61] Cebrowski, 8.

[62] Sun Tzu, The Art of War, 72.

[63] Ibid., 73.

[64] Ibid., 74.

[65] Ibid.

[66] Ibid., 134.

[67] Sun Tzu, The Art of Warfare (Ames), 102-103. "Regulation entails ... a [single] structure for logistical support." Griffith translates this passage as "By doctrine I mean ... regulation of supply routes, and the provision of principal items used by the army." This supply text in Chinese reads **zhu yong** "a master of expenditures", indicating the requirement for a single logistics person.

[68] Alberts, 44.

[69] Ibid., 176-177.

[70] Joseph R. Cipriano, "A Fundamental Shift in the Business of Warfighting," Sea Power 42 (March 1999): 42.

[71] Sun Tzu, The Art of War, 85.

[72] Ibid., 114.

[73] Ibid., 83.

[74] Ibid., 108-109.

[75] Leonhard, 163.

[76] Cipriano, 40.

[77] Campen, 181. This quote is by George J. Stein.

[78] Jeffrey C. Horne, Information Superiority as an American Center of Gravity: Concepts for Change in the 21st Century, Strategy Research Project (Carlisle Barracks: U.S. Army War College, 10 April 2000), 11-12.

[79] Campen, 176. This quote is by George J. Stein.

[80] Ibid.

[81] Thomas P. M. Barnett, "The Seven Deadly Sins of Network Centric Warfare," 1999; available from <http://205.67.218.5/dsd/7deadly.htm>; Internet; accessed 13 July 2000; 1-8.

[82] Ibid., 1-2.

[83] Ibid., 3.

[84] Ibid.

[85] Ibid., 4-5.

[86] Ibid., 6.

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