In Search of High Ground

The Airpower Trinity and the Decisive Potential of Airpower

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THROUGHOUT HISTORY, military leaders have sought better ground, usually higher ground, from which to fight. Great military theorists proclaimed the benefit of the high ground. With the advent of aircraft, that high ground became the air. With this in mind, many of the early airpower theorists saw the great potential in exploiting this new dimension and promised that air power would be the preeminent instrument of battle.

Unfortunately, in the early days of airpower, these promises rang hollow, as theory was ahead of capability. Nations were chasing the technology that would allow the capability to live up to the promising early theories. In the United States, even when the capability existed during the Korean and Vietnam wars, the practice of airpower had not been developed sufficiently; nor was the political situation suitable to exploit airpower's unique characteristics on which the theory was based.

The evolution of three key elements—*theory*, *technology*, and *practice*—is critical to the evolution of airpower, just as it is for other elements of military power. If air power is to be employed to its maximum potential in combat, each of these elements must evolve in concert with each other. Individually, the theory, technology, and employment practice of airpower are continually evolving; therefore, the challenge is to have them converge at the right time and place and to maintain that balance. When this has occurred, as it did for Israel during the 1967 Arab-Israeli War, in the Bekaa Valley in 1982, and for the United States during the recent Persian Gulf War, airpower has exhibited its maximum potential and has been decisive in the final outcome of each war. Of course, airpower's success in any war is founded during

the years that precede the war. Since combat situations are separated by longer periods of peacetime, the intervals between wars need to be exploited to ensure that airpower is ready when the need arises again.

This article introduces an original construct to explore the relationship of the key elements of airpower and to create a better understanding of the factors necessary for the most effective employment of airpower in combat. This construct—the Airpower Trinity, consisting of *theory*, *technology*, and *practice*—is derived from the concept of the Clausewitzian Trinity. After an introduction of the Airpower Trinity, the evolution of these key elements is reviewed. This review reveals the criteria and circumstances required for balance among the three. Finally, it provides a look into the future of airpower, exploring how the balance can be maintained in peacetime and exploited in war.

The art of employing troops is that when the enemy occupies high ground, do not confront him.

—Sun Tzu

The Clausewitzian Trinity and Airpower

The first theories and principles of airpower, the newest military instrument, flowed naturally from the existing warfare theory, written primarily by such land power theorists as Carl von Clausewitz, Sun Tzu, and Sir Basil Liddell Hart. Largely as a response to World War I, the development of airpower began in earnest to enable direct strikes on the enemy's ability to wage war by leapfrogging conventional ground battles. At the same time, ironically, Clausewitz's principles were criticized, primarily by Liddell Hart, for causing this bloody and costly war. However, Clausewitz's reputation was never seriously hurt because his basic concepts of warfare are not only valid, but timeless—particularly the concepts embodied in his trinity. He defined the essence of warfare through a trinity comprised of *primordial violence and passion, chance and probability influenced by creativity*, and *an instrument of policy subjected to reason alone*.[1] The Clausewitzian Trinity, depicted in schematic form in figure 1, is a construct used at the National War College to illustrate these three elements—the passion, the reason, and the chance of war—and the associated links among them.

The interaction among these three elements, as represented by the connecting arrows, depicts the critical relationship that creates a "paradoxical trinity" of these dominant tendencies. Clausewitz states:

> These three tendencies are like three different codes of law, deep-rooted in their subject and yet variable in their relationship to one another. A theory that ignores any one of them or seeks to fix an arbitrary relationship between them would conflict with reality to such an extent that for this reason alone it would be totally useless.[2]

Accordingly, they shape the battlefield; if one element gets out of balance, then, as Clausewitz warns, war has the tendency to spiral out of control. He uses the metaphor of

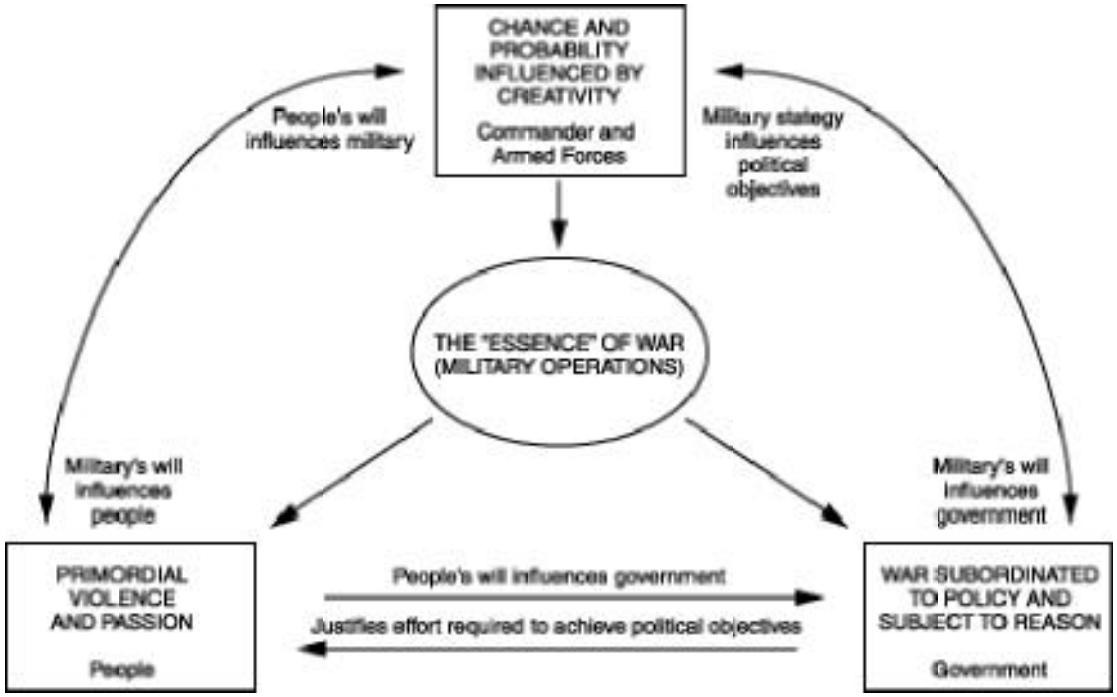


Figure 1. Clausewitzian Trinity

three magnets to maintain the necessary balance: "Our task therefore is to develop a theory that maintains a balance between these three tendencies, like an object suspended between three magnets."[3] War was allowed to spiral out of control in World War I as the element of *primordial violence and passion* overwhelmed the element of *reason,* which should maintain war as subordinate to policy.

Clausewitz further identifies the elements: the *primordial violence* mainly concerns the people; the *chance and probability* embodies the commander and his army (in the generic military sense); and the *reason* is the responsibility of the government alone.[4]

The arrows (and specifically the direction of the arrows) graphically display the relationship and interaction critical to maintaining this balance. The *War subordinated to policy and subject to reason* tenet is where political objectives are defined by the government; the link to the *Chance and probability influenced by creativity* (the military) is that military strategy is shaped by political objectives. This relationship between the military and the government is defined profoundly by Clausewitz's declaration that "the first, the supreme, the most far-reaching act of judgment that the statesman and commander have to make is to establish by that test the kind of war on which they are embarking; neither mistaking it for, nor trying to turn it into, something that is alien to its nature."[5]

Although people are inherently a part of all the elements, public opinion (the people's will) influences the government and justifies the effort required to achieve the political objectives. Clausewitz's best-known quote, "War is merely the continuation of policy by other means," links the *reason* to the *violence*. Policy is set by the government and should subordinate war to reason. The "other means" is violence, and in that element, passion can cause people to disregard reason. As will be discussed later, these two elements and their relationship got out of balance during the Vietnam War. Just as witnessed in this conflict, the people's will definitely influences both the military and the government—a very critical relationship for success. Thus, the Clausewitzian Trinity depicts the necessary and critical relationships that link together the three elements of the government, the people, and the military to keep war in balance. Maintaining this balance restrains war, as stated—if not always practiced—goal for both political and military leaders following World War I.

The people's will, one of the hardest factors to predict correctly, will more likely remain strong and positive when war is restrained by maintaining the necessary balance. Airpower's capability, when used to its maximum potential, can be a primary factor in maintaining the necessary balance in the Clausewitzian Trinity. The government, and thus the military, could exploit airpower at the strategic level. It promises an improved chance of victory with fewer casualties through its inherent capabilities such as speed, flexibility, and maneuver in a new dimension.

Many of Clausewitz's key concepts, such as concentration of force, centers of gravity, unity of command and effort, the culminating battle, and the moral and physical aspects of war, were reflected in airpower theory. Liddell Hart's indirect approach is particularly suited to airpower's capability. After the protracted bloodshed of World War I, airpower theory promised speed, not just to and on the battlefield, but, more significantly, to victory. But, if the advocates push theoretical promises too far in front of practice and technology, as in World War I, airpower cannot live up to its decisive potential.

The Airpower Trinity: An Initial Construct

Clausewitz's Trinity defines the *essence* of war; the Airpower Trinity defines the *essence* of airpower through the critical (and paradoxical) relationship between *theory, technology,* and *practice*. Figure 2, in an initial construct, draws a parallel between these two trinities. The associated links necessary to balance these elements and provide airpower with maximum potential (center) will be added in a subsequent figure. Clausewitz's Trinity deals with political and psychological

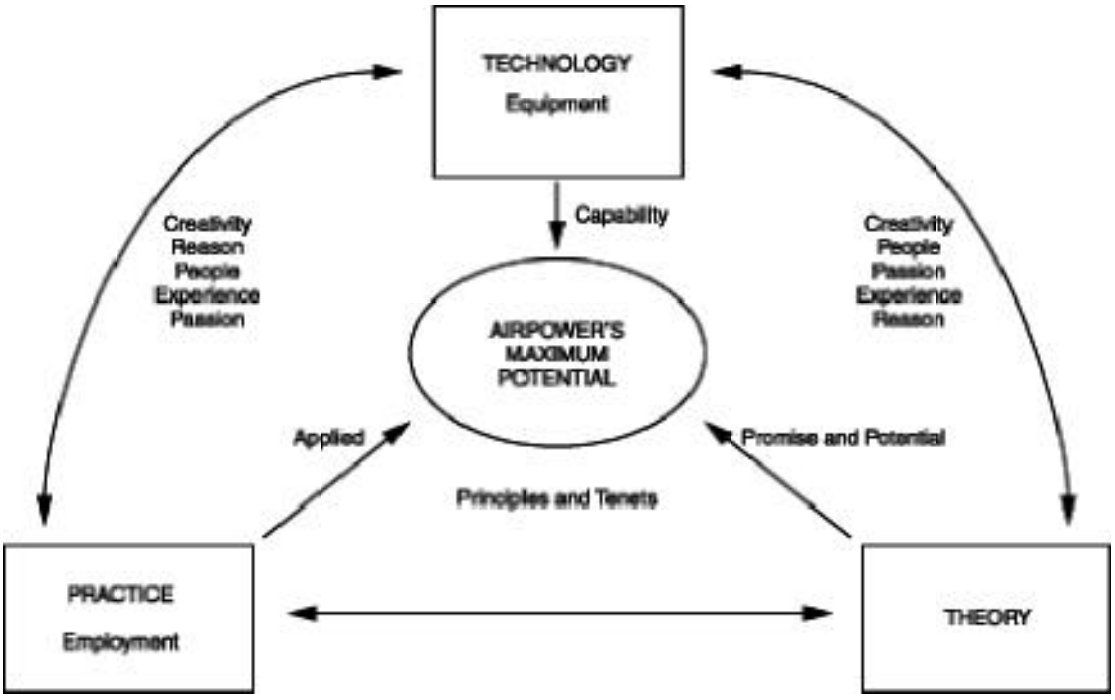


Figure 2. Airpower Trinity

factors such as reason, passion, and creativity; these factors are also embodied in the Airpower Trinity and exert similar influences. Creativity, for example, can "open up new doors" in the development of new technologies, spur new concepts for the practice of employing new technologies, and conceive of a new theory for the use of air power. Leadership and people—critical and necessary ingredients to employ airpower to its maximum potential—are among the other factors that pervade the trinity. Finally, experience is particularly important to the development of employment practices and is an excellent complement to reason.

Like the universality of Clausewitz's principles, the key elements comprising the Airpower Trinity are applicable to other services and forms of warfare. Land and sea warfare depend on the blend of *theory, technology,* and *practice* as well. The proper relationship and evolution is similarly critical to the maximum use of these military instruments in a joint campaign. Although this article does not explore the concept, a logical extension would be a "Joint Force Trinity" construct of these elements, with the "essence of war" at the center. This would be helpful for the integration of new and advanced technologies into weapon and support systems across the spectrum of joint military force.

The Airpower Trinity: The Relationship among Theory, Technology, and Practice

As with the interconnecting relationships in Clausewitz's Trinity, the relationship among the three elements is the critical part of the Airpower Trinity. Figure 3 adds the connecting links that define this relationship. The interaction among these three elements, as represented by the connecting arrows, reveals a paradoxical relationship: each element can evolve independently at its own

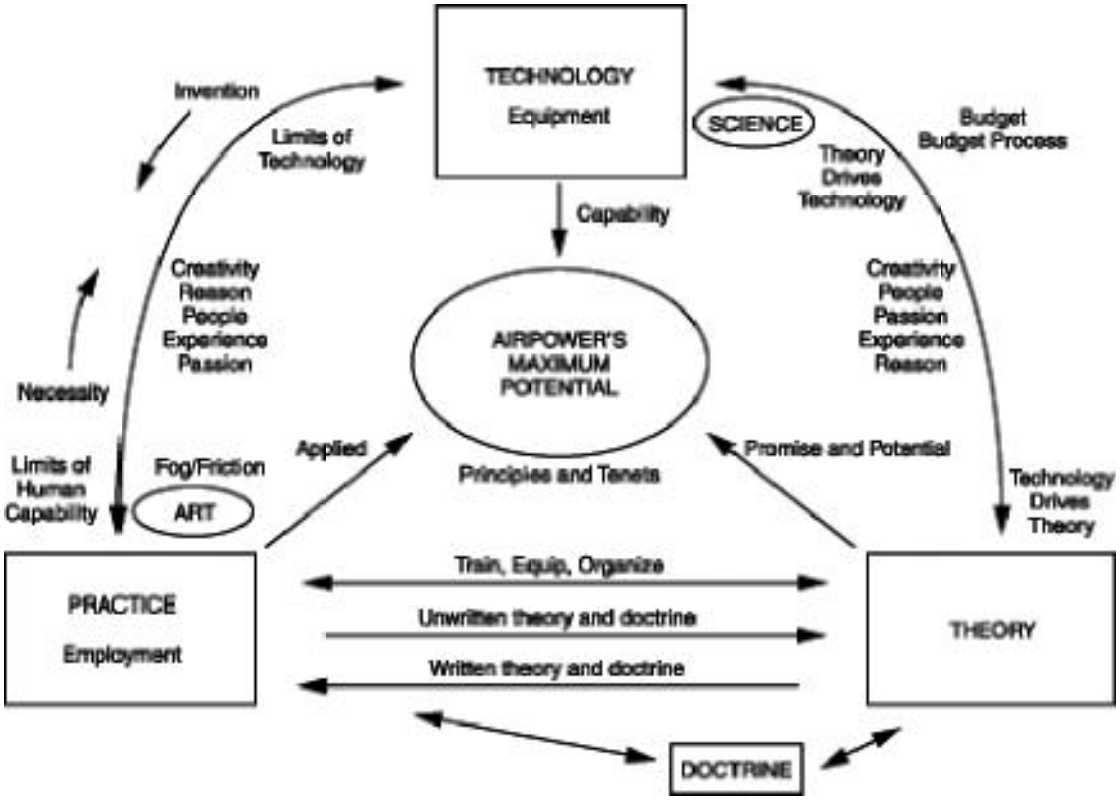


Figure 3. Airpower Trinity

pace, yet critical, dependent relationships exist among them. Clausewitz's statement above about the reality of the relationships among the three tendencies of his trinity is directly applicable here. *Theory*, *technology*, and *practice* are "deep-rooted in their subject and yet variable in their relationship to one another. A theory that ignores any one of them or seeks to fix an arbitrary relationship between them would conflict with reality to such an extent that for this reason alone it would be totally useless."[6] Accordingly, the Airpower Trinity does not ignore this critical relationship as each element evolves and seeks to define the major factors necessary to maintain the proper relationships.

The *Theory* element provides reason (parallel to the element in the same position in Clausewitz's Trinity) to the Airpower Trinity as it defines the promise and potential of airpower. It also drives *technology* by establishing the requirements of the capability; additionally, it presents a necessary conceptual framework to the *Practice* element. Doctrine and theory, obviously, are not exactly the same, but doctrine is derived from theory and practice. Hence, note its relative position in the Airpower Trinity and the "back-and-forth" interaction of doctrine, theory, and practice. The debatable position of doctrine in the trinity comes from our lack of focus on it in the past. Gen Ronald R. Fogleman, former USAF chief of staff, explains that the "Air Force traditionally has not thought a lot about doctrine." He further states that the early airmen leaders used theory to develop

employment practices and doctrine and "had doctrine in their heads—they lived it and passed it on."[7] Consequently, doctrine has not always been written. Recently, the Air Force set up a doctrine center to help formulate and integrate doctrine into Air Force operations—leveraging the trinity's three key elements.

The *Technology* element, through equipment and systems, provides the capability to reach airpower's maximum potential. Technology, with its foundation in science, inherently involves reason, but it also requires people with creativity to produce useful inventions. Although mostly "pushed" by the requirements of promising theory, technological advancements sometimes can push theory to keep up with emerging capabilities. For example, as satellite technology rapidly opens up new opportunities for information and weapons use, the theory of airpower has been pushed (particularly from the viewpoint of those wearing pilot's wings) to include space and war-fighting concepts in space.

Another factor that affects the development of technology is the available budget for research and development (R&D) and procurement of new systems. Although not a large percentage of the total life cycle cost for a wing of 72 fighter aircraft, for instance, this "up-front" investment of R&D and procurement sometimes does not compete well with current readiness and quality of life budget demands.[8] This becomes a particularly contentious issue when the overall budget is declining, as it has been in recent years. Consequently, the available budget to explore new technologies has been reduced. When this is combined with the lack of a peer competitor on the near horizon, increased modernization funding to keep our technological edge is a difficult position to support. These budget constraints will have a significant effect on the development of the technologies required for such capabilities as space-based weapons, stealth precision strike platforms, and integrated satellite and aircraft laser systems. Additionally, the budget process between the Department of Defense (DOD) and Congress can sometimes result in inconsistent outcomes and lengthy acquisition programs. This can lead to systems that the services either do not want or have incorporated but will be out-of-date by the time the system reaches the field. This is another challenge to maintaining a balance.

Technology can become so advanced and complex that it presses the limits of human capability. This is most evident in the advanced cockpits of future fighter aircraft. The amount of information is so huge and the flow so rapid that the pilot has a more difficult time absorbing and processing it all. This "information overload" could marginalize the technological advance. Additionally, not only are the physical structures of these fighter aircraft becoming more "stealthy," the aircraft can "pull more Gs" (the force of gravity) than the human body is capable of withstanding. Even as employment practices change to take advantage of these advances, such as through the use of unmanned vehicles, the human is still necessary somewhere "in the loop." This potentially limits technology. Consequently, both of these elements must be developed in tandem so that they maximize their contribution to airpower.

While necessity fosters invention, technology also has its limits. The ultimate "high ground" to employ airpower is from space, but satellites, lasers, and spaceships are not yet advanced enough in the operational area to do the practical weaponized missions. The key is that as *technology* advances, it must be through concurrent and integrated development with *theory* and *practice*. If not, the Airpower Trinity will not be in balance to "feed the center." Together the elements shape airpower's potential. Without this synergy, airpower will not provide its maximum potential—the ability to restrain warfare through quick, decisive, and low-casualty outcomes. The balance of *theory*, *practice*, and *technology* will be attained only through the lessons of history that follow.

Beginning the Journey of Airpower Evolution: World War I and World War II

The evolution of the *theory* of airpower, the *technology* that enables capability, and employment *practice* took time. Each of these elements developed individually, but there were also natural relationships between them that influenced this evolution. Airpower changed the conduct of war immediately at the tactical level; airpower as a decisive factor at the strategic level took a bit longer to emerge. However, in comparison to the history of warfare, the time frame was relatively short—about 75 years (from World War I to Desert Storm). And, in several limited cases, airpower provided strategic decisiveness earlier than that. The challenge, of course, is to ensure that airpower evolution continues such that it provides its maximum potential in future conflicts.

In World War I, application of early theory did not immediately make airpower a decisive factor. Clausewitz, obviously, did not address airpower specifically, and a translation of his theories to this instrument had not yet happened. Since there was no written airpower *theory*, development happened concurrently with *practice*, and, even then, it was not widely disseminated. The three elements of the Airpower Trinity were not in balance. The potential promised by the early advocates was way "out in front" of what *technology* could provide. This lack of technological capability restrained employment. During the ensuing years, airpower enthusiasts such as Giulio Douhet, Gen Billy Mitchell, and Sir Hugh Trenchard addressed airpower theory directly—using many of Clausewitz's concepts of warfare. These men recognized that airpower, with its ability to maneuver in the new dimension of air, was the technological advancement to change the face of the World War I battlefield, despite these initially limited results. They promised that the next war would be different.

In the years leading up to World War II, Army Air Corps strategists at the Air Corps Tactical School (ACTS) developed and taught five core principles, derived from Mitchell's vision, to guide the development of airpower:

Gen Benjamin D. Foulois at Colombey-les-Belles, France, during World War I. The early airmen leaders used theory to develop employment practices and doctrine and "had doctrine in their heads—they lived it and passed it on."

1. Modern great powers rely on major industrial and economic systems. . . . Disruption and paralysis of these systems undermines both the enemy's *capability* and *will* to fight.

2. Such major systems contain critical points whose destruction will break down these systems, and bombs can be delivered with adequate accuracy to do this.

3. Massed air forces can penetrate air defenses without unacceptable losses to destroy selected targets.

4. Proper selection of vital targets in the industrial/economic/social structure of a modern industrialized nation, and their subsequent destruction by air attack, can lead to . . . victory through air power.

5. If enemy resistance still persists after successful paralysis of selected target systems, it may be necessary as a last resort to apply force upon the sources of enemy national will by attacking cities. (Emphasis in original)[9]

These principles seemed also to reflect the pages on "center of gravity" and "national will" in Clausewitz's *On War*.[10] Moreover, as a foundation for strategic bombing during the war, the principles reflected the core belief in the decisive nature of air power. In particular, the statement that the "proper selection of vital targets . . . and their subsequent destruction by air attack, can lead to . . . victory through air power" (principle 4) implied that victory could be achieved following this prescription.

However, again, the Airpower Trinity was not in balance. The theory derived from the ACTS principles was valid and proven in later conflicts, but "victory through air power" did not occur in World War II. Airpower did make significant contributions—in some battles at the tactical level; others, such as in the ultimate surrender of Japan, at the strategic level. In *practice*, airpower was a part of the overall campaign in most battles, but it was not employed to utilize its maximum potential. *Theory* required air power to be a primary and integral part if it was to be a decisive factor in the joint campaign. There were some attempts by joint staffs, most notably the British joint staff, in operations; however, the lack of centralized control of air assets severely limited effectiveness and positive impact. The promises of Douhet, Mitchell, and the ACTS were not fulfilled.

The reality of employment *practice* proved more difficult and complex than *theory* suggested. Again, *technology* limited capability. Even with the most sophisticated bombsight, World War II aviators were unable to deliver the promised precision bombing. This capability was a must to fulfill the ACTS fourth principle (and promise). Additionally, the "will of the people," a critical relationship in Clausewitz's Trinity, significantly affected the balance of the Airpower Trinity as well. Two occurrences in the use of air power by the enemy forces reveal the complex nature of balancing theory and practice.

Intended to have a positive effect, the bombing of Pearl Harbor and the air strikes on London during the Battle of Britain had unexpected and opposite effects for the Japanese and the Germans. In each case, the intent was to use air power strategically, to destroy the will of the people to resist. Yet, these bombings solidified rather than shattered public will. In fact, the reaction of the American people to the Pearl Harbor bombings pushed the wavering Roosevelt administration into the war. Clearly, the leaders of Japan and Germany did not fully understand the nature of war with regard to the will of the people. However, an important lesson about employment was universally learned: air superiority was a requirement for any successful operation. Still, air power theory promised more than air superiority. The good news was that the vision of that fully realized promise could be seen more clearly at the end of the war.

Korea and Vietnam: Limited Wars, Limited Use

In the Korean and Vietnam limited wars, with their unclear nature and restrained conduct, Clausewitz's Trinity was forced out of balance.[11] Political objectives (*reason*) were not properly connected to military objectives and employment (the other two elements). In the Airpower Trinity, *technology* had closed the gap between promise and capability (for example, jet engines significantly improved speed, and upgraded weapons delivery systems provided more precise bombing). But even with this technological

advantage, airpower was not employed as an intended decisive factor. Even though tactical employment of airpower saved the US Army from defeat early in the Korean conflict, airpower was not an integral part of Gen Douglas MacArthur's overall battle plan. Also, this conflict occurred relatively soon after the establishment of the United States Air Force as a separate service, at a time when early emphasis was on strategic nuclear deterrence and heavy bombers.

The Vietnam War, also fought in the shadow of the cold war, saw airpower employed in a limited and disparate fashion—like the rest of the US military force. Airpower had not been "unleashed" to fully exploit its capabilities for maximum impact. This was primarily due to political considerations (White House control of targeting, etc.) that impacted and constrained *employment practice*—a critical element of the Airpower Trinity. Also, the lack of centralized control over all the air assets again diluted the ability to maximize the force. Air campaigns like Rolling Thunder and Linebacker, while accomplishing some limited tactical success, could not provide a decisive factor without integration into an overall joint war effort.

Israeli Success in the Six-Day War and the Bekaa Valley: Airpower Trinity in Balance

The maximum potential of this unique capability is achievable. The success of Israeli airpower in the 1967 Arab-Israeli War and the Bekaa Valley air campaign in the 1982 Lebanon war showed that airpower could be a decisive factor. These successes occurred when the available *theory*, *tech*nology, and *practice* concepts supported each other in the strategic application of airpower. Airpower had finally fulfilled the early promises, albeit on a relatively small scale. In both conflicts, the Israeli leaders showed a clear understanding of Clause-witzian theory; the trinity and its link-ages; Liddell Hart's indirect approach; and the principles of surprise, deception, and concentration of forces that airpower could exploit. They also understood the elements of the Airpower Trinity and their relationships.

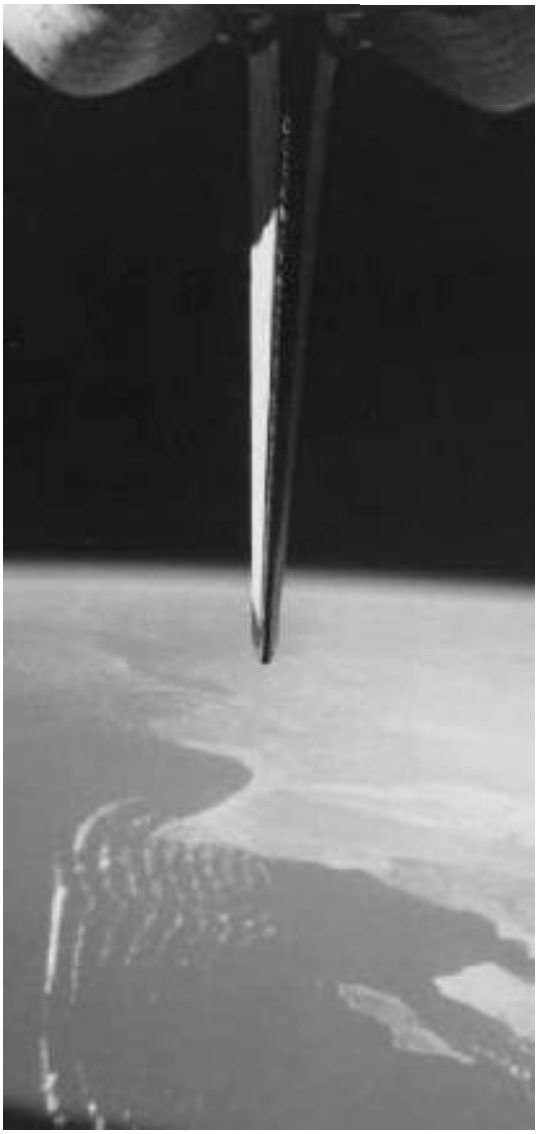
At 0745 on Monday, 5 June 1967, Israel used the element of surprise (the principle of war that is airpower's strongest advantage)[12] to launch a preemptive strike at two dozen Arab air bases in Egypt, Syria, Jordan, and Iraq. This precisely timed and coordinated strike consisted of two 80-minute attacks that destroyed the offensive potential of the Arab air forces. In this first three hours of the war, 387 Arab aircraft were destroyed, and Egypt's air force, the largest in the Arab world, went from 520 planes to 220.[13] With early air supremacy, the Israeli Air Force (IAF) could provide timely interdiction and close air support that enabled the ground forces to accomplish magnificent feats.

General Hod, commander of the IAF, when asked how it managed such unprecedented success, stated four key reasons: sixteen years of planning for the initial 80 minutes, good intelligence about the enemy, flexible and centralized control of the air assets, and skilled execution.[14] Although the Israeli strategy relied heavily on Liddell Hart's theory (when using its inherent advantage of surprise, airpower is both the ultimate in direct approach and a critical force multiplier for a numerically inferior military), Clausewitzian theory was clearly recognized (war plans supporting clear political objectives, and the criticality of the human factor in war). Strategically, Israel knew that victory had to be quick and decisive.[15] Surprise was the key to success; airpower, with its speed, range, flexibility, and ability to directly attack enemy centers of gravity, was the only force that could provide a decisive blow. Airpower sealed Israeli victory within hours of the first strike. This was the promise of airpower *theory;* the available *technology* provided the necessary capability; and the IAF pilots exploited both in their employment *practice.* The Airpower Trinity was in balance at this point in time.

The Israeli air operation over Lebanon in 1982, although very limited in scope, objectives, and the number of participants, requires mention in light of the decisive nature of airpower for at least three reasons. First, airpower probably prevented a future war with the absolute destruction of the Syrian forces. Accomplished very quickly and with very few casualties, the air war in the Bekaa Valley exhibited almost perfect employment by the IAF in the eight-minute battle. Second, this air campaign constituted the first full-scale test of current-generation American *technology* in tactical aircraft and weapons.[16] But, although there were lessons to be learned about technology of weapons and equipment, a more important lesson was about airpower employment *practices*. High-technology weapons are required in a real-time electronic warfare environment, but to be decisive, airpower still must be employed using the basic principles of war. Third, it was also about the human factor in war. In the end, despite divergent military philosophies and more sophisticated American equipment, the Syrians were simply outflown and outfought by the Israelis.

Desert Storm: Our Theory, Practice, and Technology Balanced in the Airpower Trinity

In August of 1990, Saddam Hussein boldly stated, "The United States relies on the Air Force and the Air Force has never been the decisive factor in a battle in the history of wars."[17] He was right about the United States Air Force up to that time, but he obviously was not a student of the evolution of airpower—or, for that matter, of military strategy. Consequently, Saddam lived to regret his statement. From the first-night reports of F-117s and Tomahawk cruise missiles striking Baghdad (via live CNN reporting) to nightly precision bombing videos, it became evident that this war was different.



The Oman Coast and Saudi Arabia from shuttle Columbia. *While necessity fosters invention, technology also has its limits: the ultimate "high ground" to employ airpower is from space, but satellites, lasers, and spaceships are not yet advanced enough in the operational area to do the practical weaponized missions.*

Some observers maintain that airpower alone, for all practical purposes, won the Gulf War.

The United States was at a point in time when *theory, technology,* and *practice* converged at the right time and place to allow employment of airpower to its maximum potential. The Airpower Trinity was in balance and, as such, played a prime role in the balance of the Clausewitzian Trinity. As David Hackworth concluded, "Air power did a most impressive job and virtually won this war by itself."[18] Based on the objectives of this war, airpower could not have "won it by itself," but it was the decisive factor in the quick, low-casualty allied victory.

While airpower *theory*, in general, promised the decisive battle, written US Air Force doctrine was mired in the cold war.[19] The basic doctrine manual, Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, was dated 16 March 1984 and had not changed significantly since 1959.[20] Consequently, approaching the Persian Gulf War, airpower leaders did not have a written doctrine on which to base a conventional air campaign plan. However, they did have unwritten doctrine that had been developed through their many experiences and study of the best concepts of such theorists as Clausewitz, Liddell Hart, and, of course, Mitchell and Douhet. Luckily, there were Air Force leaders, like the early airmen, who understood these concepts of theory and had them "written down in their minds,"Gen Chuck Horner, Brig Gen Buster Glosson, and Col John Warden to name the most visible. Colonel Warden had laid the foundation of an air campaign in his book *The Air Campaign: Planning for Combat*. He led the joint working group that took his European theater plan and built the initial part of the comprehensive, integrated Desert Storm air campaign.

These leaders certainly understood Clausewitz's concept of the center of gravity (see endnote 10). Warden's modified and updated version of the center of gravity with his five concentric rings became the central focus of the air campaign.[21] Gen Colin Powell, commenting on Warden's concept at one of the first strategy-planning meetings in August 1990, stated that "Warden's approach could destroy or severely cripple the Iraqi regime."[22] It remained the heart of the air campaign. With initial domestic public support tenuous due to a vivid memory of the protracted and costly Vietnam War, a quick crippling of Iraq's war-fighting capability was required. Additionally, the fragile nature of the coalition added a further requirement for a quick war, with low loss of allied lives and minimal collateral damage. A mandate from the United Nations and our allies—as well as domestic public support—gave the United States the opportunity to "unleash" airpower. To sum up the philosophy in true Clausewitzian sense, General Powell explained the battle plan: "We were using our airpower first . . . to render the enemy deaf, dumb, and blind. . . . Our strategy in going after this army is very simple; first we are going to cut it off, and then we are going to kill it."[23]

The air campaign was carried out by an employment concept of simultaneous and synchronized strikes, mass and concentration of forces, surprise and deception, outstanding intelligence, and flexibility through centralized control—all universal principles of warfare. As with the evolution of *technology,* these employment *practices* were perfected over many years. Airpower clearly benefited from a transformation in the way US forces train for combat. This was true for the entire joint arms team. As one Army general officer stated, "We didn't start winning this war last August. We started winning this war ten to fifteen, if not twenty years ago."[24] This applied to Air Force training as well.

Doctrine had advanced, not in the written form of AFM 1-1, but in other written forms such as journals and reports. This was supported by changes in employment *practices* at large-scale exercises like Red Flag, which began after the Vietnam War, and significant organizational changes in flying units in the early 1990s. Finally, probably the key reason for airpower's decisive nature was the centralized control of all air assets by one commander, the joint force air component commander. Through one integrated air tasking order for all coalition air forces, General Horner directed air assets to the missions that would provide the most decisive impact. At

long last, the *theory* element and the *practice* element were in balance with the *technology* element.

"The technology finally caught up with the doctrine," proclaimed Gen Michael Dugan, former Air Force chief of staff, as he asserted the vindication of precision bombing.[25] Dramatic improvements in precision weapons and stealth technology provided the necessary means to reach the ambitious ends of the air campaign. Attacking the will of the populace, while minimizing collateral damage—once only a promise—was now a reality. Additionally, *technology* improvements in many other areas like communications, sensors, and aircraft production and maintenance resulted in superior intelligence and situational awareness, nearly flawless synchronization of simultaneous missions, very high aircraft sortie rates, and even immediate bombing results sent to leaders in Riyadh and Washington. This minimized the "Dover factor" (bodies arriving at Dover AFB, Delaware) by reducing the loss of American lives and the "CNN factor" (immediate, real-time TV coverage) by providing very successful targeting video. Airpower provided an overwhelming, technologically superior, decisive force—the American "way of war" continually promoted by General Powell.

The Future for Decisive Airpower

"Billy Mitchell was right." Hung above the door at USAF's Air Command and Staff College during Desert Storm, this saying is finally more than theory—at least for this war. Airpower can and did provide a decisive contribution to the final outcome of that war. However, now in another period of peacetime, the challenge is to keep the elements of the Airpower Trinity in balance for the next war.

In the expected conflicts of today and tomorrow, airpower, like land or sea power, cannot provide the sole means to all ends. Depending on the purpose and nature of the conflict—and the intended political objectives—the relative importance and contribution of air, land, and sea forces vary. These forces are intended to work together to achieve the military objectives. However, even if one of the goals is to move an enemy's army, airpower can provide the decisive means to this end. Without it, the accomplishment of that objective may be threatened or require a very high price in terms of lives lost and material resources expended. To this end, employment *practices* must keep pace with *theory* and *technology* advancements to ensure that the Air Force fights Powell's "way of war."

United States airpower doctrine (AFM 1-1, March 1992) describes the basic principles and tenets for the effective application of airpower. The unique capability of airpower to operate from the "high ground" means that it can be employed quickly, anywhere needed, against any facet of enemy power.[26] Derived through experience, this current doctrine, dynamic and flexible like airpower, allows for advances in technology and threats, as well as changes in warfare. It reflects a core belief in the decisive nature of airpower with the definition of strategic air warfare as

> air combat and supporting operations designed to effect, through the systematic application of force to a selected series of vital targets, the progressive destruction and disintegration of the enemy's war-making capacity to a point where the enemy no longer retains the ability or the will to wage war.[27]

Theory and doctrine will continue to evolve, as they must, to maximize and exploit the capability of airpower.

According to Clausewitzian theory, the *nature* of war is timeless. But not so for the *conduct* of war—it changes with advances in technology. In turn, *technology* drives *practice,* with *theory* a critical factor in both. Desert Storm, a balance of airpower *theory, technology,* and *practice*, could be the culmination of a technological revolution, a midphase test of the evolution, or the verge of the next revolution in weapons and warfare. As weapons become more precise, with better standoff capability, satellites will move the "high ground" further up into space. This development,

along with the development of information warfare, will very likely make tomorrow's wars quite different from the ones we know. Employment *practices* and *theory* (and doctrine) will become more critical as future *technology* promises a capability to conduct warfare more cleanly—in a precise, limited, almost bloodless fashion—and quickly.

Future Air and Space Operations

This question about whether Desert Storm and the technologies employed constitute a revolution in military affairs (RMA) has been widely discussed. Certainly, these technological advances resulted in a high-intensity battlefield, a "hyperwar," that was a profound change in the conduct of war. James Fitzsimmonds, an Army officer writing in a 1995 article, described many of the advanced technologies used during Desert Storm that will shape the future battlefield:

> Advanced sensors and communications now provide much greater information about the enemy as well as a higher degree of operational control over our own forces. Stealth and precision-guided warheads have reduced significantly the number of platforms and amount of ordnance necessary to destroy individual targets. Conventional weapon lethality has increased, while attrition and collateral damage have been significantly reduced. These developments portend perhaps an entirely new regime of high-technology warfare in the early 21st century.[28]

Lt Gen David McCloud, USAF, director of JCS J8, echoed this assessment, listing stealth, computer systems, lasers, and information systems as revolutionary technologies that will help change the future battle space. His definition of a "revolutionary technology" focused directly on the operational environment: a technology that war fighters can use. The opportunity that the United States has to merge these technologies into future weapon systems means, according to General McCloud, that the

Billy Mitchell was right.

"relative U.S. military capabilities will undergo stunning improvements by 2010."[29]

Whether we have experienced an RMA or not, one thing on which every one can agree is that the battlefield will be different in the future. The CJCS's *Joint Vision (JV) 2010* recognizes this fact and sets the goal of "full spectrum domi nance" by the United States across the range of mili tary op era tions in the fu ture. Gen John Shalikashvili's vision is American capability to dominate any opponent—full spectrum dominance is to be the key character is tic for our armed forces to achieve this vision. *JV 2010* provides the conceptual template to "leverage technological opportunities to achieve new levels of effectiveness in joint warfighting." Each service, through the application of new operational concepts, is expected to develop its "unique capabilities within a joint framework of doctrine and programs." These new operational concepts are dominant maneuver, precision engagement, full dimension protection, and focused logistics. Power projection remains one of two fundamental strategic concepts of our mili tary strat egy; accordingly, long-range precision capability is a necessary integral part of power projection and is a "key factor in future warfare."[30]

Airpower will play a significant role in achieving this goal. The USAF follow-on strategic vi sion to "Global Reach–Global Power" was recently published under the title *Global Engagement: A Vision for the 21st Century Air Force.* This USAF vision for the first quarter of the twenty-first century states that full spectrum dominance depends on the inherent strengths of modern air and space power—speed, global range, stealth, flexibility, precision, lethality, global/theater situational awareness, and strategic perspective.[31] While air and space power re sides in all the serv ices, the US Air Force is the lead service for employing this capability. Hence, its vision and planning for the future will be used in this discussion.

This new vision details how the US Air Force fits into the na tional se cu rity strat egy of "Engagement and Enlargement" and the national mili tary strat egy (NMS). The NMS centers around two major concepts to meet the se cu rity chal lenges of the new cen tury: global presence and power projection. Since these challenges will occur across a wide range of contingencies, the joint force commander will demand flexible capabilities. The Air Force contributes these capabilities to the joint team through its "core com pe ten cies" of air and space superiority, global attack, precision en gage ment, rapid global mo bil ity, agile com bat sup port, and in for ma tion su pe ri or ity. Former secretary of the Air Force Sheila Widnall points out that coping with the new challenges and their effect on the battlefield "was no accident." The Air Force anticipated this new way of war because "of vision, sys tem atic plan ning and in vest ing in our peo ple, and the right modernization programs."[32]

The Airpower Trinity—Maintaining the Balance

Maintaining the balance in the Airpower Trinity requires deliberate planning and execution. *Vision* has been the word used in most of the documents relating to future operations. Vision is not ex actly the same as *theory,* but for the purposes of projecting the future, the airpower advocates of today—our airpower theorists—use *vision* to explain what airpower hopes to do for warfare. This is where *vision (theory)* pushes *technology* to produce the necessary capability, but this vision is possible only when the advocates have some glimpse of the "art of the possible."

For example, with such a glimpse, the authors of *Battlefield of the Future: 21st Century Warfare Issues* iden ti fied four new po tential warfare areas: space warfare, precision strike, dominating maneuver, and information warfare.[33] Space warfare, by ex tension, is in airpower's domain (more specifically, air *and space* power's domain in the future). George Friedman, who heads the Strategic Fore cast ing Group, ar gues in his book *The Future of War* that "the age of the gun is over and the future is the age of precision-guided munitions or smart weapons. He who controls space controls the battlefield." He adds that

the United States will have the edge in the twenty-first century due to high-speed missiles and space-based reconnaissance to gather information and quickly disseminate it.[34] Precision strike, dominating maneuver, and information warfare are not the sole domain of airpower; however, airpower will play a significant role in each and a major role in the precision strike area. While all of these areas are supported by the core competencies of the US Air Force, precision strike is the farthest along conceptually and practically. This allows a look at the future potential of airpower from the familiar perspective of the present.

By 2020, new technologies that will enable precision strike could provide commanders with "wide-area surveillance and target acquisition, near-real-time responsiveness, and highly accurate, long-range weapons" to achieve strategic effects at intercontinental distances.[35] This will be a dramatic increase in capability. In 1943, the US Eighth Air Force prosecuted only 50 strategic targets in an entire year. In the first 24 hours of Desert Storm, the coalition air forces prosecuted 150 strategic targets. By the year 2020, the potential could exist to prosecute five hundred strategic targets in the first minute of a war.[36] This accomplishment will come only from the synergistic effect of linking the technologies required in all of these new warfare areas. For airpower to live up to its potential in this vision of warfare, *technology* will have to produce the necessary capabilities. It seems the technological advancements, thus far, make that highly probable.

These current technological advancements are so rapid and dramatic, a potential problem is that employment *practices* may not be able to keep up with that pace. Since the "cause and effect" relationship discussed earlier between *theory* and *technology* keeps these two elements more closely in balance, the more critical relationship is between *technology* and *practice*. And *technology* will be the driver in this relationship. The development of employment *practices* to take advantage of this advanced technology will be required for airpower to make the *vision* a reality. Consequently, new operational concepts and organizational modifications may provide greater leverage for future success than the technologically advanced systems themselves.

As the future battlespace becomes more lethal and complex, the technologies required to survive in this environment will likely result in systems that are not compatible with manned flight. New operational concepts will increasingly employ unmanned systems to reduce the loss of life, to utilize technologies that exceed the limits of human capability, and to meet signature requirements in a more stealth-necessary environment. The organizational modifications required to operationalize these concepts have already begun in the US Air Force. The first unmanned aerial vehicle (UAV) squadron has been established at Nellis AFB, Nevada. The establishment of the squadron and the location are significant because this organizational modification strikes directly at the heart of the founding identity of the US Air Force: the pilot in the cockpit (with a scarf flowing in the breeze). Not only will this challenge the core institutional culture, it will challenge the warrior ethos.[37] How ironic that the first UAV squadron is at Nellis AFB, the "home of the fighter pilot." The development of UAV technology and practices is an example of where concerted effort, planning, and leadership will be required to keep the Airpower Trinity in balance.

Conclusion

The synergistic evolution of three key elements—*theory, technology,* and *practice*—is critical to the evolution of airpower in order to achieve its maximum combat potential. This is the essence of airpower—a force that can provide a decisive factor to the outcome of conflict. This article introduced the Airpower Trinity, originating from the concept of the Clauzewitzian Trinity with his "three magnets balancing the trinity." This new construct explores the relationship of *theory, technology,* and *practice* to the essence of airpower. As in the Clausewitzian Trinity, the interaction among these elements must produce a balance of the Airpower Trinity.

This is necessary for the maximum effective employment of airpower in combat. When this has occurred, as it did for Israel in the 1967 Arab-Israeli War, the Bekaa Valley in 1982, and for the United States during the recent Persian Gulf War, airpower exhibited its maximum potential and was decisive in the final outcome of each war.

The balance of *theory*, *technology*, and *practice* is a necessary ingredient for success in subsequent wars. The future battle space will be a new regime of high technology and complex warfare—extended into space, with more precision strike and greater demand for accurate and timely information. Full spectrum dominance, the *JV 2010* objective for this battle space, depends on the inherent strengths of airpower. This *theory* and *practice* must stay in balance with the rapidly changing *technology*. Attention in the future to the concept of the Airpower Trinity will ensure *air and space power* provide a decisive factor in future conflict. And, once developed, the "Joint Force Trinity" could prove the sine qua non of future victories. □

Notes

1. Carl von Clausewitz, *On War*, trans. and ed. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 89.
2. Ibid.
3. Ibid.
4. Ibid.
5. Ibid., 88.
6. Ibid., 89.
7. Gen Ronald R. Fogleman's commander's call remarks to National War College, 18 February 1997. With regard to the early airmen leaders, he referred to those in 1945, the 1960s, and the mid-1970s.
8. Ibid. To put the R&D and procurement costs of new tactical air (F-22, F/A-18 E/F, and JSF) into perspective, General Fogleman presented a comparison of modernization costs (R&D and procurement are the primary ones) to the total cost over a 35-year life span of several major weapons and their organization, such as an F-22 fighter wing, an aircraft carrier, or a heavy mechanized division. The intent was not to compare a heavy mechanized division to a fighter wing on any type of cost-benefit relationship, but rather to show that the "up-front" costs in *all* of these capabilities are rather low compared to the cost to maintain the capability over a 35-year life span.
9. Haywood S. Hansell Jr., *The Strategic Air War against Germany and Japan: A Memoir* (Washington, D.C.: Office of Air Force History, 1986), 9–10.
10. Clausewitz defined center of gravity as "the hub of all power and movement, on which everything depends . . . the point against which all our energies should be directed." Clausewitz, 595–96.
11. Dr. Ilana Kass, Seminar M, 28 October 1996, National War College, Washington, D.C.
12. This is true according to AFM 1-1, *Basic Aerospace Doctrine of the United States Air Force*, vol. 1, March 1992, 16. Most aviators believe flexibility is the key to airpower. Flexibility allows for surprise.
13. "Israel's Swift Victory," *Life*, Special Edition, 1967, 40.
14. Randolph and Winston Churchill, *The Six Day War* (Boston: Houghton Mifflin Company, 1967), 91–92.
15. Israeli cabinet members were terrified at the prospect of a premature cease-fire. They remembered when US pressure forced defeat on them (with the British and the French) in 1956 when victory was only hours away. The Israeli plan in 1967 was based on the belief that time would be short and victory would have to be as swift and decisive as possible. Randolph and Winston Churchill, 93.
16. "U.S. Arms Used in Lebanon War Outstrip Soviets," *Wall Street Journal*, 5 August 1982.
17. "Excerpts from Interview with Hussein on Crisis in Gulf," *New York Times*, 31 August, 1990, A-10.
18. David H. Hackworth, "Lessons of a Lucky War," *Newsweek*, 11 March 1991, 49.
19. See earlier remarks by USAF chief of staff. Doctrine can be written, like AFM 1-1, or unwritten, like that practiced by airmen day-to-day.
20. Mark A. Clodfelter, "Of Demons, Storms, and Thunder: A Preliminary Look at Vietnam's Impact on the Persian Gulf Air Campaign," *Airpower Journal* 5, no. 4 (Winter 1991): 27.
21. Colonel Warden discusses his concept of center of gravity in his book and adds that it is the point where the enemy is most vulnerable and where attacks will have the best chance of being decisive. For Desert Storm, he defined the enemy's center of gravity to consist of five concentric rings: (from the center out) leadership, production facilities, infrastructure, population, and fielded military forces. The vital targets were at the center and should be attacked first, or at least simultaneously. Something that airpower could do was to concentrate force at the decisive point. John A. Warden III, *The Air Campaign: Planning for Combat* (Washington, D.C.: National Defense University Press, 1988), 9–11; and Clodfelter, 23.
22. Colin L. Powell with Joseph E. Persico, *My American Journey* (New York: Random House, 1995), 473.
23. Ibid., 509–10.
24. Bard E. O'Neill and Ilana Kass, "The Persian Gulf War: A Political-Military Assessment," *Comparative Strategy*, April–June 1992, 227.
25. Michael Dugan, "First Lessons of Victory," *US News and World Report*, 18 March 1991, 36.
26. AFM 1-1 (1992), vol. 1, 5.
27. Ibid., vol. 2, 302. This doctrine also identifies on page 116 at least three decisive uses for the capability of airpower forces.
28. James R. Fitzsimmonds, "The Coming Military Revolution: Opportunities and Risks," *Parameters*, Summer 1995, 30.
29. Lt Gen David McCloud, lecture, National War College Class of 1997, 13 March 1997.
30. Chairman, Joint Chiefs of Staff, *Joint Vision 2010* (Washington, D.C.: Joint Chiefs of Staff, 1995), 1-11.
31. *Global Engagement: A Vision for the 21st Century Air Force* (Washington, D.C.: Department of the Air Force, 1997), 7.
32. John A. Tirpak, "The Air Force Today and Tomorrow," *Air Force Magazine*, January 1996, 20.
33. James Blackwell et al., *The Revolution in Military Affairs, Battlefield of the Future: 21st Century Warfare Issues* (Maxwell AFB, Ala.: Air University Press, 1995), 75.
34. "Why the 21st Could Be the American Century," *Parade/Washington Post*, 6 April 1997, 8.
35. Blackwell, 79.
36. Ibid., 78.
37. Michael G. Vickers, *Warfare in 2020: A Primer* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 1996), 7.