OUT OF THE WEB AND INTO THE REVOLUTION: A PERSPECTIVE OF STRATEGIC AIRPOWER IN THE INFORMATION AGE

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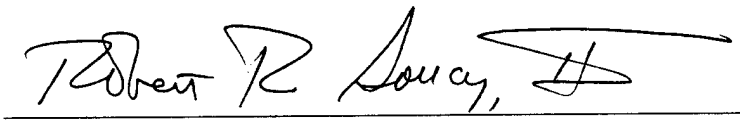

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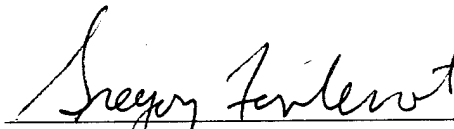

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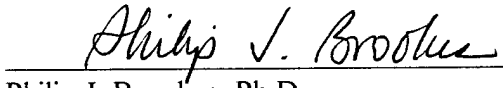

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ABSTRACT

OUT OF THE WEB AND INTO THE REVOLUTION: A PERSPECTIVE OF STRATEGIC AIRPOWER IN THE INFORMATION AGE by Major James Riggins, USAF, 47 pages.

This monograph explores the validity of Colonel John A. Warden III's strategic airpower theory as various nations, including the U.S., enter a Revolution in Military Affairs (RMA) based on the rapid advancements in information technologies, and the operational and organizational concepts which exploit these technologies. Warden's theory is based on modeling an enemy as a system of five rings representing leadership, organic essentials, infrastructure, population, and fielded military forces. The method of attack in his theory is that of parallel warfare, striking nearly simultaneously across aspects of the system critical to the leadership ring in order to induce strategic paralysis.

The monograph traces the evolution of strategic airpower theory since 1917 with an emphasis on the post World War I period, World War II, Vietnam, and Operation Desert Storm. Additional discussion focuses on the nature of societal shifts toward the information age, and the potential character of the associated RMA. It then analyzes the Warden theory as used by an informational age U.S. military against a variety of adversaries including an advanced peer competitor.

This monograph concludes that the Warden model is valid for such scenarios if modified to specifically include the element of information. It is only valid, however, if one properly identifies the nature of the enemy and character of the war one is fighting— a task that is becoming increasingly difficult as the world's societies trisect into agrarian, industrial, and informational levels. While the model remains valid, lethal airpower in many cases is not the appropriate tool to implement the theory.

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INTRODUCTION

> *. . .effects in war seldom result from a single cause; there are usually several concurrent causes. It is therefore not enough to trace, however honestly and objectively, a sequence of events back to their origin: each identifiable cause still has to be correctly assessed.*
>
> *Carl von Clausewitz*[1]

When General Ulysses S. Grant ordered Major General William T. Sherman to begin a new type of campaign against the Confederates in April 1864, he was perhaps the first military strategist to recognize the change in warfare which would guide airpower theorists for decades in the 20th century. Frustrated by his inability to achieve a decisive Napoleonic battle, Grant ordered Sherman to attack deep into the enemy's interior to target not the army, but the materiel and national morale which allowed the army to function. In Sherman's view, "denied war resources and the supporting will of the Confederate population . . .the organized armies would soon collapse."[2] The generals recognized that the conduct of warfare and the nature of civilization had changed: industrialized nations now had the capacity to sustain large armies over extended periods. In essence, they declared an entire nation the enemy and subject to attack, and perceived that attacks against the enemy's heart would lead to victory at a lower cost to the Union. This viewpoint also appears in the earliest versions of United States (U.S.) strategic airpower theory, and remains consistent to the present. However, the world is seemingly undergoing a change perhaps as profound, if not more so, than the industrial revolution which fostered Grant's strategy, and airpower theory may be forced to change with it.

In spite of the tremendous change to aerospace technology in the 20th century, American strategic airpower thought and doctrine has remained relatively constant since 1917. While variations occurred over time, one common thread has been the consistent focus on war with the "modern" industrial nation-state, and the proposed destruction of the nation's infrastructure and industrial base, over direct population attack, to collapse some combination of the enemy's capability and will to continue the conflict. Advances in weapons technology had little or no impact on these basic premises.

While not published doctrine, the work of Colonel John Warden III reflects one

popular, contemporary airpower theory. Warden holds that one can model any strategic entity as a system of five rings. The rings, which he also considers centers of gravity, include leadership, organic essentials, infrastructure, population, and fielded military. Warden proposes the persistent and simultaneous attack on the essential nodes of this system, emphasizing the crucial leadership ring, to induce a strategic paralysis on the entire system. The paralysis, in turn, should compel the opposing political leadership to concede victory to the attacker. The U.S. employed the essence of the five-ring model and its underlying concepts with great success during Operation Desert Storm (ODS).

The relative consistency of airpower theory since 1917 makes sense when one views airpower from the grand context of the societal structure within which it was born and evolved. Unlike land or sea power, the entire period of airpower rests in the heart of the industrial age world, a period where political power lies in the nation-state, and the world community gauged the strength of a nation by its industrial output, reserves of raw materials, and sophistication of its transportation infrastructure. This represents a segment of the period in human history that authors Alvin and Heidi Toffler refer to as "Second Wave," or "mass-industrial"[3] civilization. This was a period where modern nations would use the fruits of the industrial revolution to lift the size, scope, and lethality of warfare to previously unimaginable levels.

The Tofflers and others assert that the U.S. and other nations are currently undergoing another transformation to a "Third Wave," or information based civilization. To continue to view today's world in the same manner as in previous decades, according to the Tofflers, is improper because "it is too simple and it is obsolete. Simple because it tries to explain world power in terms of only two factors—economic and military. Obsolete because it overlooks the growing role of knowledge—including science, technology, culture, religion, and values—which is now the core resource of all advanced economies and of military effectiveness as well." [4] Of course, a revolution of this scope cannot avoid impacting the conduct of warfare.

The subset of the Third Wave shift impacting the conduct of warfare, commonly referred to as the Military Technical Revolution (MTR) or Revolution in Military Affairs (RMA), goes beyond simply developing and employing new technologies. A true RMA

represents a fundamental change in military doctrine, organization, and technology. At the core of the current RMA are new sensor and communication technologies, improved weapon precision, and information doctrine. This RMA, along with its parent Third Wave shift, impacts how the U.S. military views warfare and the tools to execute it. These same elements outside the U.S. affect the nature of potential adversaries. Thus, the RMA must also impact the doctrinal foundations of current American strategic air thought.

Given the fundamental changes wrought by these societal shifts, the question this monograph seeks to answer is "does the RMA and the larger Third Wave revolution impact the validity of current U.S. strategic airpower theory?" Answering such a question on the future relevance of airpower theory first requires understanding the theory's origins. Therefore, this monograph presents the evolution of U.S. strategic air doctrine through five historical periods, World War One (WW I), the inter-war years, WW II, Vietnam, and ODS. To project the impact of airpower doctrine into the future also requires a basic vision of the RMA. While the specifics of the RMA and the shift to a Third Wave civilization are impossible to determine, the monograph will present the broad themes and aspects which are common to the current RMA literature. The focus remains at the strategic and operational levels of war, and avoids detailed discussions of specific new or potential technologies. With this background, the monograph will analyze the validity of current U.S. airpower thought, and Warden's five-ring model in particular, in the context of the Revolution in Military Affairs.

EVOLUTION OF U.S. STRATEGIC AIRPOWER DOCTRINE

> *A modern state is such a complex and interdependent fabric that it offers a target highly sensitive to a sudden and overwhelming blow from the air.*
>
> *B.H. Liddell Hart*[5]

As the world entered an era of total war between large, industrialized nation-states, armies grappled with the same inability to achieve decisive victory that plagued the American Civil War belligerents. Gradually, they would turn to airpower to break the stalemate of modern war, and seek new ways to strike at the capability and will of the enemy. While these two elements remain constant in U.S. strategic airpower theory,

the preferred methods for accomplishing these objectives and the degree to which each theme was emphasized have varied.

World War I

America's entry into the war in 1917 signaled the birth the U.S. airpower doctrine, as well as the debates on the proper use of airpower which continue to this day. The essence of the debate was whether air units should be divided among individual ground commanders to support their troops, or controlled centrally to act throughout the theater of operations. The latter option implied the existence of targets more significant than the enemy's troops to accomplishing the war aims.

While General John J. Pershing, commander of the Allied Expeditionary Forces (AEF), firmly held the belief that the role of aviation was the direct support of army units[6], he afforded a degree of latitude to his First Army Air Service commander, General William Mitchell. Mitchell accepted the importance of aviation to the ground combat units but, along with and probably influenced by Major General Sir Hugh M. Trenchard, he developed a vision of defeating an enemy not by bombing their troops, but "ultimately in 'hitting an enemy's great nerve centers at the very beginning of the war so as to paralyze them to the greatest extent possible.'"[7]

Lieutenant Colonel Edgar S. Gorrell of the Air Service's Technical Section converted Mitchell's vision from theory to reality. Recognizing that the German army relied on a few key war industries and transportation nodes, Gorrell and his staff developed an air operations plan focusing strategic bombing against these targets. The plan directed sequential air attacks against the four key regions of Dusseldorf, Cologne, Mannheim, and the Saar.[8] Pershing, however, never implemented Gorrell's plan. Faced with a shortage of bombers through simple lack of production, he feared the Air Service could not provide the necessary support to the Army *and* execute strategic bombing.[9]

Mitchell and Gorrell developed two significant, though unproven, features of strategic air thought. First, airpower could impart significantly more influence on the outcome of a war by attacking into the heart of an enemy nation versus attacking soldiers on the front line. Second, the crucial targets in the enemy nation were those industries

upon which their army relied, such as munitions plants. The emphasis, then, was on the indirect attack of the army, not the paralysis or collapse of the nation; and on physical warmaking capacity, not the national will. These concepts would change and evolve in the years building up to WW II as industrial societies became more complex and contributed more to the conduct of war.

The Inter-War Years

The foundation of U.S. airpower doctrinal development between the wars lay in the Air Corps Tactical School (ACTS), established in 1920. Airpower prophets and military theorists such as Mitchell, Trenchard, Italian Air Marshall Guilio Douhet, J. F. C. Fuller, and B. H. Liddell Hart each drew their own specific lessons from WW I as to the potential of air attacks, and their writings influenced the ACTS officers to varying degrees. They each maintained the underlying premise that strategic bombing served as a powerful *means* to defeat an industrialized nation-state in a manner less costly than the bloody trench combat of the WW I, but they differed in their theories on the appropriate *ways* to employ that bombing. They differed in their opinions as to what constituted a strategic center of gravity (COG) for a nation-state, the vital centers (industry, communications, oil, food centers, etc.), the national will, the army, or a combination of the three. A comparison between the views of Douhet and the ACTS curriculum highlights some of these doctrinal differences.

Douhet based his concept of strategic combat on the premise that future wars would be between modern nation-states; such war would involve the full mobilization of the nation, thereby making all citizens subject to attack; and the will of a nation lies in the will of its population. In 1927 he wrote:

> It seems paradoxical to some people that the final decision in future wars may be brought about by blows to the morale of the civilian population. But that is what the last war proved, and it will be verified in future wars with even more evidence. The outcome of the last war was only apparently brought about by military operations. In actual fact, it was decided by the breakdown of morale among the defeated peoples—a moral collapse caused by the long attrition of the people involved in the struggle. The air arm makes it possible to reach the civilian population behind the line of battle, and thus to attack their moral resistance directly.[10]

Douhet proposed direct attacks on cities using explosive, incendiary, and chemical weapons as the means to "crush the material and moral resistance of the enemy."[11]

In the U.S., the ACTS prepared a course text in 1926 titled *Employment of Combined Air Force* which emphasized the destruction of the enemy's morale, not his armies, as the goal of war and of strategic airpower. The means of breaking the morale was through attacks on the enemy nation's vital centers, industry and transportation, but not necessarily through direct attack on civilians.[12]

In the 1930s ACTS thought gradually shifted to the "industrial web theory," a concept closely modeled from Gorrell's recently rediscovered strategic bombing plan of WW I. The industrial web theory stipulated that

> (1) In "modern warfare," the military, political, economic, and social facets of a nation's existence were so "closely and absolutely interdependent" that interruption of the delicate balance could suffice to defeat an enemy state; (2) strategic bombing, precisely aimed at these "vital centers" of an enemy's industrial complex, could wreck the fragile equilibrium and hence destroy the enemy state's war-making capability; and (3) such destruction would also wreck the enemy nation's capacity to sustain normal day-to-day life, which would in turn destroy the will of its populace to fight.[13]

This theory clearly sought the collapse of the nation, not the destruction of the army, as its end state. Collapse would occur through the destruction of national "organic systems"[14] and not merely war materiel factories. Additionally, the theory reflected the American military reluctance to target civilians physically.

While the terminology might have been different in the 1920s and 1930s, the analysis performed by the ACTS faculty resembles the problem facing the Air Force today. The Air Corps after WW I assessed the key nations of the world as being well established in what is today called the Second Wave. That is, the prime threats to the United States came from modern industrialized nations. The airpower theorists concentrated on symmetric warfare,[15] Second Wave versus Second Wave, for the condition of total war. They correctly grounded their analysis within this framework to determine the most efficient and effective means to achieve victory against a modern nation. Their theory is as much a study in what constitutes victory in war—understanding the source of a nation's strength and its vulnerabilities—as it is a concept on how to employ aircraft. These

thoughts emanated primarily from airpower theorists because airpower offered the technology which met the requirements of the theory. War would constitute the real test for these airpower concepts.

World War II

One of the chief architects of the airpower strategy for WW II was Captain (later General) Haywood S. Hansell of the newly created Air War Plans Division (AWPD). In 1941, prior to the U.S. entering the war, the division developed a European plan which sought the "breakdown of the industrial and economic structure of Germany" by identifying "a system of objectives vital to the continued German war effort and to the means of livelihood of the German people, and *tenaciously concentrating all bombing* [original emphasis] toward the destruction of those objectives."[16] Additionally, Hansell believed that direct bombing of cities could be used as a last resort, but his division "never accepted attack on civilian populations as the main method of air warfare."[17]

The first version of the AWPD plan (AWPD-1) called for the destruction and disruption of the following systems:[18]

Table 1: AWPD-1 Target List

System	Targets
German Air Force	18 airplane assembly plants 6 aluminum plants 6 magnesium plants
Electric Power	50 generating plants and switching systems
Transportation	47 marshaling yards, bridges, and locks
Synthetic Petroleum	27 synthetic plants
TOTAL	154 targets

When the U.S. entered the war in Europe, the U.S. modified the basic precepts of AWPD-1 only slightly. The Combined Bomber Offensive Plan of June 1943, concentrated on the primary targets of the ball-bearing industry (highest priority), German aircraft industry and air force, oil (both synthetic and natural), steel production, and transportation.[19] The air planners intentionally ignored the electric power system after concluding the system to be too highly developed and resistant to attack.[20] Throughout

1944 and 1945, the bombing offensive struck numerous secondary target systems such as submarine production, V-1 and V-2 rocket production and launch facilities, automobile plants, and a host of smaller industries.[21] Finally, as conceptualized in AWPD-1 as a last resort, the U.S. participated in direct incendiary attacks of German cities.[22]

The *United States Strategic Bombing Surveys* (USSBS) of WW II concluded that the strategic bombing efforts in Europe were decisive, albeit with room for improvement, thus validating the pre-war doctrine of ACTS and the AWPD. While the attacks on most systems were ineffective due to German rebuilding and dispersal efforts, as well as slack in the production potential, the attacks on two key categories proved essential: oil and transportation. Synthetic and natural petroleum production was difficult to disperse or harden, and thus proved susceptible to persistent air attacks.[23] Additionally, attacks on the rail and canal network severely degraded the overall German economy, industrial output, and the operational movement of the army.[24] The USSBS stated that even though Germany still had a fielded army at the end of the war, "with the impending collapse of the supporting economy, indications are convincing that they would have had to cease fighting . . .within a few months."[25]

Just as significant, however, is the USSBS conclusion on the moral domain aspect of the industrial-web theory:

> The mental reaction of the German people to air attack is significant. Under ruthless Nazi control they showed surprising resistance to the terror and hardships of repeated air attack, to the destruction of their homes and belongings, and to the conditions under which they were reduced to live. Their morale, their belief in ultimate victory or satisfactory compromise, and their confidence in their leaders declined, but they continued to work efficiently as long as the physical means of production remained. The power of a police state over its people cannot be underestimated.[26]

The results of this war and those to come support the notion that predicting and measuring the impact of bombing on the intangible of national will is difficult, if not impossible.

In the Pacific, Japan would prove even more susceptible to the concepts of the industrial-web theory. As a newly modernized nation, her industrial infrastructure was less efficient and robust, and less capable of being dispersed, than her German ally.

Additionally, Japan's industry relied on imported raw materials requiring open sea lines of communication.

The original strategic bombing plan for Japan reflected the goals of the European effort, namely to destroy the industrial and economic structure of the country to deny Japan the ability to wage war and demoralize the population. However, frustrated by poor weather and low bombing accuracy, General Henry "Hap" Arnold ordered incendiary raids on Japanese cities in March 1945. The Committee of Operations Analysts also proposed the attack of cities to destroy industrial plants, disrupt transportation and the labor force, destroy finished products, and to attack the will of the Japanese quickly and directly.[27] Cities became a primary target, lowering iron, steel, oil, bearings, and electronics to the secondary list. The frustrations of the prolonged war in the Pacific moved the air planners closer to a Douhet-like solution than their European counterparts.

Strategic bombing of the Japanese mainland devastated the country. For example, oil refinery output was reduced by 83 percent, aircraft engine plants by 75 percent, electronics plants by 70 percent, and ordnance plants by 28 percent.[28] The physical destruction of the bombing combined with the interdiction of Japanese shipping, brought industry to a near standstill. By the end of the war, most key industrial plants were out of the raw materials necessary to continue production. Strategic bombing further slowed industrial output by disrupting the civilian work force through destruction of housing and local transportation.

The attacks on urban centers, combined with low food production and increased disease, greatly deteriorated civilian morale. The USSBS research indicates that by June 1945, 68 percent of the Japanese believed Japan would lose the war, and "over one-half attributed the principal cause to air attacks, other than the atomic bombing attacks, and one-third to military defeats. Sixty-four percent of the population stated that they had reached a point prior to surrender where they felt personally unable to go on with the war."[29] Post war analysis of the Japanese situation lead both General Hansell and the USSBS to conclude that even without the atomic bomb, the U.S. could have exerted sufficient pressure on Japan through conventional bombing to cause her unconditional surrender prior to an invasion of the mainland. Such a conclusion was impossible during

the war because of a lack of accurate intelligence on the Japanese situation.

Airpower did lead to victory without a bloody ground war predicted by the prophets. The USSBS and most historians agree the application of strategic airpower was necessary to the victory. But, this case study also points to the extreme difficulty in predicting a cause and effect relationship when planning air operations. Strategic bombing of Germany's "industrial web" crippled Germany in some key areas, but left others relatively unaffected. The national will aspect of the industrial web theory is even more difficult to validate through WW II results. In Germany, attacks on the social fabric had the desired *effect* of crushing civilian morale; however, it did not lead to the desired *objective* of capitulation without marching into Germany.

What success this theory did achieve in WW II it achieved because the character of the conflict and the belligerents coincided with the basic assumptions upon which the theory was based. The enemies were industrialized nations with mass Second Wave militaries. Both Japan and Germany, and their respective militaries, had the industrial and societal vulnerabilities which the air theory sought to exploit. The model fit because the preconditions were met. Where the concept failed, in the minds of the air theorists, it failed because technology, in terms of precision and the ability to attack persistently, had not yet caught up to the doctrine. Because of the large number of aircraft required to strike individual target sets, the Allies had to strike them in sequence, allowing the enemy to repair, recover, harden, and disperse in the intervals between strikes. However, to the U.S. Army Air Forces, the contributions of strategic bombing to victory in both theaters validated their airpower theories.

Vietnam

The USAF, having perceived true success of its industrial web theory in WW II, and having considered the limited Korean War as an anomaly, continued to stress total war against an industrialized nation in its key doctrinal publications.[30] Such a theory provided no flexibility based on the level of the war, the nature of the enemy's society, or the character of the war. Thus, the USAF entered Vietnam wanting to apply unlimited (but non-nuclear) war techniques in a limited war, and sought Second Wave COGs in a

First Wave society. More fundamentally, however, they desired to fight a conventional military war against an enemy fighting a more political people's war of nationalism. The U.S. military's inability to recognize these contradictions doomed any military campaign to failure, not just strategic bombing.

Under Air Force Chief of Staff, General Curtis LeMay, the Air Force sought to apply the WW II industrial web theory to "accomplish destruction of the North Vietnamese will and capabilities as necessary to compel the Democratic Government of . . . Vietnam to cease providing support to the insurgencies. . . ."[31] LeMay's planners envisioned success through the destruction of North Vietnam's war making capability, their industrial infrastructure, and key organic systems.[32] President Lyndon Johnson, fearing a Soviet or Chinese response, rejected LeMay's plan to bomb the vital centers.

In place of strategic bombing, Johnson allowed the three year "Rolling Thunder" air operation beginning February 1965.[33] He initially ordered the focus on interdiction below the 20th parallel,[34] but expanded the authorization to include some petroleum targets further north in June 1966.[35] The North, however, exhibited no weakening in their will to continue the war, in spite of the bombing. Instead of reassessing their model of the North's society, the JCS simply concluded that they had attacked the wrong node in the North's industrial web, and proposed attacks on the electrical power system. Johnson did permit "raids against power transformers, ammunition dumps, and other objectives near Hanoi and Haiphong, [but] the assaults barely hindered the enemy. . . ."[36] Even with the President's approval for significantly increased bombing effort and increased target sets, the Tet offensive of January 1968, proved that Rolling Thunder diminished neither the capability nor the will of the North to continue the war.

President Richard Nixon, more willing to increase the bombing scope and intensity, authorized the Linebacker bombing operations. Believing their Rolling Thunder failure to be the result of political limitations, and not a fundamental misapplication of strategic bombing doctrine, the JCS continued to emphasize a WW II mentality in planning.

> As in Rolling Thunder, the Joint Chiefs targeted what they considered the vital components of the North's industrial apparatus, and once more they emphasized the transportation system. Targets included rail lines and road networks, bridges, railroad yards, equipment repair facilities, petroleum, oil, and lubricants (POL) storage areas, and thermal power plants. Unlike

> Rolling Thunder, however, the chiefs received authority to attack the various targets simultaneously.[37]

Linebacker I, running from April to October 1972, elicited limited concessions from the North but no concrete agreement to end the conflict. When the peace negotiations stalled in late 1972, Nixon authorized Linebacker II, the "Christmas Bombings" around Hanoi, to break the impasse.[38] During the reopened Paris negotiations in December 1972 and January 1973, the North Vietnamese made the concessions necessary for the U.S. to withdraw "with honor."[39]

The USAF's predisposition toward total symmetric war tainted the conclusions they drew from the war. They concluded that not being allowed to apply the industrial web concept of societal destruction and disruption from the start of the war caused the defeat. However, two other more significant factors contributed to making the limitations on strategic bombing irrelevant.

First, the air doctrine was geared for the wrong level of the enemy's society. Air planners initially assumed the North to be a Second Wave society highly reliant on what little industry existed. In their minds, the paucity of industry made that which existed a much more lucrative target. But, North Vietnam was an agrarian society. For the U.S. to have a true impact on their civilization, attacks against the food supply and population, not industry would have been more appropriate. When some in the military did eventually propose the bombing of irrigation dikes for the purpose of destroying the rice crops, the JCS and national leadership shunned the option.[40] To them, the notion of starving or killing civilians was repugnant. As with the industrial web theory, direct attacks on the population were a method of last resort, and not justifiable or defensible in Vietnam.

Second, even if the U.S. military had understood the limited nature of the war and the level of the enemy's society, strategic bombing would have failed from the lack of understanding of the true character of the war. The U.S. never understood that the North Vietnamese were fighting both a military *and* a political struggle in which all the people were weapons. The U.S. turned to weapons to fight the military battle in search of victory in the Western sense, but never understood that bombing was an inappropriate tool to counter the political struggle.[41] Robert McNamara, former Secretary of Defense,

summarized this problem in 1995,

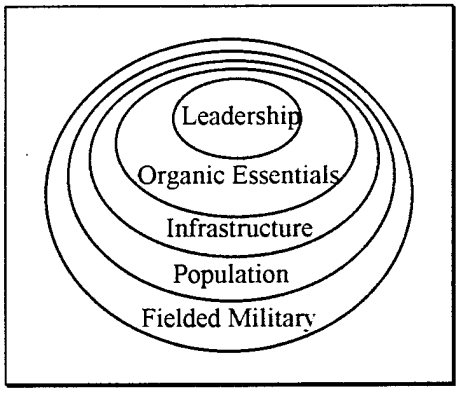
> "Should we have carried out Nixon's '72 bombing in '66? The chiefs didn't recommend it then, and it wouldn't have worked anyway. I was in the Marianas during World War II, and we killed 100,000 people in Tokyo in *one day* in 1945 with [conventional] bombing. It didn't change Japanese behavior. Short of genocide, it is unlikely that you can break a nation's will by bombing. I know of no thoughtful analysis of the war that says we would have won if we had "unleashed" our military.[42]

Operation Desert Storm

Precision guided munitions (PGMs) and stealth technology provided the U.S. the means to execute the essence of the industrial web theory against Iraq, means which were unavailable in WW II and just emerging during Vietnam. The U.S. air concept, however, evolved beyond the pre-WW II ACTS doctrine to one proposed by Colonel John M. Warden III in his role as Deputy Director of Plans for Warfighting Concepts on the USAF Air Staff. Warden and his Air Staff planners implemented his theories in an air operations plan known as Instant Thunder which became the foundation for the air phase of the ODS campaign.

Warden agreed with the ACTS theorists that the key to quick, decisive victory against a modern nation-state was strategic air attack against vital elements of the society, and not using airpower strictly in support of the army. Warden differed, however, in his priorities of the "vital elements" and the method of attack. Warden modeled the modern nation as a system of five rings, or centers of gravity, with increasing importance from the outer to the inner ring.[43]

Figure 1: The Five-Ring Model



Unlike Hansell and the architects of the industrial web theory, Warden placed "military and civil leadership" at the center of his model as the most important COG.[44] The remaining rings in decreasing priority, of "key production" (which Warden later changed to "organic essentials"), "infrastructure," "population," and "fielded military forces," bear a striking resemblance to the categories targeted in WW II.

The second subtle but more significant difference between the two theories concerns the method of attacking the key targets. The industrial web theory sought the sudden destruction of the key war industries and organic systems to deny both the enemy the capability to wage war, and to make the cost of war unbearable to the leaders and population. Warden proposed the parallel, near simultaneous attack against the nation's key strategic and operational vulnerabilities to neutralize the national leadership and paralyze the entire societal system.[45] Regardless of the ring under attack, "all actions are aimed against the mind of the enemy command or against the enemy system as a whole. Thus, an attack against industry or infrastructure is not primarily conducted because of the effect it might or might not have on fielded forces."[46] Additionally, if the paralysis does not convince the leadership to sue for peace, it helps create the conditions to destroy the enemy's forces in a more efficient and less costly manner.

Warden's theory as applied to Instant Thunder envisioned attacks against eighty-four Iraqi targets designed to isolate Saddam Hussein from his military and the Iraqi people.[47] The key target categories of the *leadership* ring in Warden's plan were the Saddam regime and its associated command, control, and telecommunications.[48] In the *key production* ring Instant Thunder primarily targeted oil, electricity, and nuclear, biological, and chemical weapon production facilities. The rest of this category consisted of "fifteen supply depots, factories, and repair shops . . . ."[49] Instant Thunder targeted rail yards and rail and highway bridges in the third ring, *infrastructure*.[50] The Instant Thunder plan specified no targets in the fourth ring, *population*, as the National Command Authority dictated minimum civilian casualties and collateral damage as an objective. Warden believed, however, that Instant Thunder attacks in the other rings would indirectly target the minds of the population, psychologically alienating them from the Saddam regime.[51] In the fifth ring, *fielded military forces*, Instant Thunder targeted weapons of mass destruction, and elements which challenged the coalition's air superiority. The targets in this ring included Iraqi airfields, the air defense headquarters, air defense sector operations centers, surface-to-air missile systems, and chemical and biological weapons plus associated delivery platforms.[52]

Even though the target list grew significantly between the completion of the

original Instant Thunder plan and the start of the war, the essence of Warden's strategic concept remained. The strategic air operations successfully attacked forty-five targets in Baghdad with minimal collateral damage, disrupting senior military and civilian command and control. Shutting down the Baghdad electrical power grid further adding to the confusion and the shock to the national system. The operations applied further pressure by striking twenty-eight petroleum facilities and cutting off Iraq's production.[53] The shock to the Iraqi system was swift, and the paralysis came quickly. Whether the paralysis alone would have induced Saddam to withdraw from Kuwait is a matter of speculation for the final air operations plan left him little opportunity to do so. Although the air portion of the campaign contained three phases—strategic attack, air defense suppression, and attacks on the Iraqi army—the phases had significant overlap and Iraqi armor units were attacked starting the first day.[54] What is clear, is that the instant shock and paralysis, followed by relentless pressure, allowed significant destruction of Iraqi units (from the air) throughout the depth of the theater, greatly facilitating the eventual ground operations.

ANALYSIS OF THE FIVE-RING MODEL

> *Strategic warfare provides the most positive resolution of conflicts. To execute it well, however, we must reverse our normal method of thinking; we must think from the big to the small, from the top down. We must think in terms of systems; we and our enemies are systems and subsystems with mutual dependencies. Our objective will almost always involve doing something to reduce the effectiveness of the overall system. . . .*
>
> *Colonel John A. Warden III*[55]

Warden's model is more than an updated version of the industrial web theory, and has application throughout a much broader spectrum of conflict and adversaries. To understand this point, and to determine the applicability of the model in the future, requires a deeper examination of Warden's theory.

Nature of the Enemy

Although the USAF successfully applied the basic five-ring model to Iraq in ODS, the model applies not only to Second Wave nations, but to any "strategic entity." Warden defines a strategic entity as "any organization that can operate autonomously; that is, it is

self-directing and self-sustaining."[56] Thus, he claims the model to be as applicable against a guerrilla organization or drug cartel as it is against a modern, complex, industrialized nation. Also, the "five rings" do not constitute an "airpower" model as much as a model to analyze an enemy to determine its strategic and operational centers of gravity. The operational artist must then determine the weapon category for use against those COGs.

Critical to Warden's model is the notion that one must analyze and attack the adversary as an entire system, focusing on the system's leadership. To Warden, the "most critical ring is the command structure, be it a civilian at the seat of government or a military commander directing a fleet, which is the only element of the enemy that can make concessions, that can make the very complex decisions that are necessary to keep a country on a particular course, or that can direct a country at war."[57] The desired impact is on the system, and not just on the fielded forces of that system. As Warden states, "it is pointless to deal with enemy military forces if they can be bypassed, by strategy or technology, either in the defense or offense."[58]

Another crucial aspect of the model concerning the nature of the enemy is that an enemy system is not merely one set of five rings, but rather a series of five-rings within rings. This idea allows planners to refine their analysis to greater and greater detail from the starting point of the overall five-ring model. For example, within the organic essentials ring of a nation-state's model may lie electrical power and petroleum systems, both of which can themselves be modeled by the same five rings construct.

Limited and Unconventional War

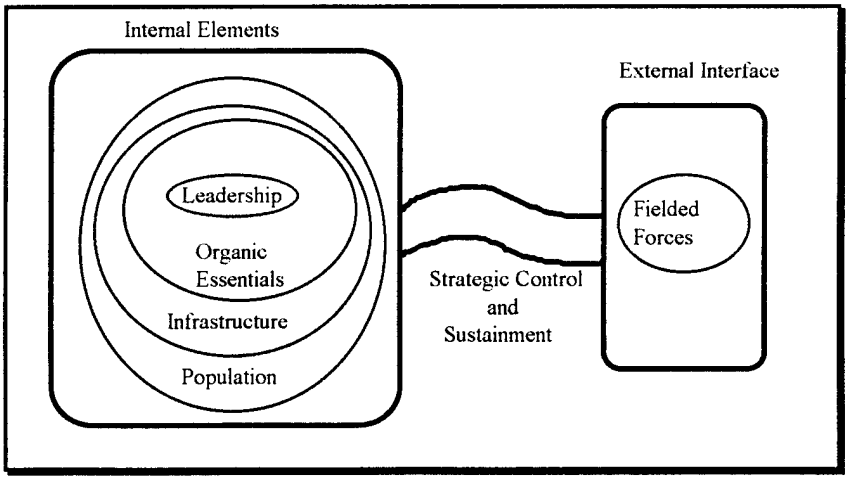
The lack of flexibility limited the early airpower theories such as the industrial web concept. These theories had real applicability only against modern states in conventional, total war. Warden contends that no such restriction exists in his model. By envisioning an enemy as a system of systems, each reflected by its own five-rings, a planner can attack at any desired level. If political or physical limitations prohibit attacks on an enemy's national infrastructure or organic essentials, then one may have to focus efforts against the systems which lie in the enemy's fielded forces ring.[59]

Problems with the Model

Warden's original plan used the five-ring model in its purest form: a parallel strategic attack generating such paralysis in the command structure and organic essentials of Iraq that it would compel Saddam to withdraw from Kuwait. The paralysis would occur so suddenly that Iraq's army would be rendered irrelevant. But, Generals Horner and Schwarzkopf did not implement the Instant Thunder plan in its original form. The reasons Central Command (CENTCOM) modified the plan are sound, and point out two current weaknesses in the model.

First, the nested nature of the rings implies a similarity in the fundamental essence of each ring. There are not different types of rings, only rings of different COG categories. In actuality, two types of rings exist: those which the system requires for internal maintenance of functions, and those which provide the interface outside the system to confront opposing systems directly. In the current five-ring model, it is the fielded forces which provide the external interface, while the other four rings are necessary to sustain the overall system and the military. The CENTCOM concern in ODS was that even if the air war paralyzed the internal system of the Saddam regime, the external element, the fielded army, would still present a significant threat to friendly forces. Figure 2 shows how the model might look if one differentiates between internal and external system elements.

Figure 2: The Modified Five-Ring Model



The second problem, closely related to the first, is that the model does not directly force planners to consider the factor of time in the expected collapse of the system. While a successful attack on the central leadership ring may indeed generate system failure, the resultant paralysis does not propagate instantaneously through the system. After the "head is cut off," the "body" may continue to twitch for a period of time. Planners must consider this aspect and determine the degree to which they must target the fielded forces to ensure a necessary level of friendly protection.

Even with these two problems, the essence of the five-ring model proved its worth in the Persian Gulf. Emphasizing the concept of parallel attack on prioritized strategic centers of gravity created the conditions for a rapid ground phase with impressively low casualties. The issue, though, is whether or not the model's utility projects into the future of the RMA.

INTO THE REVOLUTION

> *Since Operation DESERT STORM, there has been a focus on the technological dimension of warfare. The social dimension however, is no less important—possibly even more. In fact, the two cannot be separated. Social structures and social needs produce technological innovation, while that innovation in turn affects, and sometimes transforms, the social system out of which it has developed.*
>
> *Sir Michael Howard*[60]

With the global emergence of the information era comes the question of whether the current strategic airpower theories remain viable. Three key interacting elements impact this question; how this journey into the Third Wave transforms societies, the nature and character of the RMA which may accompany such a transformation, and the future character of war. Not all nations will undergo this information age shift leaving a world mixed with First, Second, and Third Wave societies and militaries. The U.S., as part of the Third Wave, must anticipate possible conflicts with First and Second Wave adversaries, as well as a similarly structured, or peer, enemy. Therefore, an analysis of future airpower doctrine must go beyond a simple study of information age factors to include this full spectrum of conflict.

The Third Wave Society

What are the characteristics of a Third Wave society which may alter the way the U.S. military applies airpower against that society? The Tofflers describe the following key features which summarize the most common beliefs in what the Third Wave will bring.[61] These features provide a convenient starting point for an analysis of how Warden's model might apply to a post-industrial, information-based entity.

"Factors of Production and Intangible Values": An information based society has knowledge as the primary input into the economy. This contrasts with First Wave societies where land is the most vital form of production, or with Second Wave nations which rely on labor and raw materials. Knowledge does not completely replace land, labor, and raw materials, but it can reduce the amount of each the society requires, and it thus becomes dominant. The strength of a Third Wave nation is no longer measured in terms of tangible values such as numbers of factories or quantity of raw materials. The new measure of value becomes the society's ability to generate and apply knowledge. This implies that the society's strength moves away from the physical domain of industry and production, and into a cybernetic domain where knowledge use manifests itself as the interaction between humans and technology. Therefore, an information based society also creates a greater demand for skilled, educated labor as compared to a mass industrial or agrarian economy.

"De-Massification": The Third Wave society will move away from large mass production factories to small, interacting, specialized production facilities. As computers and robotics replace the formerly labor intensive production processes, "niche" companies will be better able to respond quickly to customer needs. Such a trend is already appearing in U.S. businesses.

"Innovation and Scale": As the pace and rate of market competitions continue to increase, companies will place a greater premium on innovation to stay ahead in the marketplace. Aided by information technology and pushed by the need to innovate, the size of work units will decrease.

"Organization": Bureaucratic, top-down hierarchies will disappear, replaced by more horizontal structures. Such organizations allow, and take greater advantage of, the

flow of information and its translation into a product.

"Systems Integration": Information technology will allow greater complexity within organizations which must constantly adapt to maintain their advantage. Such organizations require advanced forms of systems integration on a day-to-day basis.

"Infrastructure": The iron, steel, and concrete infrastructures which define Second Wave societies will become less important than computer-based informational systems and networks.

"Acceleration": The explosion of information technologies will create an exponential rise in the rate of change occurring in the economy and the military. The increased pace and volume of knowledge and information exchange will likewise spark innovation at a quicker rate.

These fundamental changes have significant implications for doctrine and strategy. As knowledge and information become sources of strength for a nation, they will generate new strategic centers of gravity, produce new concepts and tools for conducting war, and fundamentally affect the character of certain forms of conflict. The impact is greatest when a Third Wave shift also gives rise to a revolution in military affairs.

The RMA Impact

To determine the impact on future Air Force doctrine, one must translate the generalities of Third Wave society into the more military specific RMA. A true RMA is not just introduction of a revolutionary technology, but rather "a *fundamental advance in technology, doctrine or organization that renders existing methods of conducting warfare obsolete.*"[62] Within the RMA and its technological, intellectual, and organizational components, technology may not be the most critical element of the RMA. The revolution wrought by Napoleon principally depended on organizational and doctrinal factors within the larger societal shift to nationalism. The more cogent of the RMA studies to date do consider all three elements and provide a framework for further analyzing the future applicability of the five-ring model from within an RMA based military.

Technological: Analyst Frank Kendall cites the technologies fueling the current RMA as "1) sensors for broad area search with targeting quality resolution; 2) near

real-time data processing and communications to support mission planning and attack execution; and 3) highly lethal precision attack weapons."[63]

Improved area sensors will allow continuous, real-time observation of signature producing objects throughout the depth of the theater of war. Large platform sensors such as satellites, the E-3 Airborne Warning and Control System (AWACS), and the E-8 Joint Surveillance and Target Attack Radar system (JSTARS) currently represent the state-of-the-art in this area but may not adequately project into the future. Martin Libicki of the Institute for National Strategic Studies believes these vulnerable platforms fail to take advantage of the revolution in microelectronics and information technology. He envisions a distributed network of numerous small, low cost (possibly disposable), airborne and ground sensors seeking a variety of signatures, and able to provide target indications to the command structure or directly to a weapon.[64] Just as in an information based economy, this concept takes advantage of the low cost of computing and communications technologies, and security through redundancy, dispersion, and a flattened hierarchy.

The rapid evolution of civilian communications technology will have a profound effect on the battlefield. Telecommunications advances are producing data and voice transmission capabilities in smaller packages allowing greater distribution of communications units. The same trend which created the palm size, low cost cellular phone in less than a decade shows no signs of abating. This aspect of the revolution impacts human - human, human - machine, and machine - machine interactions.

One technological aspect of the RMA which takes advantage of the improvements in sensors, computing power, and communication is the precision guided weapon. Current precision weapons, with man-in-the-loop guidance can achieve better than three foot circular error probable (CEP) accuracy.[65] Combined with advanced sensors and navigation computers, weapons under development, such as the Joint Direct Attack Munition (JDAM) and the Tri-Service Stand-off Attack Missile, will achieve these same accuracies with autonomous guidance and increased stand-off range.

The true advances will come, however, with the innovative integration of these and other technologies to create synergistic capabilities. For example, Libicki envisions using

the sensor network to provide precise target location information to a sensor-less autonomous weapon.[66] In this way, an existing information network allows a lower cost kill mechanism which may increase the number available for use. The USAF is already studying sensor-to-shooter technologies where advanced airborne sensors can detect a mobile target and provide real time target location information to an autonomous precision weapon already in flight.

Intellectual: A number of strategists predict some common doctrinal trends within the RMA. Despite differences in terminology, most agree the RMA will include the concepts of information dominance, disengaged combat, non-linear warfare, and synergies through jointness.

Information dominance is not a new concept in warfare. The notion of learning as much about the enemy as possible while hiding one's own intentions can be found in the writings of Sun Tzu in the sixth century B.C. What changes with the current RMA is the relative importance of information and the speed with which it flows. Just as in the Third Wave society, this RMA pushes knowledge to the forefront, and raises the value of dominating the transfer of this knowledge.

> Knowledge of the enemy's location provides the basis for military action. Precise location of enemy targets is necessary for precision-guided munitions. Amid the swift pace of modern battle, the rapid exchange of information about the status of the fight and reliable, real-time command and control are indispensable to success. To achieve mastery of this realm, U.S. forces will seek *information dominance* [emphasis in original]—acquiring the necessary information for friendly forces while denying it to the enemy.[67]

While the need for information dominance is widely accepted, specific applications are far less clear. "Blinding" the enemy on the battlefield, such as the Coalition did in ODS by destroying the Iraqi means to gather intelligence, represents one form of information dominance. The concept is much larger in the RMA. At the national strategic level, for example, one may also desire to limit the political leadership's access to their people by controlling or disrupting the local media, telephone, and computer networks. Dominating information does not necessarily imply the use of destructive force, nor is it restricted to the technological nodes of an information system or network. The nature of the enemy's

society, military, and the conflict will dictate the proper targets and means for dominating information. As one example, "information war in unconventional conflicts will rely on human intelligence, special forces, and advanced sensors capable of detecting guerrilla groups. It also suggests an expanded role for psychological operations and civil affairs units. . . ."[68]

The importance of information dominance generates the associated concept of information superiority. It appears that gaining and maintaining information superiority as a first step in a future conflict will become as critical as gaining and maintaining air superiority is today. Just as air superiority is not an end in itself, information superiority is an enabling factor which maximizes the effects of all other efforts.

The second intellectual concept of the RMA is that of disengaged combat. A continuous trend throughout the history of warfare is the dispersal of the battlefield as improved weapons allowed greater individual firepower and made concentrated forces much more vulnerable.[69] The technology of the RMA will continue this trend as advanced militaries increasingly rely on long range, stand-off, precision weapons and sensors to strike at great range. Because the character of all conflicts does not lend itself to this type of warfare, however, autonomous stand-off weapons will not completely replace direct fire, manned weapons. But, the threat of weapons of mass destruction and the increased pressure to minimize friendly casualties, combined with the technological advances, will reinforce the trend to disengaged combat especially against an industrial or post industrial adversary. As one strategist stated,

> In high-intensity war between modern states, moreover, close contact is becoming increasingly lethal. The RMA is making it easier for military forces to locate and destroy the enemy that at any time in history. One need only imagine what a war would be like between *two* [emphasis in original] sides with the U.S. capabilities displayed in the Gulf. Eventually, the movement of large-scale forces on the battlefield may be tantamount to suicide, and modern mechanized warfare may become the contemporary equivalent of the Somme.[70]

The third intellectual concept of the RMA is civilianization of war which involves the "transfer of militarily relevant work once carried out by military-specific industries to civilian-oriented industries instead."[71] Unlike the large weapons platforms of the Second

Wave era which relied on a defense industrial base for manufacture, information technologies are derived from the commercial sector. Two factors cause this. First, information technologies are inherently dual use. Mass civilian consumption, not the relatively low consumption by the military, primarily drives innovation in these technologies. Second, competitive factors in the civilian sector increase the pressures to produce these technologies at lower cost.

Civilianization has profound implications. Proliferation of technologies with military potential will be impossible to control. With a high rate of innovation in these industries, the risk of technological surprise or neutralization of a technological advantage increases. As the Tofflers point out,

> in a Third Wave world, in which both technologies and products diversify to meet the demands of de-massified markets, the number of items with dual-use potential grows. And when we look beyond products and technologies to their components and subtechnologies, the number of potential military permutations skyrockets. . . . In turn, the very diversity of products and technologies translates into a far greater diversity of weapons as well.[72]

A fourth intellectual implication of the RMA is increased synergy through jointness. Just as in the Third Wave society in general, the information age creates the potential for networked systems and shared data across service lines. Those militaries wishing to reap the full benefits of the RMA will strive for this integration and its synergistic results. Information in a theater of war must be readily available to all appropriate users regardless of the source. Additionally, "advances in military technology have made synergy more important than ever. The faster and more precise war becomes, the more need there is for tight and continuous cooperation among various kinds of forces. . . . The ability of units to move, on the ground or in the air, with lightning speed will be wasted if the command and control system cannot keep up."[73]

The fifth intellectual characteristic is the execution of simultaneous operations. While the previous factors are enabling elements in conducting war, this characteristic more directly represents a shift in the actual conduct of war. Defense analyst Dr. Jeffrey Cooper defines the current RMA at the operational level as "a (massively) parallel series of synchronized integrated operations conducted at high-tempo, with high lethality and

high mobility, throughout the depth and extent of the theater, intended to force the rapid collapse of both the enemy's military power and the enemy's will."[74] Once the sole domain of aerospace forces, future modern weapons of all services will fit this definition.

Organizational: Military organizations, like the Third Wave corporation, will adopt the concept of decentralized decision making with "the decisional authority . . . being pushed to the lowest possible level."[75] The increased tempo of Third Wave warfare drives the need to shorten decision and execution cycles. This in turn forces the replacement of bureaucratic, vertical hierarchies with flatter, horizontal structures. Restructuring also decreases the vulnerability of the "inner ring" command structure.[76]

The Future Character of War

Just as the shift to the Second Wave did not eliminate conflict with First Wave societies, as evidenced by Vietnam, the shift of various nations to the information age does not eliminate the possibility of current war forms. The future of conflict only becomes more complex as the new variables of the Third Wave revolution are inserted into the equation. Any theory or doctrine which focuses exclusively on a single war form or class of adversary will lose its viability and credibility.

Historically, militaries tend to apply new technologies with their current, inappropriate doctrine, for war against known enemies. Thus the Allies applied the airplane to artillery spotting and ground unit support, and the tank in support of infantry attacks through most of WW I. Only when doctrine and organization changed to match the potential of the new technologies did the true RMA occur. The true payoff of revolutionary technology is not realized unless it is used in revolutionary ways.

The current RMA is susceptible to the same problems. Arguments that change is unnecessary because no threat exists today that can challenge the U.S. in its technological superiority can be dangerous. Equally dangerous is the narrow viewpoint which focuses exclusively on a Second Wave threat. Both arguments over simplify a complex and unpredictable future. Warfare will continue to occur against a variety of threats.

In addition to the national industrial age militaries such as Iran, Iraq, North Korea, or India, other levels of threats, either existing or emerging, may pose problems to U.S.

national security. Historian Martin van Creveld posits a second type of threat from "terrorists, guerrillas, bandits and robbers. . . ."[77] Van Creveld envisions a future of disintegrating nation states where protracted and bloody low intensity conflict between sub-national and extra-national groups, defined along ethnic, linguistic, religious, or cultural lines prevails.

A more dangerous threat is that of the Third Wave peer competitor. The current lack of such an opponent should in no way imply that it cannot emerge. Throughout the history of war, technological or doctrinal asymmetries have been short-lived. The mismatch of Desert Storm may not appear in the next major war the U.S. fights as countries study the lessons from that conflict and attempt to neutralize U.S. advantages. This threat may arise from a transformed, advance Second Wave nation, or from a lower level nation which bypasses the development of a mass military and leaps forward into an information age approach. Whatever the source, this entity will most likely undergo an information age RMA and assume the characteristics described in the previous section.

AIRPOWER IN THE RMA

> *We are standing today, not at the end of history but at a historic turning point. Just as Alexander's exploits only reached the Middle Ages as a dim, fantastic tale, so in the future people will probably look back upon the twentieth century as a period of mighty empires, vast armies, and incredible fighting machines that have crumbled into dust. Nor is it even likely that their demise will be regretted, given that each age tends to consider itself the best of all and to grade the past in accordance as it led to, or detracted from, the things that are considered valuable at present.*
>
> *Martin van Creveld, 1991*[78]

An understanding of the Third Wave society, RMA, and character of potential conflict leads to the question, "to what degree, if any, do these factors impact the five-ring model as applied to airpower?" Because future warfare can take on an increasingly diverse set of characteristics, one cannot answer this question by analyzing a single or most likely form of war. Therefore, this section analyzes the applicability of the model within the four contexts of the previous section—against an unconventional or niche adversary, against a Second Wave adversary, against a Third Wave society without an RMA based military,

and against a peer competitor which operates an RMA based military within a Third Wave society. In each case, the U.S. military is assumed to have undergone an RMA transformation within a Third Wave shift of the American society. The analysis uses three criteria to assess the five-ring model in each case: 1) Can the model discern appropriate centers of gravity if properly applied?, 2) Is airpower the appropriate tool to strike the COGs identified in the model?, and 3) Based on the answers to questions 1 and 2, does the model require any modification to increase its utility?

Case 1: The Unconventional or Niche Adversary

Regardless of whether these adversaries result from intra-state conflict as Van Creveld describes, or from a developed nation which adopts a dissimilar mode of war to counter the U.S., they pose numerous problems to a Third Wave military. The variety in this war form is limitless. The mode of warfare may be guerrilla, irregular, or unconventional. The type of war may be revolutionary, civil, or limited. The means of war will include political action as much, if not more so, than military action. Finally, the possible religious or ethnic nature of these wars will inflame the passions of entire populations, making the assumption of rational actors a dangerous one. The environments may include jungle and urban terrain. The weapons may be "low-technology," hand carried, and emitting low signatures, conditions which mitigate against the exploitation of information age technologies. The niche players realize they cannot counter the U.S. through modern conventional means and instead resort to low technology methods of sabotage and terrorism that may include nuclear, chemical, or biological weapons either in theater, or within the U.S. They will seek an asymmetric response that neutralizes a U.S. technological advantage and disrupts the U.S. objective of short, decisive combat with minimum friendly casualties.

Even with a technologically limited adversary, the five-ring model is still valid in identifying their COGs. As Warden states, while one can model all strategic entities with the five rings, the content and the "vulnerabilities of the rings clearly change from one societal system and one historical period to another."[79] The infrastructure and organic essentials may be more primitive and non-electronic; however, any guerrilla, terrorist, or

other irregular military organization will still have essentials required for their particular form of struggle. The model provides the broad categories that constitute a system, but it is up to the operational artist to determine the specific elements of each category.

One must use Warden's model properly, mindful of its contextual elements. For example, simply recognizing the need to identify COGs does not necessarily lead to the correct COGs. As in any use of the five-ring model, the level and quality of intelligence gathering and interpretation determines the appropriateness of the attack plan. The danger in assessing these unconventional and possibly First Wave entities by a Third Wave military is that the latter may rely too heavily on advanced technical means which will have limited applicability and usefulness in the situation. For many of these wars, there will be no substitute for human intelligence, especially when the enemy uses few electronic means of communication, and is dispersed throughout a population.

This type of war also lessens the impact of other RMA characteristics. The scarcity of appropriate targets for precision weapons and advanced sensors diminishes the advantage of disengaged combat. In fact, when one becomes unable to locate targets with signatures, disengaged combat may become impossible. Information dominance, in the contemporary technical definition, loses some relevance against an adversary who uses human-to-human transmission of information. One may require non-technical means of achieving this dominance. Finally, the concept of high-tempo, high-lethality, simultaneous operations will rarely be useful against this type of enemy because of their elusive nature and blending with the indigenous population. These entities will intentionally protract the conflict and seek sanctuary in areas that risk high collateral damage to offset indirectly the U.S.'s technical advantages.

Even if one properly identifies the ring elements in this case, airpower will often be an inappropriate means of attack. Even Warden concedes that, "air is of marginal value in a fight against self-sustaining guerrillas who merge with the population. In this case, no significant target exists for air attack."[80] This is not to say that airpower supporting special operations or psychological warfare would not be useful. Advanced information age communications and sensors may also be of some benefit even if they do not provide the

large relative advantage that they might in a different form of war, or against an enemy who relies more on technology.

For this case, then, the five-ring model requires no modification. One must use it, as Warden cautions, with a clear understanding of the character of the conflict and the nature of the enemy. If the USAF had used the five-ring model in Vietnam but still based its use on the assumption that North Vietnam was a modern industrial nation, the outcome would still have been a failure. For this type of war, the most difficult task for an RMA based USAF will be to develop an appropriate strategy that incorporates modern technologies in support of special operations or infantry intensive activities.

Case 2: The Second Wave Adversary

The U.S. in ODS was not so much an RMA based force as it was a Second Wave military with refined organization, force structure, and doctrine, integrated with current information age technologies. Still, the results give a hint as to the advantages a Third Wave military might have against a Second Wave foe. This form of asymmetry, unlike the Third Wave - First Wave conflict, plays to the strength of the Third Wave force. Large mechanized forces using electronic command and control emit intense signatures. Additionally, they rely on an industrial infrastructure interconnected with complex lines of communication—both very susceptible to strategic attack.

As it did in ODS, the five-ring model, when properly applied, works well against an industrialized enemy. The large, physical nature of the key elements comprising an industrial society and military creates an easier problem of assessing and modeling the enemy's strategic system than found in the previous case. Again, the most difficult aspect is gathering and interpreting the appropriate intelligence to model properly the opposing system and subsystems in order to identify the vulnerable nodes for destruction. A clear understanding of the political objectives and end state is a critical aspect of this analysis as it may force limitations on the attack of certain rings.

This case allows the optimum means of attack in the form of parallel, simultaneous operations with the objective of strategic system paralysis. In this asymmetric war, the RMA based military will rapidly gain information superiority, gathering information on the

enemy while blinding his ability to do the same. Strikes against the Second Wave military will consist of long range stand-off precision weapons to simultaneously disrupt or destroy the leadership ring, destroy those long range weapons posing an immediate threat to friendly forces, and attacking the critical aspects of the remaining four rings as identified in the analysis phase. The means available to the future generation RMA based military permits a greater degree of parallel attack, even more compressed in time than was demonstrated in ODS. The information technologies and flattened command hierarchy allows compression of each phase in the analysis and execution cycle, thereby increasing simultaneity and amplifying the degree of strategic shock and paralysis. The particular asymmetry of this case maintains the now preferred national strategic advantage of minimizing collateral civilian damage by its relatively short duration and use of precision weapons.

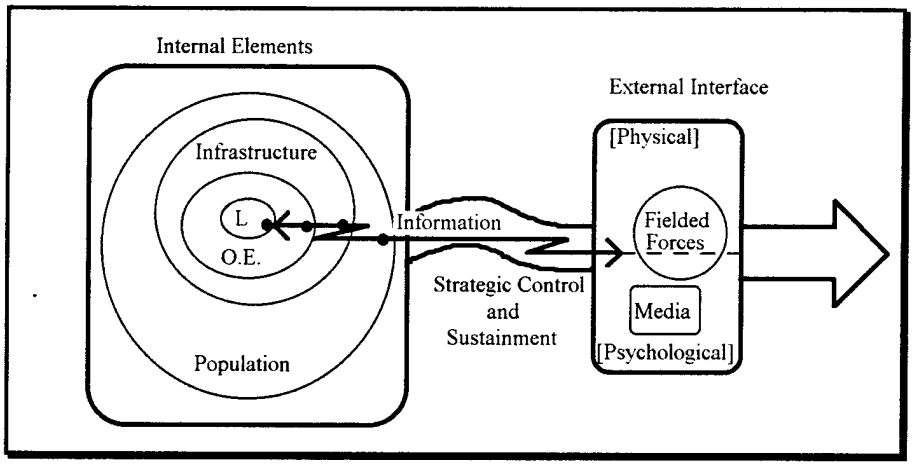
Aerospace power, for Case 2, will play a critical, and at times dominant, role in the joint application of power. In the information dominance role, satellites, unmanned aerial vehicles (UAVs) for collection and electronic warfare, air launched sensors, and airborne sensors will allow continuous information warfare throughout the depth of the theater. Other, non-aerospace elements may also be synergistically combined to perform this function. In the attack role, airpower again is an appropriate tool given its speed, range, and lethality, and the distance and number of the key strategic target elements likely in such a scenario.

As for the protection of friendly rings, the dispersed organization, combined with the capability for disengaged combat under the RMA provides a greater degree of security from the most dangerous tools of the Second Wave military, weapons of mass destruction. Ideally, though, if one induces the paralysis swiftly enough and targets these weapons from the beginning, one may prevent their employment.

There are conceptual problems inherent with this type of conflict. Specifically, the means employed by the information age military indicates a potential weakness in the model. The degree of paralysis is proportional, and the duration of the conflict inversely proportional, to the level of success in the battle for information dominance at the start of the conflict. For example, the suppression or destruction of Iraq's early warning radars,

and the disruption of communication flow between air defense Sector Operations Centers in the opening hours of ODS permitted Coalition air forces to gain air superiority quickly. The Coalition then continued to "blind" all levels of the Iraqi government and military command structure, and maintain control of the air, facilitating the very one-sided outcome. Information is clearly critical to warfare yet not explicitly portrayed in the model. To Warden, information is the "gravity that holds the solar system of the five rings together"[81]— it pervades the entire model. Even though Warden appreciates the vital nature of information, the fact remains that his model does not force a planner to consider the distinct category of information as a possible COG. Figure 3 proposes one possible revision to the modified model of Section 4 which increases the prominence of information by indicating its connectivity between all five rings.

Figure 3: Informational Five-Ring Model



Note that the modified model also recognizes the use of psychological elements, both from the military and the media, as a means of externally applying information.

The advantages realized in Case 2 are a function of the type of asymmetry encountered. Of course, as history shows, asymmetries are never permanent. Strategic entities on the losing end of such mismatches adapt and change. They either copy the successful nation or develop new technology, doctrine, and organizations to overcome the deficiency. The rapid Soviet military modernization after WW II to include nuclear weapons and a robust space program provides one example.

As the U.S. drives further into the RMA, it seems unlikely that any nation which

studied the results of ODS would challenge America in the same Second Wave manner, attacking the strength of a Third Wave military.[82] One option available includes adopting an unconventional or niche form of warfare which reduces the effectiveness of informational warfare, prolongs a conflict, and targets the will of the U.S. population, in essence, reverting to Case 1. The opponent may also resort to the terrorist type use of chemical or biological weapons in an attempt to generate a large number of U.S. casualties and break down U.S. political support.

Case 3: The Third Wave Society, Second Wave Military

While the shift to a Third Wave society is a necessary condition for a nation to enter the informational RMA fully, not all nations that make the societal shift will translate that shift into an RMA. More likely, there will exist a delay between the societal shift and overcoming the military inertia to commence the revolution. An industrial age, mass military supported by a primarily informational age society results.

Because the five-ring model does not assume one societal or military form over another, the modified model of Case 2 applies equally well here. Again, with the model serving only as a guideline for analysis, the true challenge lies in the ability for the planner to assess correctly the differing nature of the military and parent society. The Third Wave society poses new challenges and difficulties to the intelligence agencies attempting to model it. De-massification will move essential production out of centralized, detectable centers. As societal and economic organizations develop horizontal hierarchies, they increase the difficulty in identifying the strategic leadership ring. Lastly, as the nation's economic strength shifts to its ability to generate and apply intangible knowledge, analysis of their organic essentials moves away from the more classical definitions, and will, in many ways, be more difficult to detect and model. The model, then, is still valid, but the difficulty in applying it will increase.

Assuming that strategic warfare will still require direct physical attacks on the enemy's society, the changing nature of the Third Wave adversary's society impacts the utility of airpower. The factors of intangible values, de-massification, and organization which complicated the intelligence assessment phase, also affect the attack phase.

A Third Wave society moves its strength from the macro to the micro level. The large industrial and infrastructure complexes, so susceptible to destructive bombing, lose their degree of importance to the Third Wave economy and they are replaced with dispersed, specialized, small scale networks and agencies which are less susceptible to bombing. This forces a re-evaluation of the use of airpower against these societies. However, while vulnerabilities in the traditional industrial COGs diminish, new vulnerabilities will appear:

> Societies that depend on the Net [the societal information network] can be attacked by harming the Net just as industrial societies can be attacked by shutting down electricity. Losing faith in the Net is akin to losing faith in the State. Overt threats against the Net may yield useful concessions. Picking up the right information on the Net can be used to pressure individuals.[83]

Even though the source of strength in the Third Wave society is the intangible of knowledge, to translate that source into something useful requires the informational connectivity of individuals, organizations, and businesses. Libicki indicates that this electronic network is susceptible to three different modes of attack: physical, syntactic, and semantic.

> *Physical* [emphasis in original] attacks on the electronics and wires of the Net (switches, trunk wires, major databases and other key nodes) is certainly possible, but, in and of itself, not a new kind of warfare. Industrial-era targets of the electricity, water, natural gas, transportation, or broadcasting systems will remain equally juicy targets. Moreover, most targets of the Net are both harder to find (because they lack distinguishing physical characteristics), easier to protect (because they tend to be relatively small compared to other key targets, and cheaper to make redundant (particularly the few nodes that hold really critical data). Physical attacks will nonetheless ensue, but society's vulnerability to them can be substantially lessened by appropriate and not expensive measures.[84]

Syntactic attack, on the other hand, involves the insertion of a computer virus or other mechanism which "disables the operations logic of the Net and causes it to crash."[85] *U.S. News & World Report* claims that U.S. intelligence agencies used just such a technique against Iraq before the start of ODS by covertly installing a microchip containing a virus into the Iraqi's French made air defense computer system.[86] Semantic attack, in contrast, floods the network with false statements or data of the type the system expects.[87] While

such attacks may be more difficult to execute, for the victim they are much harder to detect and can devastate a network. The latter two forms also carry the added political benefit of not putting civilian workers at risk.

Thus, while destructive airpower against the society's network elements may be feasible, it may not be the only, nor most desirable, form of attack against information age COGs. How the U.S. military might organize, train, and execute these other "cyberwar" techniques is beyond the scope of this monograph, but it is nonetheless critical for the military to study and adopt new, more efficient forms of information warfare. Syntactic and semantic attacks on networks also challenge the current notions of bomb damage assessment (BDA). In destructive attacks, a variety of ground, air, or space borne sensors can detect results and the degree of damage to a large extent. Non-destructive techniques leave no such telltale signature. Thus, while cyberwar may accelerate the pace and tempo of modern combat, new war forms may also increase fog and friction.

The discussion thus far has focused on high intensity, strategic war in the 20th century sense of attacking societal elements. The current case (Third Wave society, Second Wave military) generates another possibility. The shift to societal attack came about in the late 19th century when battles lost their decisiveness and became bloody, attritional conflicts. If an information age RMA allows decisive battle over a Second Wave military, then it also diminishes the argument for attacking a nation's civilian framework, and reopens the case for strategic victory through the operational level destruction of the enemy's capability to fight. The arguments supporting this concept primarily concern the evolving Western notions of morality in war. If the capability exists to destroy an enemy's military quickly, with extremely low risk of friendly casualties, then it may be difficult to support, within the U.S. military and the American public, the need to bomb parts of civilian society. Additionally, as Third Wave economies become much more global than their predecessors, the risk of international repercussions from striking economic targets increases. If one accepts these arguments, then it follows that airpower will play a significant role in this case as an instrument of destruction of the opposing military forces from long range.

As to the question of modifications to the five-ring model for this case, it requires

none beyond those already described. Whether the political leadership deems societal attacks as necessary or to be avoided, the model still applies.

Case 4: The Peer Adversary

While the current military advantage maintained by the U.S. seems unthreatened in the near term, the chance of this situation remaining so far into the future is slim at best. The civilianization, low cost, and global access of information age tools of war guarantees proliferation. A peer competitor to the U.S. will develop, and bring with it a new set of challenges. This Third Wave adversary will have likewise undergone an RMA within their military and acquired the characteristics described in the previous section.

As in Case 3, the five-ring model, as modified, continues to be adequate, but only with some expanded concepts of the rings. First, at both the strategic and operational levels, horizontal hierarchical organizations will disperse the leadership ring and decision-making process, increasing the difficulty of identification and disruption or destruction.

Second, at both levels of warfare again, the organic essentials and infrastructure rings depart from the classical definitions and assume greater informational and high technology characteristics. Organic essentials may include the information network which ties a particular industry or industries together, rather than the industries themselves. Or, it may be an electronic banking network. Other information networks might be considered as critical infrastructure components the way rail and road systems have been throughout 20th century warfare.

Third, one must give greater attention to the enemy's fourth ring, fielded military. This ring, with its own stealth, precision weapons, and advanced sensors and communications, poses a significant threat to friendly COGs. Additionally, this ring will contain the organizations and tools to conduct information warfare. To a much greater degree than in the other cases, the concept of simultaneous attack must include, and not bypass, elements of the military ring. The compressed decision and execution cycles of the Third Wave society and military, combined with decentralized control, makes bypassing the fielded forces in favor of greater effort against the center ring a riskier endeavor.

The arguments made in Case 3 for and against airpower usage when conducting information war against a Third Wave society equally apply here. The inclusion of an RMA based enemy military in this case, however, warrants additional comments. First, airpower and other forms of long stand-off weapons will increase in importance once the enemy has the ability to reach further and with greater precision. But, the nature of required airpower will change. As the enemy also has the capability to conduct parallel war of paralysis in this case, winning information dominance assumes extreme importance and becomes more technical in character than in previous cases. The aerial tools for accomplishing this dominance, either manned or unmanned platforms, must increase in number relative to the destructive weapons.

Additionally, the enemy's possession of advanced sensors, including the very real possibility of counter-stealth capability, increases the vulnerability of an air force consisting of a few large, highly complex, expensive, manned platforms. This symmetric Third Wave war raises the need for many smaller, dispersed sensors as opposed to a few AWACS and JSTARS. It also calls for large numbers of low cost, long range, precision weapons not requiring penetration of enemy airspace by many manned platforms.

None of these issues generates a requirement to change the modified five-ring model as they are all application issues and do not indicate any fundamental flaw in the model itself. Unlike the industrial web theory, this model does not make any inherent assumptions as to the nature of the enemy society or the character of the war. That is not to say, of course, that the model alone contains all the right answers. It is only a framework for analysis. The proper application of the operational art must still contain an objective and accurate assessment of the enemy, the conflict, and the environment, as well as an understanding of one's own strengths and vulnerabilities.

CONCLUSION AND RECOMMENDATIONS

Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.

Air Marshall Giulio Douhet[88]

The irony of the end of the cold war is that the world traded the stability of a superpower stand-off for the uncertainty of a complex future. This future is further clouded by the emergence of the Third Wave society which increases the permutations in an already complex spectrum of war. From the turmoil of this relentless pace of change comes the need to re-evaluate the concepts of strategic war from the airpower perspective, for this aspect of warfare, perhaps more so than others, is deeply affected by fundamental changes in societies.

U.S. strategic airpower theory at its inception relied on a single, narrowly focused view of the enemy and the nature of war, concentrating on total war against the modern industrialized nation-state. Between 1917 and 1949, such a basis for the theory seemed sound as the Army and USAF analyzed the airpower lessons of two world wars. It took the Korean and Vietnam wars to highlight the inflexibility and lack of validity of the theory when the character of war or the nature of the enemy did not agree with the underlying assumptions. The lessons might have been lost were it not for Colonel John Warden whose works stimulated airmen to stress the operational art in their application of airpower, and to analyze an enemy for its true, not desired, nature. His five-ring model and concept of imposing strategic paralysis through parallel war did not represent Air Force doctrine during ODS in the sense that his thoughts were not commonly shared beliefs. The bitter disagreements within the USAF over his Instant Thunder plan attest to that fact. However, the fact that CENTCOM did apply his theory in the first phase of ODS with great success, and the increasing popularity of his concepts since the war, indicate the relevance of his work. The true test of that relevance is how well the model applies to the future.

Unlike the industrial web theory which developed with a single threat type in mind, Warden designed the five-ring model more generically, treating all strategic entities as

systems with certain common functional characteristics. While the model lists the major rings, it fails to list explicitly the material which binds the rings together—information. Warden does not ignore information; his Instant Thunder plan included numerous attacks on information gathering and transmitting nodes to isolate the Iraqi leadership. But, as the RMA brings with it new concepts about information warfare, information itself may become a separate COG category or assume a more prominent role in the model. With this modification, one can see the model's applicability through a wide spectrum of conflict.

A more critical conclusion arises from the analysis of the future relevance of the five-ring model. The use of this model, or any model, falls in the category of "science of war." One can understand the construct of the rings, but miss Warden's *intent* behind the model. The five rings themselves do not provide a calculus for strategic warfare. The true operational "art" only comes when one uses the model with a clear understanding of the political, social, cultural, ethnic, demographic, and geographic context of the conflict one is about to enter. Only when one accomplishes this does the model apply to the myriad of conflict types possible in the future.

A second important conclusion is that the USAF planner cannot blindly apply the model in all cases using the classical means of strategic bombing. Another essential element of the operational art is recognizing the appropriate means of attack, either destructive or non-destructive, after one identifies the COGs. In some cases, such as in unconventional, limited conflicts, the possibility increases that airpower may not be the dominant means for attacking the rings. Likewise, the adversary's technical sophistication increases, so does the value of airpower, but so do the possibilities to employ high-technology, non-aerial modes of information disruption.

Additionally, the Third Wave shift and the RMA, both in the U.S. and with potential adversaries, is producing a fundamental change in strategic airpower thought from what was a fairly constant theory for most of this century. While the ultimate "end" remains the desire to force one's will on the enemy, the "ways" to accomplish that change in the RMA military. In WW II, strategic bombing sought to deny the enemy the capability to fight by performing what may be called strategic interdiction, where the Allied air forces destroyed war materiel at the production source, or denied its movement from the

industrial base to the armies. An equal objective was to destroy the will of the people by making life unbearable through the vast destruction of the modern social fabric.

With the five-ring model, the "way" to achieve the same end is through strategic paralysis brought on by parallel, persistent warfare. Because of the simultaneous, short duration nature of Third Wave war against Second or Third wave enemies, the attack of war production (except for weapons of mass destruction) will pay little or no dividends. While the paralysis is mostly physical, its desired effect is psychological, and is aimed at the leadership to force concessions, and at the population to force a change in government or policy. The means to accomplish this paralysis result from the technologies, doctrine, and organizations of the informational RMA. What will change in the future against the peer competitor is the type of targets one must strike to achieve the paralysis—informational networks will become decisive points as important, if not more so, than electricity and petroleum systems are today.

This study highlights three recommendations. First is the need to modify the five-ring model to include the element of information specifically. Second, is the need for intelligence organizations to adapt within the RMA and keep pace with the exponentially increasing requirements for rapid, accurate information. The five-ring model becomes worthless without valid information about the enemy. Third, one must always be aware of the possibility of a low or high technology niche capability which bypasses the strengths of an RMA based military to attack in a dissimilar or asymmetric fashion.

While it may be true that a military can never determine the nature of an RMA while it is in the middle of it, ignoring the future is more dangerous than missing some aspects of the revolution. Airpower has played a significant role in the conduct of war this century. But, unless the theory keeps up with the changing character of war, new technology might not protect it from some future misapplication.

ENDNOTES

[1] Carl von Clausewitz, On War, trans. and ed. Michael Howard and Peter Paret (New York: Alfred A. Knopf, 1993), p. 182.

[2] Peter Paret, ed., Makers of Modern Strategy from Machiavelli to the Nuclear Age (Princeton, New Jersey: Princeton University Press, 1986), pp. 434-435.

[3] Alvin Toffler, and Heidi Toffler, War and Anti-War (Boston: Little, Brown and Company, 1993) p. 19.

[4] Toffler, War and Anti-War, p. 17.

[5] Charles M. Westenhoff, ed., Military Airpower, The CADRE Digest of Airpower Opinions and Thoughts (Maxwell Air Force Base, Alabama: Air University Press, 1990), p. 33.

[6] Thomas H. Greer, The Development of Air Doctrine in the Army Air Arm 1917-1941, (Washington, D.C.: Office of Air Force History, United States Air Force, 1985) pp. 3-4.

[7] Greer, Development of Air Doctrine, p. 9.

[8] Mark Clodfelter, "Pinpointing Devastation: American Air Campaign Planning before Pearl Harbor," The Journal of Military History 58 (January 1994): 80

[9] Clodfelter, "Pinpointing Devastation," p. 82.

[10] Giulio Douhet, The Command of the Air, Trans. Dino Ferrari. (Washington D.C.: Office of Air Force History, 1983) p. 126.

[11] Douhet, The Command of the Air, p. 125

[12] Greer, Development of Air Doctrine, p. 41.

[13] Clodfelter, "Pinpointing Devastation," p. 84

[14] Haywood S. Hansell Jr., The Strategic Air War Against Germany and Japan: A Memoir, ed. Richard H. Kohn and Joseph P. Harahan, (Washington, D.C: Office of Air Force History, United States Air Force, 1986), p. 12.

[15] The term "symmetric war" assumes a different meaning to different theorists. One common definition of symmetry is the like use of force, such as air versus air, army versus army, etc. Others define it as the like use of weapons, infantry versus infantry, for example. For the purpose of this monograph, however, "symmetry" will mean similar societal forms such as First Wave versus First Wave.

[16] Hansell, Strategic Air War Against Germany and Japan, p. 33-34.

[17] Hansell, Strategic Air War Against Germany and Japan, p. 36.

[18] Hansell, Strategic Air War Against Germany and Japan, p. 35.

[19] United States Air Force, The United States Strategic Bombing Surveys, (Maxwell Air Force Base, Alabama: Air University Press, 1987), pp. 14-32.

[20] United States Air Force, United States Strategic Bombing Surveys, p. 33. The Survey determined that such a conclusion was incorrect. The German electrical power system was indeed fragile and susceptible to attack. Furthermore, according to the Survey, such attacks could have seriously reduced German war production. (pp. 33-34)

[21] United States Air Force, United States Strategic Bombing Surveys, pp. 28-30.

[22] United States Air Force, United States Strategic Bombing Surveys, pp. 35-36. The Survey estimates the total bombing casualties from October 1, 1943 to January 31, 1945 to be 305,000 killed, 780,000 wounded, and 7,500,000 left homeless. This damage resulted from both Royal Air Force and U.S. Army Air Force bombing. (p. 36)

[23] United States Air Force, United States Strategic Bombing Surveys, pp. 20-25. Production was concentrated in 13 synthetic plants and the Ploesti oil fields of Rumania and Hungary. In 1944 Allied attacks reduced production from the synthetic plants from 316,000 tons per month to 5,000 tons. By 1945 the German Army virtually ground to a halt due to the lack of gasoline. An unexpected side effect of the attacks on synthetic oil production was the severe impact it had on the production of synthetic nitrogen.

methanol, and rubber. The loss of much of their nitrogen and methanol production created a shortage of ammunition, explosives, and fertilizer.

[24] United States Air Force, United States Strategic Bombing Surveys, pp. 30-32. German freight car loadings dropped from 900,000 to 214,000 cars between September and December 1944.

[25] United States Air Force, United States Strategic Bombing Surveys, p. 38.

[26] United States Air Force, United States Strategic Bombing Surveys, p. 39.

[27] Hansell, Strategic Air War Against Germany and Japan, p. 218.

[28] United States Air Force, United States Strategic Bombing Surveys, p. 88.

[29] United States Air Force, United States Strategic Bombing Surveys, p. 95.

[30] Mark Clodfelter, The Limits of Air Power, (New York: The Free Press, 1989), p. 30.

[31] Clodfelter, Limits of Air Power, p. 75.

[32] Clodfelter, Limits of Air Power, p. 76.

[33] The President's objectives for Rolling Thunder differed substantially from his military advisors on the JCS. While both parties agreed on the need to disrupt the flow of weapons and personnel from the North, Johnson hoped the air effort would demonstrate American resolve and bolster South Vietnamese morale, while not destroying North Vietnam's viability as a state. See Clodfelter, Limits of Air Power, p. 60.

[34] Clodfelter, Limits of Air Power, p. 64.

[35] Applying their WW II approach to strategic planning, the JCS determined petroleum to be the key node in North Vietnam's capability to supply the war in the South. As such, petroleum became the JCS's primary target category in late 1965 and 1966. The attacks on petroleum storage sites in June through August 1966 severely damaged or destroyed key targets in the North except for those the President deemed as too risky to attack because of potential collateral damage. By August 1966, the attacks reduced North Vietnam's storage capacity to 75,000 metric tons. Damage to the North's major storage facilities proved an insufficient measure to halt infiltration. Intelligence reports and studies in late 1966 indicated that the North needed only a fraction of their storage capacity to support vehicle movement to the South, and sufficient petroleum was arriving from the Soviet Union in dispersible drums. See Clodfelter, Limits of Air Power, p. 98-101.

[36] Stanley Karnow, Vietnam. A History (New York: Penguin Books, 1983), p. 504.

[37] Clodfelter, Limits of Air Power, p. 158.

[38] The U.S. launched 3000 bomber and other sorties over eleven days starting on December 18. While not directly targeting civilians, the Linebacker II missions allowed for massive night B-52 raids on targets at the outskirts of Hanoi, close enough for the populace to feel the bomb impacts and have their lives disrupted. See Clodfelter, Limits of Air Power, p. 184.

[39] The military claimed that the successful conclusion to the negotiations proved the validity of their air doctrine. The conclusion is invalid because the Linebacker II missions did not achieve "victory" for the U.S., but only brought the North back to the peace talks to accept a previously negotiated arrangement. The key element causing the North to accept the negotiated peace was not American bombers, but the Americans dropping their insistence that the North withdraw their troops from South Vietnam as part of an armistice. The bombings did create tremendous damage and hardship in the Hanoi and Haiphong regions, but returning to Paris to sign the accord also met Hanoi's long term objective of removing America from Vietnam. See Karnow, Vietnam. A History , p. 647.

[40] Clodfelter, Limits of Air Power, pp. 126-127.

[41] In his thorough work on the North Vietnamese culture and strategy, Douglas Pike writes:

> A paradox existed. It was possible to lose the war by losing battles, but winning the battles did not mean victory. Therefore, while the traditional definition of "defeat" in war remained valid, the traditional definition of "victory" did not. Victory could only be defined as some new ongoing condition, not as a point in time. Vietnam therefore

> should be regarded not as a war requiring victory but as a problem requiring solution. The problem was political, social, psychological, communicational, *and* [original emphasis] military. In the range of solutions that could be envisioned were some America could term successful and some not. In any event, what was required was that the Allied forces become. . . problem-oriented not victory-conscious. . . . The Allied forces in Vietnam had clear advantage in warfare's traditional criteria, mass and movement—they had more men, more firepower, greater logistic resources. But this proved of only limited advantage. It was difficult to bring the massive available power to bear against a force that was everywhere and nowhere, with no fixed command center, with no territory it was obliged to defend, or if such territory existed it was off limits. . . .Advantage in mass and movement remains crucial in war. But. . . such superiority can be sharply minimized by an agrarian-based movement fighting a protracted conflict marked by gradual attrition and slow strangulation on both military and political fronts.

Douglas Pike, PAVN: People's Army of Vietnam (Novato, California: Presidio Press, 1986), pp. 250-251.

[42] Jonathan Alter (interview with Robert S. McNamara), "I Sweated Blood at Night About it," Newsweek, 17 April 1995, p. 53.

[43] John A. Warden III, "The Enemy as a System," Airpower Journal, IX (Spring 1995), pp. 44-49.

[44] The differences and similarities between the strategic air doctrine and its application in WW II and ODS are worth noting. While many target categories were similar in both wars, the objective of attacking those targets differed. In ODS Warden identified the Saddam regime as the primary COG, with attacks on the infrastructure contributing to isolating Saddam through physical destruction and psychological impact. The WW II air planners viewed the key industries and organic systems as the critical centers of gravity. The aim of their destruction was also twofold: to destroy the capability of the army to continue the war, and to crush the will of the populace. This difference in the two doctrines was caused by the technology available to execute the doctrine, and the differences in the character of the two wars. The authors of the WW II strategic bombing concepts were convinced, as was Warden, that airpower alone could conceivably end the war, but they also realized that they did not have the technology to achieve this theoretical goal. Bombing accuracies were so poor that the U.S. could not produce sufficient quantities of bombers to achieve the simultaneous destruction of all the identified organic system nodes. They therefore had to adopt a sequential approach which required time; time that permitted the axis armies to continue the fight, develop new tactics, and repair bomb damage.

[45] About parallel warfare, Warden states:

> States have a small number of vital targets at the strategic level—in the neighborhood of a few hundred with an average of perhaps 10 aimpoints per vital target. These targets tend to be small, very expensive, have few backups, and are hard to repair. If a significant percentage is struck in parallel, the damage becomes insuperable. Contrast parallel attack with serial attack in which only one or two targets come under attack in a given day (or longer). The enemy can alleviate the effects of serial attacks by dispersal over time, by increasing the defenses of targets that are likely to be attacked, by concentrating his resources to repair damage to single targets, and by conducting counteroffensives. Parallel attack deprives him of the ability to respond effectively, and the greater the percentage of targets hit in a single blow, the more nearly impossible his response. (Warden, "The Enemy as a System," p. 54.)

[46] Warden, "The Enemy as a System,", p. 51.

[47] Cohen, Eliot A., director, Gulf War Air Power Survey, Vol I: Planning and Command and Control (Washington: Department of the Air Force, 1993), p. 112. This number would rise significantly before the war started as new intelligence information arrived and CENTCOM revised their plan.

[48] The most efficient means of attacking telecommunications on a widespread basis appeared to be through attacking the electrical power grid, an element of the key production ring. Instant Thunder's goal was "to reduce Baghdad's power supply by sixty percent and Iraq's as whole by thirty-five percent." See Cohen, Gulf War Air Power Survey, Vol I: Planning, p. 116.

[49]Cohen, Gulf War Air Power Survey, Vol I: Planning, p. 119.

[50] Cohen, Gulf War Air Power Survey, Vol I: Planning, p. 120.

[51] By *not* attacking the populace through either direct, destructive means, or producing long term damage to their national essentials such as electricity, Warden hoped to isolate the central leadership ring from the rest of the nation. In general, the five ring model does not discount direct attacks on the population as was performed in the total war of the 1940's. However, the model is situational and based on a detailed analysis of the character of the conflict and the enemy. In the case of ODS, a limited war from America's perspective, the planners and national political leadership did not consider the Iraqi population to be belligerents, and therefore were not subject to attack. Additionally, it was clear to the planners that the fragile national and coalition will could not withstand the impact of large numbers of civilian casualties. See Cohen, Gulf War Air Power Survey, Vol I: Planning, p. 120.

[52] Cohen, Gulf War Air Power Survey, Vol I: Planning, p. 120. Significant in their absence from the original plan, according to the GWAPS, were Iraqi army maneuver unit targets. The GWAPS states that with "the exception of attacks on Iraq's air defenses and its deployed chemical weapons, Warden's campaign would leave Iraq's fielded forces intact. He expected Iraq to withdraw from Kuwait without much of a fight." See Cohen, Gulf War Air Power Survey, Vol I: Planning, p. 112. Colonel Richard Reynolds' Heart of the Storm provides a more detailed and accurate account of this subject. On 10 August 1990, Warden briefed General Schwarzkopf that the "ground forces in Kuwait and those in Iraq near or on the border would be attacked only if they attempted to move forward. . . into Saudi Arabia." (p. 55) During an 11 Aug briefing to General Colin Powell, Chairman of the JCS, "Warden explained that he wanted to hit the Republican Guard in Iraq but was opposed to taking out the ground forces along the front lines in southern Kuwait. The colonel was convinced that if anyone could overthrow Saddam, it was the conscripted army he would leave as cannon fodder to replace his elite Republican Guard invasion force when the latter pulled back from the front." (p. 72) Powell responded with the guidance that the Iraqi army must be destroyed, and not simply allowed to withdraw. From this point forward, Warden planned for a second phase, *after* the strategic attacks, which would destroy the Iraqi army. Warden's debates with other senior USAF officers, including Lt General Charles Horner, commander of U.S. Air Forces, Central Command, was not that the USAF would ignore the enemy army, but that those attacks were secondary to the strategic effort. The debate begun between Pershing and Mitchell in WW I had never really been laid to rest. See Richard T. Reynolds, Heart of the Storm. The Genesis of the Air Campaign Against Iraq, (Maxwell Air Force Base, Alabama: Air University Press, 1995), pp. 54-129.

[53] Richard P. Hallion, Storm Over Iraq, Air Power and the Gulf War (Washington: Smithsonian Institution, 1992), pp. 191-193.

[54] Hallion, Storm Over Iraq, p. 189.

[55] Warden, "The Enemy as a System," p. 55.

[56] Warden, "The Enemy as a System," p. 55.

[57] Warden, "The Enemy as a System," p. 49.

[58] Warden, "The Enemy as a System," p. 52.

[59] Warden, "The Enemy as a System," p. 53.

[60] Michael Howard, and John F. Guilmartin, Jr., Two Historians in Technology and War (Carlisle Barracks, Pennsylvania: Strategic Studies Institute, U.S. Army War College, 1994) p. 5.

[61] Toffler, War and Anti-War, pp. 58-63.

[62] David Jablonsky, The Owl of Minerva Flies at Twilight: Doctrinal Change and Continuity and the Revolution in Military Affairs (Carlisle Barracks, Pennsylvania: Strategic Studies Institute, U.S. Army War College, 1994), p. 7.

[63]Frank Kendall, "Exploiting the Military Technical Revolution: A Concept for Joint Warfare," Strategic Review 20 (Spring 1992): p. 24.

[64] Martin C. Libicki, The Mesh and the Net. Speculations on Armed Conflict in a Time of Free Silicon (Washington, D.C: Institute for National Strategic Studies, National Defense University, 1994), pp. 28-34.

[65] The CEP is defined as the radius of the circle around a desired aim point within which 50% of the weapons would impact. The term is used as a measure of weapons delivery precision.

[66]Libicki, Mesh and the Net, pp. 33-34.

[67] Michael J. Mazarr, The Revolution in Military Affairs: A Framework for Defense Planning (Carlisle Barracks, Pennsylvania: Strategic Studies Institute, U.S. Army War College, 1994), p. 9.

[68]Mazarr, Revolution in Military Affairs, p. 11.

[69] James J. Schneider, "VULCAN'S ANVIL: The American Civil War and the Emergence of Operational Art" (U.S. Army School of Advance Military Studies course text, Fort Leavenworth, Kansas, 16 June 1991), pp. 6-23.

[70] Mazarr, Revolution in Military Affairs, p. 16.

[71] Toffler, War and Anti-War, p. 184.

[72] Toffler, War and Anti-War, p. 185.

[73]Mazarr, Revolution in Military Affairs, p. 13.

[74] Jeffrey R. Cooper, Another View of the Revolution in Military Affairs (Carlisle Barracks, Pennsylvania: Strategic Studies Institute, U.S. Army War College, 1994), p. 30. Cooper's definition very closely reflects Warden's theory of parallel warfare.

[75] Toffler, War and Anti-War, p. 78.

[76] Not all theorists accept the notion that an information age military will decentralize their decision making. Eliot Cohen foresees the possibility that "the danger of *military* micromanagement looms much larger. A general in Washington, an admiral in a command ship or a theater commander in rear headquarters may have access to almost the same information as a forward commander, and in some cases more. Those distant commanders will often succumb to the temptation to manipulate individual units in combat accordingly." See Eliot A. Cohen, "The Mystique U.S. Air Power," Foreign Affairs 73 (January/February 1994): 115. Cohen's prediction is certainly possible; however, for the Third Wave military to garner the full potential from the RMA, they must resist the temptation to further centralize their decision making.

[77] Martin van Creveld, The Transformation of War (New York: The Free Press, 1991), p. 197.

[78] Van Creveld, Transformation of War, p. 224.

[79] Warden, "The Enemy as a System," p. 52.

[80]John A. Warden III., The Air Campaign. Planning for Combat (Washington: NDU Press, 1988; reprint ed., Washington: Pergamon-Brassey, 1989) p. 125.

[81] Telephone interview with Colonel John A. Warden III, United States Air Force Air Command and Staff College, Maxwell Air Force Base, Alabama, 30 March 1995.

[82] Of course, the assumption of a "rational" enemy rarely passes the test of cultural, religious, or ideological differences.

[83] Libicki, Mesh and the Net, p. 109.

[84] Libicki, Mesh and the Net, pp. 110-111.

[85] Libicki, Mesh and the Net, p. 111.

[86] U.S. News & World Report, Triumph without Victory. The Unreported History of the Persian Gulf War (New York: Times Books, 1992), p. 224.

[87] Libicki, Mesh and the Net, p. 115.

[88] Charles M. Westenhoff, ed., Military Airpower. The CADRE Digest of Airpower Opinions and Thoughts (Maxwell Air Force Base, Alabama: Air University Press, 1990), p. 85.

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