IN SEARCH OF HIGH GROUND

The Air Power Trinity and the Decisive Potential of Air Power

DAVID K. EDMONDS

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

— Sun Tzu

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 air power 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 air power, 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 air power had not been developed sufficiently; nor was the political situation suitable to exploit air power'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 air power, 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

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theory, technology, and employment practice of air power 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, air power has exhibited its maximum potential and has been decisive in the final outcome of each war. Of course, air power's success in any war is founded during the years that precede the war. Since combat situations are separated by longer periods of peace-time, the intervals between wars need to be exploited to ensure that air power is ready when the need arises again.

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This article introduces an original construct to explore the relationship of the key elements of air power and to create a better understanding of the factors necessary for the most effective employment of air power in combat. This construct – the Air Power Trinity, consisting of *theory*, *technology*, and *practice* – is derived from the concept of the Clauzewitzian Trinity. After an introduction of the Air Power 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 air power, exploring how the balance can be maintained in peace-time and exploited in war.

THE CLAUSEWITZIAN TRINITY AND AIR POWER

The first theories and principles of air power, 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 air power 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 criticised, 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 comprising *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 Fig. 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]

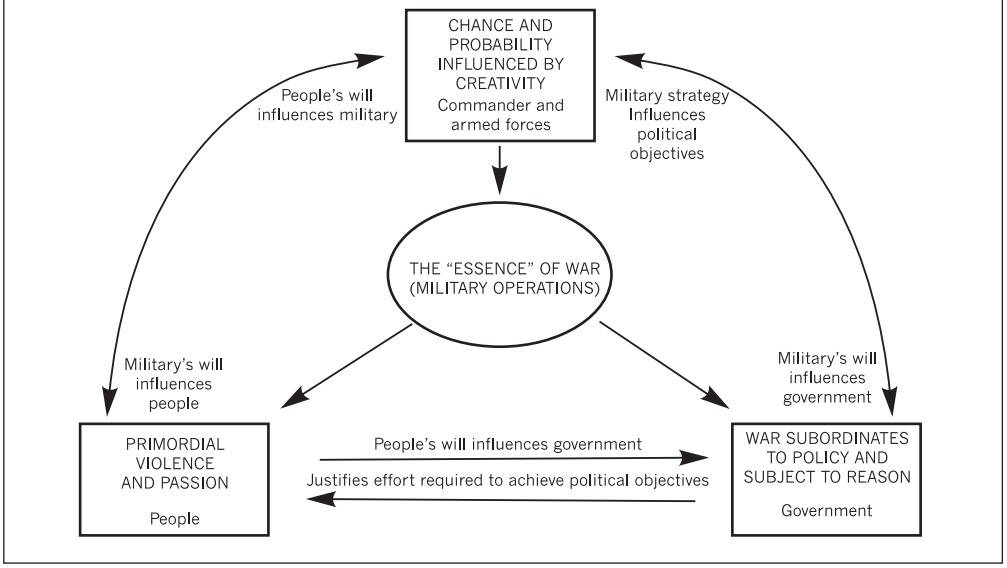
Accordingly, they shape the battlefield; if one element gets out of balance, then, as Clausewitz warns, war has the tendency to spiral out of control. He uses the metaphor of three magnets to maintain the necessary balance: "Our task, therefore, is to develop a theory that maintains a balance between 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

1. Carl von Clausewitz, *On War*, trans. and ed. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), p. 89.
2. Ibid.
3. Ibid.

army (in the generic military sense); and the *reason* is the responsibility of the government alone.[4]

Fig. 1. Clausewitzian Trinity



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

4. Ibid.
5. Ibid., p. 88.

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, a stated – if not always practised – goal for both political and military leaders following World War I.

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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. Air power'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 air power at the strategic level. It promises an improved chance of victory with fewer casualties through its inherent capabilities such as speed, flexibility, and manoeuvre in a new dimension.

Many of Clausewitz's key concepts such as concentration of force, centres of gravity, unity of command and effort, the culminating battle, and the moral and physical aspects of war, were reflected in air power theory. Liddell Hart's indirect approach is particularly suited to air power's capability. After the protracted bloodshed of World War I, air power 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, air power cannot live up to its decisive potential.

THE AIR POWER TRINITY: AN INITIAL CONSTRUCT

Clausewitz's Trinity defines the essence of war; the Air Power Trinity defines the *essence* of air power through the critical (and paradoxical) relationship between *theory, technology,* and *practice*. Fig. 2, in an initial construct, draws a parallel between these two trinities. The associated links necessary to balance these elements and provide air power with maximum potential (centre) will be added in a subsequent figure. Clausewitz's Trinity deals with political and psychological factors such as reason, passion, and creativity; these factors are also embodied in the Air Power 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 air power 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.

Fig. 2. Air Power Trinity

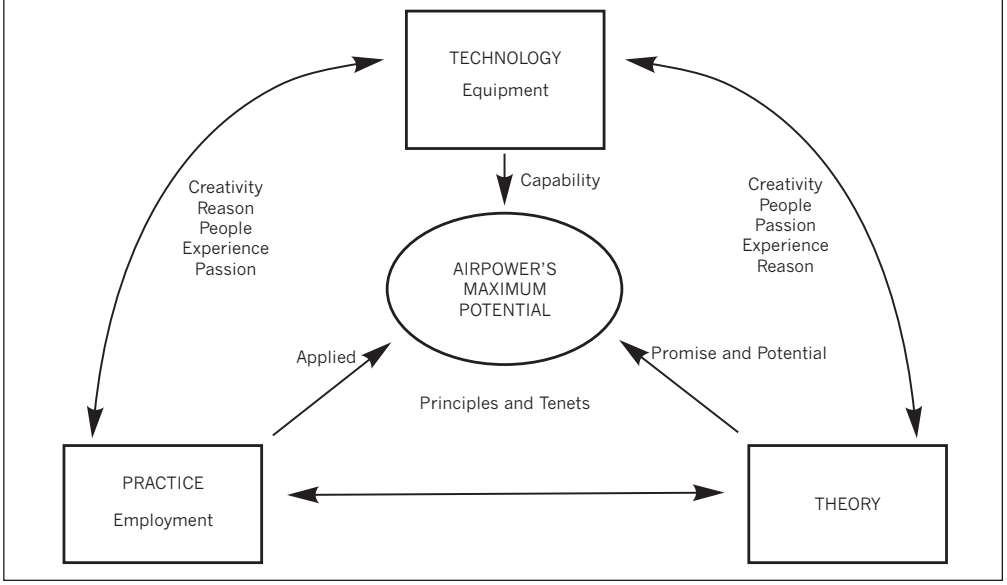
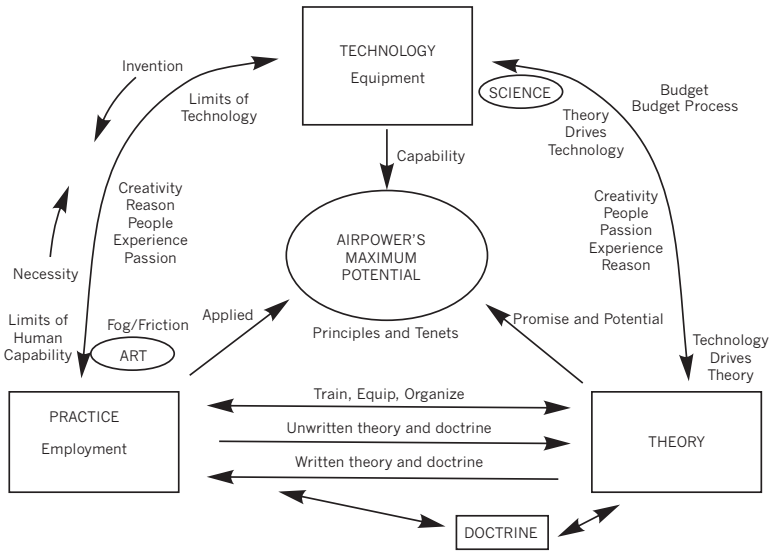


Fig. 3. Air Power Trinity



Like the universality of Clausewitz's principles, the key elements comprising the Air Power Trinity are applicable to the 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 centre. 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 AIR POWER 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 Air Power Trinity. Fig. 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 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 Air Power 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 Air Power Trinity as it defines the promise and potential of air power. 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 Air Power 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 United States Air Force (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 centre to help formulate and integrate doctrine into air force operations – leveraging the trinity's three key elements.

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6. Ibid., p. 89.
7. Gen Ronald R. Fogleman's commander's call remarks to National War College, February 18, 1997. With regard to the early airmen leaders, he referred to those in 1945, the 1960s, and the mid-1970s.

The technology element, through equipment and systems, provides the capability to reach air power'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 air power 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 modernisation 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 Defence (DoD) and Congress can sometimes result in inconsistent outcomes and lengthy acquisition programmes. 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

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, Gen Fogleman presented a comparison of modernisation 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 organisation, such as an F-22 fighter wing, an aircraft carrier, or a heavy mechanised division. The intent was not to compare a heavy mechanised 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.

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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 marginalise 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 maximise their contribution to air power.

While necessity fosters invention, technology also has its limits. The ultimate "high ground" to employ air power is from space, but satellites, lasers, and spaceships are not yet advanced enough in the operational area to do the practical weaponised missions. The key is that as *technology* advances, it must be through concurrent and integrated development with *theory* and *practice*. If not, the Air Power Trinity will not be in balance to "feed the centre." Together the elements shape air power's potential. Without this synergy, air power 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.

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BEGINNING THE JOURNEY OF AIR POWER EVOLUTION: WORLD WAR I AND WORLD WAR II

The evolution of the *theory* of air power, 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. Air power changed the conduct of war immediately at the tactical level; air power 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, air power provided strategic decisiveness earlier than that. The challenge, of course, is to ensure that air power evolution continues such that it provides its maximum potential in future conflicts.

In World War I, application of early theory did not immediately make air power a decisive factor. Clausewitz, obviously, did not address air power specifically, and a translation of his theories to this instrument had not yet happened. Since there was no written air power *theory*, development happened concurrently with *practice*, and, even then, it was not widely disseminated. The three elements of the Air Power 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, air power enthusiasts such as Giulio Douhet, Gen Billy Mitchell, and Sir Hugh Trenchard addressed air power theory directly—using many of Clausewitz's concepts of warfare. These men recognised that air power, with its ability to manoeuvre 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 air power:

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 defences without unacceptable losses to destroy selected targets.
4. Proper selection of vital targets in the industrial/economic/social structure of a modern industrialised 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 "centre 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.

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However, again, the Air Power 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. Air power did make significant contributions—in some battles at the tactical level; in others, such as in the ultimate surrender of Japan, at the strategic level. In *practice*, air power was a part of the overall campaign in most battles, but it was not employed to utilise 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;

9. Haywood S. Hansell Jr., *The Strategic Air War Against Germany and Japan: A Memoir* (Washington, D.C.: Office of Air Force History, 1986), pp. 9-10.
10. Clausewitz defined centre 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, n.1, pp. 595-596.

however, the lack of centralised control of air assets severely limited effectiveness and positive impact. The promises of Douhet, Mitchell, and the ACTS were not fulfilled.

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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 Air Power 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 Harbour 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 Harbour 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 realised 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

11. Dr. Ilana Kass, Seminar M, October 28, 1996, National War College, Washington, D.C.

objectives (*reason*) were not properly connected to military objectives and employment (the other two elements). In the Air Power 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, air power was not employed as an intended decisive factor. Even though tactical employment of air power saved the US Army from defeat early in the Korean conflict, air power was not an integral part of Gen Douglas MacArthur's overall battle plan. Also, this conflict occurred relatively soon after the establishment of the USAF 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 air power employed in a limited and disparate fashion – like the rest of the US military force. Air power 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 Air Power Trinity. Also, the lack of centralised control over all the air assets again diluted the ability to maximise 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.

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ISRAELI SUCCESS IN THE SIX-DAY WAR AND THE BEKAA VALLEY: AIR POWER TRINITY IN BALANCE

The maximum potential of this unique capability is achievable. The success of Israeli air power in the 1967 Arab-Israeli War and the Bekaa Valley air campaign in the 1982 Lebanon War showed that air power could be a decisive factor. These successes occurred when the available *theory, technology,* and *practice* concepts

supported each other in the strategic application of air power. Air power had finally fulfilled the early promises, albeit on a relatively small scale. In both conflicts, the Israeli leaders showed a clear understanding of Clausewitzian theory; the trinity and its linkages; Liddell Hart's indirect approach; and the principles of surprise, deception, and concentration of forces that air power could exploit. They also understood the elements of the Air Power Trinity and their relationships.

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.

At 0745 on Monday, June 5, 1967, Israel used the element of surprise (the principle of war that is air power'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 the 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 centralised 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, air power is both the ultimate indirect approach and a critical force multiplier for a numerically inferior military), Clausewitzian theory was clearly recognised (war plans supporting clear political objectives,

12. This is true according to AFM 1-1, *Basic Aerospace Doctrine of the United States Air Force*, vol. 1, March 1992, p. 16. Most aviators believe flexibility is the key to air power. Flexibility allows for surprise.
13. "Israel's Swift Victory," *Life*, Special Edition, 1967, p. 40.
14. Randolph and Winston Churchill, *The Six Day War* (Boston: Houghton Mifflin Company, 1967), pp. 91-92.

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; air power, with its speed, range, flexibility, and ability to directly attack enemy centres of gravity, was the only force that could provide a decisive blow. Air power sealed Israeli victory within hours of the first strike. This was the promise of air power theory; the available technology provided the necessary capability; and the IAF pilots exploited both in their employment practice. The Air Power 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 the light of the decisive nature of air power for at least three reasons. First, air power 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 air power employment *practices*. High-technology weapons are required in a real-time electronic warfare environment, but to be decisive, air power 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.

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.

15. Israeli Cabinet members were terrified at the prospect of a premature ceasefire. 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, Ibid., p. 93.
16. "US Arms Used in Lebanon War Outstrip Soviets," *Wall Street Journal*, August 5, 1982.

DESERT STORM: OUR THEORY, PRACTICE, AND TECHNOLOGY BALANCED IN THE AIR POWER 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 USAF up to that time, but he obviously was not a student of the evolution of air power, 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 United States was at a point in time when *theory, technology,* and *practice* converged at the right time and place to allow employment of air power to its maximum potential. The Air Power 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, air power could not have "won it by itself," but it was the decisive factor in the quick, low-casualty allied victory.

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While air power 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 March 16, 1984, and had not changed significantly since 1959.[20] Consequently, approaching the Persian Gulf War, air power leaders did not have a written doctrine on which to base a conventional air campaign plan.

17. "Excerpts from Interview with Hussein on Crisis in Gulf," *New York Times*, August 31, 1990, p. A-10.
18. David H. Hackworth, "Lessons of a Lucky War," *Newsweek*, March 11, 1991, p. 49.
19. See earlier remarks by USAF chief of staff. Doctrine can be written, like AFM 1-1, or unwritten, like that practised 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, p. 27.

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 theatre plan and built the initial part of the comprehensive, integrated Desert Storm air campaign.

These leaders certainly understood Clausewitz's concept of the centre of gravity (see endnote 10). Warden's modified and updated version of the centre 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" air power. To sum up the philosophy in true Clausewitzian sense, General Powell explained the battle plan: "We were using our air power 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]

21. Colonel Warden discusses his concept of centre 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 centre of gravity to consist of five concentric rings: (from the centre out) leadership, production facilities, infrastructure, population, and fielded military forces. The vital targets were at the centre and should be attacked first, or at least simultaneously. Something that air power could do was to concentrate force at the decisive point. John A. Warden III, *The Air Campaign: Planning for Combat* (Washington, D.C.: National Defence University Press, 1988), pp. 9-11; Clodfelter, n. 20, p. 23.

22. Colin L. Powell with Joseph E. Persico, *My American Journey* (New York: Random House, 1995), p. 473.

23. Ibid., pp 509-510..

The air campaign was carried out by an employment concept of simultaneous and synchronised strikes, mass and concentration of forces, surprise and deception, outstanding intelligence, and flexibility through centralised control – all universal principles of warfare. As with the evolution of *technology*, these employment *practices* were perfected over many years. Air power 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.

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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 organisational changes in flying units in the early 1990s. Finally, probably the key reason for air power's decisive nature was the centralised 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, Gen 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 minimising collateral damage – once

24. Bard E. O'Neill and Ilana Kass, "The Persian Gulf War: A Political-Military Assessment," *Comparative Strategy*, April-June 1992, p. 227.
25. Michael Dugan, "First Lessons of Victory," *US News and World Report*, March 18, 1991, p.36.

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 synchronisation of simultaneous missions, very high aircraft sortie rates, and even immediate bombing results sent to leaders in Riyadh and Washington. This minimised 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. Air power provided an overwhelming, technologically superior, decisive force – the American "way of war" continually promoted by Gen Powell.

THE FUTURE FOR DECISIVE AIR POWER

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

In the expected conflicts of today and tomorrow, air power, 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, air power 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 *practice*s must keep pace with *theory* and *technology* advancements to ensure that the air force fights Powell's "way of war."

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United States air power doctrine (AFM 1-1, March 1992) describes the basic principles and tenets for the effective application of air power. The unique capability of air power 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 air power, allows for advances in technology and threats, as well as changes in warfare. It reflects a core belief in the decisive nature of air power 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 maximise and exploit the capability of air power.

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 air power 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.

According to Clausewitzian theory, the nature of war is timeless. But not so for the conduct of war – it changes with advances in technology.

26. AFM 1-1 (1992), vol. 1, p. 5.
27. Ibid., vol. 2, p. 302. This doctrine also identifies on page 116 at least three decisive uses for the capability of air power forces.

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" focussed 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 Gen McCloud, that the "relative US military capabilities will undergo stunning improvements by 2010."[29]

Whether we have experienced an RMA or not, one thing on which everyone can agree is that the battlefield will be different in the future. The CJCS's *Joint Vision* (*JV*) 2010 recognises this fact and sets the goal of "full spectrum dominance" by the United States across the range of military operations in the future. Gen John Shalikashvili's vision is American capability to dominate any

28. James R. Fitzsimmonds, "The Coming Military Revolution: Opportunities and Risks," *Parameters*, Summer 1995, p. 30.
29. Lt Gen David McCloud, lecture, National War College Class of 1997, March 13, 1997.

opponent – full spectrum dominance is to be the key characteristic 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 manoeuvre, precision engagement, full dimension protection, and focussed logistics. Power projection remains one of two fundamental strategic concepts of our military strategy; accordingly, long-range precision capability is a necessary integral part of power projection and is a "key factor in future warfare."[30]

Power projection remains one of two fundamental strategic concepts of our military strategy; accordingly, long-range precision capability is a necessary integral part of power projection and is a "key factor in future warfare."

Air power will play a significant role in achieving this goal. The USAF follow-on strategic vision 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 21st 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/theatre situational awareness, and strategic perspective.[31] While air and space power resides in all the Services, the USAF 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 USAF fits into the national security strategy of "Engagement and Enlargement" and the National Military Strategy (NMS). The NMS centres around two major concepts to meet the security challenges of the new century: global presence and power projection. Since these challenges

30. Chairman, Joint Chiefs of Staff, *Joint Vision 2010* (Washington, D.C.: Joint Chiefs of Staff, 1995), pp. 1-11.

31. *Global Engagement: A Vision for the 21st Century Air Force* (Washington, D.C.: Department of the Air Force, 1997), p. 7.

Maintaining the balance in the Air Power Trinity requires deliberate planning and execution.

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 competencies" of air and space superiority, global attack, precision engagement, rapid global mobility, agile combat support, and information superiority. 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, systematic planning and investing in our people, and the right modernisation programs."[32]

THE AIR POWER TRINITY: MAINTAINING THE BALANCE

Maintaining the balance in the Air Power Trinity requires deliberate planning and execution. *Vision* has been the word used in most of the documents relating to future operations. Vision is not exactly the same as *theory*, but for the purposes of projecting the future, the air power advocates of today – our air power theorists – use *vision* to explain what air power 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."

The authors of *Battlefield of the Future: 21st Century Warfare Issues* identified four new potential warfare areas: space warfare, precision strike, dominating manoeuvre, and information warfare.

For example, with such a glimpse, the authors of *Battlefield of the Future: 21st Century Warfare Issues* identified four new potential warfare areas: space warfare, precision strike, dominating manoeuvre, and information warfare.[33] Space warfare, by extension, is in air power's domain (more specifically, air and space power's domain in the future). George Friedman, who heads the Strategic

32. John A. Tirpak, "The Air Force Today and Tomorrow," *Air Force Magazine*, January 1996, p.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), p. 75.

Forecasting Group, argues 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 21st century due to high-speed missiles and space-based reconnaissance to gather information and quickly disseminate it.[34] Precision strike, dominating manoeuvre, and information warfare are not the sole domain of air power; however, air power 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 USAF, precision strike is the farthest along, conceptually and practically. This allows a look at the future potential of air power from the familiar perspective of the present.

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.

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 air power 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.

34. "Why the 21st Could be the American Century," *Parade/Washington Post*, April 6, 1997, p. 8.
35. Blackwell, n. 33, p. 79.
36. Ibid., p. 78.

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 air power to make the *vision* a reality. Consequently, new operational concepts and organisational modifications may provide greater leverage for future success than the technologically advanced systems themselves.

As the future battle space 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 utilise technologies that exceed the limits of human capability, and to meet signature requirements in a more stealth-necessary environment. The organisational modifications required to operationalise these concepts have already begun in the USAF. 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 organisational modification strikes directly at the heart of the founding identity of the USAF: 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 Air Power Trinity in balance.

CONCLUSION

The synergistic evolution of three key elements – *theory, technology, and practice* –is critical to the evolution of air power in order to achieve its maximum combat

37. Michael G. Vickers, *Warfare in 2020: A Primer* (Washington, D.C.: Centre for Strategic and Budgetary Assessments, 1996), p. 7.

potential. This is the essence of air power—a force that can provide a decisive factor to the outcome of conflict. This article introduced the Air Power 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 air power. As in the Clausewitzian Trinity, the interaction among these elements must produce a balance of the Air Power Trinity. This is necessary for the maximum effective employment of air power 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, air power exhibited its maximum potential and was decisive in the final outcome of each war.

The synergistic evolution of three key elements – theory, technology, and practice –is critical to the evolution of air power in order to achieve its maximum combat potential. This is the essence of air power—a force that can provide a decisive factor to the outcome of conflict.

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 air power. This *theory* and *practice* must stay in balance with the rapidly changing *technology*. Attention in the future to the concept of the Air Power 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.