2 Tactical Air Power Theory

> *The greatest historical joke on airmen was that they – having struggled for a century to escape the battlefield in their quest for equal status and independence – having fought so many bitter battles to free themselves from the indignity of providing "mere support" to ground forces – it was on the battlefield where air power finally achieved not mere equality, but its claim to ascendancy.*[1]

For over a century, air power advocates have proclaimed that air forces alone could win wars. Their claims, in turn, have supported the creation and sustainment of independent air forces. Unfortunately, these theorists have reflected airmen's hopes more than explained how air power works best in modern warfare. Of the US air campaigns identified in Table 1.1, directly attacking the enemy's fielded forces was the strategy most often adopted. Direct attack also had more success in achieving military and political objectives than strategic bombing or air interdiction. Air power is a complement to, not a substitute for, ground forces. Air forces and armies work best in combined arms operations, where tactical aircraft (tacair) finds and strikes the enemy's fielded forces well behind the front lines. The lethal threat from air power has its most significant impact by inhibiting an enemy army from concentrating at the decisive point.[2]

Paradoxically, to date, an air power theory for why, how, and when air forces are most commonly and effectively employed has been omitted.[3] Under certain conditions, air power can decimate a massed and maneuvering army. In practice, such occasions have been rare, as threatened troops usually disperse and hide. Taking such defensive measures comes

[1] Stephen Budianky, *Air Power: The Men, Machines, and Ideas That Revolutionized War, from Kitty Hawk to Gulf War II* (New York: Viking, 2004), 441.
[2] Carl Von Clausewitz, *On War* (Princeton, NJ: Princeton University Press, 1976), 195.
[3] James Corum and Wray Johnson allude to, but do not develop, such a theory. *Airpower in Small Wars: Fighting Insurgents and Terrorists* (Lawrence: University Press of Kansas, 2003), 7.

at a high price, though, as a scattered force forfeits the initiative or is left vulnerable to an opposing army's attack. The most significant impact of air power on the battlefield is measured not by the damage inflicted but by the degree to which air power deters the enemy from executing its preferred strategy.

This chapter develops a theory of tactical air power (TAP) for the direct attack of fielded forces. The chapter begins in the interwar period with a brief history of the development of the tactical air power doctrine in Germany, the Soviet Union, Great Britain, and the United States. (Those unfamiliar with air power theory may want to first refer to Appendix A.) Before World War II, most airmen believed that, after gaining air superiority, air forces should strategically attack the enemy's war industries and interdict their lines of communication. Without tactical air doctrine, airmen later scrambled during combat to support friendly troops. Left undeveloped was a theory for why and how air power works against fielded forces.[4] When threatened from the air and the ground, an enemy army is placed on the horns of a dilemma. Does it disperse and hide against the air threat, to be left defenseless against the opposing ground force? Or does it instead concentrate and maneuver, only to be vulnerable to airstrikes? TAP theory explains when fielded forces are most susceptible to air attack and the enemy's reaction.

History of Tactical Air Doctrine

Tactical air doctrine development commenced in World War I but matured in World War II, first by the German Luftwaffe and later by the Soviet VVS (*Voyenno-Vozdushnyye Sily*), the British RAF (Royal Air Force), and the US Army Air Force.[5] Initially, the air doctrine of all but the VVS prioritized gaining air superiority, followed by strategic attack and air interdiction against the enemy's war industries and lines of communication (LOC). Air doctrine provided only tertiary consideration of the direct attack on the enemy's fielded forces. The tactical air doctrine that was developed focused on practical measures such as operating a functioning command and control (C2) system. Left unspoken and unwritten were explanations for why and how directly targeting enemy armies from the air could impact whether battles were fought and the outcome of those that were.

[4] Robert Pape, *Bombing to Win* (Ithaca, NY: Cornell University Press, 1995), 69.
[5] *Voyenno-Vozdushnyye Sily* translates as Military Air Force.

The Luftwaffe

Tactical air forces played a significant role in the German combined arms operations unleashed across Europe at the outset of World War II.[6] Though the 1920 Versailles Treaty had banned military aviation, the Germans secretly maintained an air staff that assessed air power in World War I. They concluded their air force had not been sufficiently aggressive. The priority should have been to gain air superiority by offensive action, engage the enemy's air force, and persistently attack the enemy air force's supporting infrastructure. Air superiority would be hard-won and require a sustained effort.[7] In 1933, the Nazi Party provided ample resources to produce aircraft and recruit personnel. The newly formed Luftwaffe grew exponentially, procuring a fleet of 1,900 airplanes by 1935, when it published its service doctrine, *Conduct of Aerial Warfare*.[8] The 100-page regulation articulated air power's role in the German concept of operational warfare. The Luftwaffe was an independent air force, but its doctrine emphasized joint warfighting. Once it gained air superiority, the Luftwaffe could indirectly pressure the enemy by striking deep or directly supporting the Wehrmacht.[9]

Conduct of Aerial Warfare stressed a flexible approach to targeting, depending on the enemy and the situation. The regulation discussed in detail how to gain air superiority, but afterward limited its consideration of targeting to strategic attack on the enemy's war production or interdiction of the enemy's transportation.[10] Surprisingly, the doctrine did not mention how the Luftwaffe should directly support the Wehrmacht. The Condor Legion revealed a shortfall in tactical air doctrine the following year when it deployed to support Nationalist forces in the

[6] James Corum, *The Luftwaffe: Creating the Operational Air War, 1918–1940* (Lawrence: University Press of Kansas, 1997); Robert Citino, *The German Way of War* (Lawrence: University Press of Kansas, 2005); Williamson Murray, "German Army Doctrine 1918–1939, and the Post-1945 Theory of 'Blitzkrieg Strategy'" in Carol Fink, Isabel Hull, and MacGregor Knox, eds., *German Nationalism and the European Response, 1890–1945* (Norman: University of Oklahoma Press, 1985); Gerhard Gross, *The Myth and Reality of German Warfare: Operational Thinking from Moltke the Elder to Heusinger* (Lawrence: University Press of Kansas, 2016).

[7] James Corum and Richard Muller, *The Luftwaffe's Way of War: German Air Force Doctrine 1911–1945* (Baltimore, MD: Nautical and Aviation Publishing Company of America, 1998), 6–7.

[8] Corum and Muller, *The Luftwaffe's Way of War*, 9.

[9] Corum and Muller, *The Luftwaffe's Way of War*, 118–157.

[10] Strategic targeting also included power production. Corum and Muller, *The Luftwaffe's Way of War*, 133.

Spanish Civil War.[11] In combat, the Condor Legion cobbled together basic procedures for close air support (CAS). Later, the Luftwaffe continued to refine its techniques for supporting mobile ground forces in 1939 and 1940 with back-to-back blitzkrieg offensives against Poland, Denmark, Norway, Belgium, and France.

Conduct of Aerial Warfare presented the rationale for air superiority, strategic bombing, and interdiction but left unanswered why, how, or when its air force should directly attack an enemy's army. However, the Luftwaffe was not alone, as similar experiences befell the Soviets, British, and Americans.

The Soviet Air Force

In 1917, the Bolsheviks claimed the remnants of Russia's Imperial Air Force with its assortment of obsolete aircraft.[12] The Communists were determined to develop an air fleet to support its Red Army.[13] A strong military required an expanded industrial base, and the Soviet Union included aircraft factories in its five-year plans.[14] In 1922, to augment production, the Soviets secretly collaborated with the Germans, exchanging training facilities for technical assistance.[15] By 1928, the Soviet Union had established within the Red Army a professional air force, the VVS, which comprised 10 percent of its military.[16] With Joseph Stalin's continual support, the VVS established itself as a first-rate air power by the early 1930s.[17] The Soviet's penchant for building

[11] Williamson Murray, *The Luftwaffe: 1933–45: Strategy for Defeat* (London: Brassey's, 1996), 15.

[12] David Jones, "The Beginning of Russian Air Power, 1907–1922" in Robin Higham and Jacob Kipp, eds., *Soviet Aviation and Air Power* (Boulder, CO: Westview Press, 1977), 21; Von Hardesty, *Red Phoenix: The Rise of Soviet Air Power: 1941–1945* (Washington, DC: Smithsonian, 1982), 36, 41; Asher Lee, *The Soviet Air Force* (New York: John Day Company, 1962), 23; Kenneth Whiting, *Soviet Air Power* (Boulder, CO: Westview Press, 1986), 5.

[13] Hardesty, *Red Phoenix*, 42; Lee, *The Soviet Air Force*, 27.

[14] Neil Heyman, "NEP and the Industrialization to 1928" in Higham and Kipp, eds., *Soviet Aviation and Air Power*, 42–43; Hardesty, *Red Phoenix*, 43; Lee, *The Soviet Air Force*, 30–34.

[15] Kenneth Whiting, "Soviet Aviation and Air Power under Stalin, 1928–1941" in Higham and Kipp, eds., *Soviet Aviation and Air Power*, 49; Whiting, *Soviet Air Power*, 10; Alexander Boyd, *The Soviet Air Force since 1918* (New York: Stein & Day, 1977), 10, 23.

[16] Heyman, "NEP and the Industrialization to 1928," 48; Hardesty, *Red Phoenix*, 45; Whiting, *Soviet Air Power*, 12.

[17] Higham and Kipp, *Soviet Aviation and Air Power*, 4; Hardesty, *Red Phoenix*, 45; Ray Wagner, ed., and Leland Fetzer, trans., *The Soviet Air Force in World War II: The Official History, Originally Published by the Ministry of Defense of the USSR* (New York: Doubleday, 1973), 8.

enormous structures in part explains the VVS fielding by 1935 the world's largest bomber aircraft. In addition, Soviet fighters proved first-rate, with the Il-15 the standard combat aircraft flown by the Loyalists in the Spanish Civil War.[18]

However, a series of conflicts in the late 1930s revealed shortcomings with the VVS. By 1937, during the Spanish Civil War, the Soviet "volunteer" force was outclassed when the Germans outfitted their Condor Legion with the latest Bf-109 fighters and Ju-87 Stukas.[19] In addition, VVS bombers, which comprised 60 percent of the Soviet fleet, performed poorly in Spain.[20] In 1938, Soviet airmen fared better in confronting the Japanese in Manchuria.[21] However, in late 1939, during the Winter War, the VVS again struggled, meeting fierce resistance from Finnish airmen flying western aircraft.[22] Though the Soviets ultimately compelled Finland to accept a peace agreement, the VVS suffered heavily, including losing half its bombers.[23]

As the VVS grappled with foreign powers, it was simultaneously thwarted domestically by Stalin's purges.[24] The purges decimated the leadership ranks of the Red Army and VVS, leaving the Soviet Union vulnerable to invasion in June 1941.[25] Operation Barbarossa exposed severe weaknesses in Soviet military preparedness, organization, technology, and doctrine.[26] However, the Luftwaffe's extraordinary operational success, destroying three-quarters of the VVS in the first few days, did not translate into a political victory for Hitler.[27] Though the Soviets suffered enormous losses, they endured and regrouped in the east,

[18] Hardesty, *Red Phoenix*, 46; Whiting, "Soviet Aviation and Air Power under Stalin," 51.
[19] R. A. Mason and John Taylor, *Aircraft, Strategy and Operations in the Soviet Air Force* (Coulsdon: Jane's, 1986), 26; Hardesty, *Red Phoenix*, 50; Lee, *The Soviet Air Force*, 36, 42; Whiting, *Soviet Air Power*, 17; James Sterrett, *Soviet Air Force Theory, 1918–1945* (London: Routledge, 2007), 61.
[20] Whiting, *Soviet Air Power*, 15.
[21] Hardesty, *Red Phoenix*, 51; Whiting, "Soviet Aviation and Air Power under Stalin," 59–62; Whiting, *Soviet Air Power*, 18; Boyd, *The Soviet Air Force since 1918*, 86.
[22] Lee, *The Soviet Air Force*, 47; Whiting, *Soviet Air Power*, 20; Sterrett, *Soviet Air Force Theory*, 70.
[23] Hardesty, *Red Phoenix*, 52; Whiting, "Soviet Aviation and Air Power under Stalin," 65.
[24] Hardesty, *Red Phoenix*, 54; Lee, *The Soviet Air Force*, 39.
[25] Mason and Taylor, *Aircraft, Strategy and Operations in the Soviet Air Force*, 26; Whiting, "Soviet Aviation and Air Power under Stalin," 62–63; Boyd, *The Soviet Air Force since 1918*, 81.
[26] Whiting, *Soviet Air Power*, 24–25; Wagner, *The Soviet Air Force in World War II*, 9–10; Boyd, *The Soviet Air Force since 1918*, 50; John Greenwood, "The Great Patriotic War, 1941–1945" in Higham and Kipp, eds., *Soviet Aviation and Air Power*, 77.
[27] Hardesty, *Red Phoenix*, 61; Lee, *The Soviet Air Force*, 53–54; Boyd, *The Soviet Air Force since 1918*, 110–111; Sterrett, *Soviet Air Force Theory*, 86.

trading space for time. A key to Soviet resiliency proved to be the relocation of armament and aircraft factories east of the Urals.[28]

The Red Army and the VVS resisted the German advance where they could, but ultimately the expansive terrain and the brutality of the Russian winter ground the Wehrmacht to a halt short of Moscow in December 1941.[29] The following spring, the VVS's chief, Marshal Alexander Novikov, initiated a series of reforms.[30] Novikov exerted more centralized control and flexibility by reorganizing the VVS into air strike groups (*Udarnyye Aviatsionnyye Grouppy* or UAGs). Instead of being dispersed, the UAGs could now concentrate.[31] He kept an air corps in reserve to commit where and when needed.[32] Novikov also assigned air deputies to frontline army groups to improve the cooperation between air and ground commanders.[33] Improved radio communications further allowed the VVS to conduct coordinated combined arms offensives. Finally, Soviet mass production generated aircraft to compete with the Luftwaffe in both quantity and quality.[34]

In the winter of 1942–43, the VVS grew more aggressive.[35] When dedicated UAGs concentrated attacks at critical points, the VVS gained local air superiority and conducted preparatory strikes to support a combined arms breakthrough.[36] Once the Soviets breached the German lines, the VVS pursued retreating forces to prevent the reestablishment of the German defenses.[37] At the Battle of Stalingrad, the Red Army counterattacked with a pincer movement, which cut off the German 6th Army. The VVS then imposed an air blockade to prevent the Luftwaffe's aerial resupply effort.[38] At subsequent battles in the

[28] Lee, *The Soviet Air Force*, 54. By 1943, these plants were mass producing the next generation of Soviet fighters, attack, and medium bombers required for the deep battle, combined arms operations envisioned by Marshal Mikhail Tukhachevsky. Richard Simpkin, *Deep Battle: The Brainchild of Marshal Tukhachevsky* (London: Brassey's Defence Publishers, 1987); Hardesty, *Red Phoenix*, 58; Lee, *The Soviet Air Force*, 55.

[29] Hardesty, *Red Phoenix*, 74; Lee, *The Soviet Air Force*, 55; Whiting, *Soviet Air Power*, 27.

[30] Hardesty, *Red Phoenix*, 82; Sterrett, *Soviet Air Force Theory*, 100; Greenwood, "The Great Patriotic War," 88–89; Boyd, *The Soviet Air Force since 1918*, 141–145; Wagner, *The Soviet Air Force in World War II*, 89.

[31] Hardesty, *Red Phoenix*, 86.

[32] Sterrett, *Soviet Air Force Theory*, 101.

[33] Hardesty, *Red Phoenix*, 87, 118.

[34] This included the latest Yak fighters and the IL-2 *shturmovik* attack aircraft. Hardesty, *Red Phoenix*, 88–89; Lee, *The Soviet Air Force*, 56–57; Whiting, *Soviet Air Power*, 35–36.

[35] Hardesty, *Red Phoenix*, 91.

[36] Mason and Taylor, *Aircraft, Strategy and Operations in the Soviet Air Force*, 62.

[37] Hardesty, *Red Phoenix*, 106–107; Mason and Taylor, *Aircraft, Strategy and Operations in the Soviet Air Force*, 64.

[38] Hardesty, *Red Phoenix*, 118; Lee, *The Soviet Air Force*, 58–59; Boyd, *The Soviet Air Force since 1918*, 160–161; Wagner, *The Soviet Air Force in WWII*, 142–146.

spring and summer of 1943, at Kuban and Kursk, the VVS continued to refine its tactical air doctrine to concentrate air and ground forces in massive, combined arms offensives.[39]

Unlike the Germans, British, and Americans, the Soviets never seriously envisioned the independent employment of their air force. The realities of being a continental power with the threat posed by the German Wehrmacht motivated the Soviets to focus on a tactical air doctrine to support the Red Army. For the British and Americans, however, the advantage of geography and the stopping power of water (or beaches) provided these two maritime powers the luxury of being able to consider independent air operations. The crucible of battle in World War II would force both nations, as it had the Germans and the Soviet Union, to develop and adapt their tactical air doctrine.

The Royal Air Force

Unlike the Luftwaffe and VVS, which both acknowledged the need for joint operations, the RAF viewed air power as a substitute for ground forces and prioritized heavy bombers for strategic attack.[40] The closest the RAF had to a tactical air power theorist was J. C. Slessor. While on the Army Staff College faculty in the interwar period, Slessor lectured on and later published *Air Power and Armies*.[41] Like the Luftwaffe, Slessor articulated a theory of air power for the indirect attack of armies based on deep strikes on munition factories and interdicting enemy lines of communication. Neither approach required detailed coordination with the British Army, leaving the RAF free to develop its strategic bombing force. Not until the defeat of the British Army on the Continent, culminating in the evacuation at Dunkirk in May 1940, followed by a series of sobering battles in North Africa in 1941, did the RAF acknowledge the need for better air–land cooperation.[42]

[39] Hardesty, *Red Phoenix*, 121–180; Greenwood, "The Great Patriotic War," 97–104; Boyd, *The Soviet Air Force since 1918*, 176–177; Wagner, *The Soviet Air Force in World War II*, 162–163, 185–186; Sterrett, *Soviet Air Force Theory*, 111–117.

[40] Tami Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914–1945* (Princeton, NJ: Princeton University Press, 2002), 69–127; Philip Meilinger, "Trenchard, Slessor, and Royal Air Force Doctrine before World War II" in *The Paths of Heaven: The Evolution of Airpower Theory* (Maxwell AFB, AL: Air University Press, 1997), 40–60.

[41] J. C. Slessor, *Air Power and Armies* (Oxford: Oxford University Press, 1936); Meilinger, *The Paths of Heaven*, 61; Philip Meilinger, *Airwar: Theory and Practice* (London: Frank Cass, 2003), 64–74.

[42] Paul Johnston, "The Question of British Influence on U.S. Tactical Air Power in World War II" *Air Power History* 52:1 (Spring 2005), 19; H. Smyth, "From Coningham to

The Desert Air Force (DAF) commander, Air Marshal Arthur Tedder, tasked Vice Air Marshal Arthur "Mary" Coningham to improve air–land relations.[43] The key to cooperation began with a mutual understanding between army and air force commanders for what each service could contribute, along with a shared vision of how to integrate air and land forces.[44] Coningham relocated his headquarters next to the 8th Army headquarters to enhance cooperation, understanding, and trust. In September 1941, a series of conferences by the DAF and 8th Army resulted in an *Air Support Directive* that provided the foundation for successful British air–land cooperation for the remainder of the war.[45]

Not until a year later, at the Second Battle of El Alamein in September 1942, would the British finally field a mature air–ground system.[46] As with the Luftwaffe, the first objective for the DAF remained gaining air superiority. Air forces could then strike the enemy's lines of communication, as envisioned by Slessor, or provide direct support to ground forces.[47] Air support control measures included centralized command and control of all theater air assets, with the army's air requests prioritized at the joint headquarters. In addition, the new doctrine standardized attack profiles, set requirements for placement of the bomb line, and regulated air/ground communications and signals.[48] The DAF deployed a wireless communication system featuring a "tentacle"-like network with multiple forward air support links (FASL), which connected forward air controllers (FACs) to headquarters via radio. FASLs were assigned to army division headquarters to request air support and provide deconfliction and targeting guidance when aircraft arrived

Project Coningham-Keyes: Did British Forces Relearn Historical Air-Land Cooperation Lessons During Operation 'Telic'" *Defence Studies* (June 12, 2007), 261, 265.

[43] Arthur Tedder, *With Prejudice: The World War II Memoirs of Marshal of the Royal Air Force Lord Tedder, Deputy Supreme Commander of the Allied Expeditionary Force* (Boston, MA: Little, Brown & Co.,1966), 162.

[44] Smyth, "From Coningham to Project Coningham-Keyes," 265.

[45] The directive was later codified in March 1942 as Middle East (army and air) Training Pamphlet No. 3A, *Direct Air Support.* Richard Hallion, *Strike from the Sky: The History of Battlefield Air Attack, 1911–1945* (Washington, DC: Smithsonian, 1989), 4; Smyth, "From Coningham to Project Coningham-Keyes," 267; David Hall, *Learning How to Fight Together: The British Experience with Joint Air–Land Warfare* Research Paper 2009-2 (Maxwell AFB, AL: Air Force Research Institute, March 2009), 17.

[46] *The End of the Beginning: Bracknell Paper No. 3 A Symposium on the Land/Air Cooperation in the Mediterranean War 1940–43* (Bracknell: RAF Staff College, 1992), 21.

[47] Smyth, "From Coningham to Project Coningham-Keyes," 271.

[48] The bomb line was known as the bomb safety line and is now known as the fire support coordination line (FSCL). It was usually a physical feature of geography easily identifiable from the air and ground. It is a deconfliction measure to reduce fratricide and coordinate fire. Smyth, "From Coningham to Project Coningham-Keyes," 267.

overhead.[49] In addition, reconnaissance aircraft began to function as rudimentary airborne FACs, and air liaison officers (ALOs) provided additional advice and support for intermediate-level army commands.[50] The British tactical air doctrine was prescriptive, however, telling airmen and soldiers how to coordinate their forces but not explaining the reasoning for why or how a combined arms approach could be effective.

The RAF developed a purpose-designed air support aircraft, a modified Hawker Hurricane, assigned to directly attack enemy fielded forces.[51] "Hurribomber" pilots developed dive-bombing techniques to increase the accuracy of their 250-pound bombs, a tactic like that employed by the Luftwaffe's Ju 87 Stuka dive bombers.[52] The British pushed westward with a functioning air-support system, reaching Tunisia by February 1943. They were joined in North Africa by the United States. As with the British experience, the Americans would have to learn critical lessons for air–ground cooperation the hard way.

The United States Army Air Forces

Unlike the Luftwaffe and RAF, the American air forces, like the VVS, were not independent. In anticipation of the coming war and the importance air power would play in the conflict, in June 1941 the US Army Air Corps was elevated in status to the US Army Air Forces (USAAF). Still, army generals governed the USAAF. When war came, the US Army quickly updated its doctrine on air–ground cooperation in Field Manual 31-35, *Aviation in Support of Ground Forces*, published in April 1942.[53] On the surface, the regulation looked like the British *Direct Air Support* doctrine with two caveats. First, the air commander advised the ground commander, with no hint of the coequal status enjoyed by the RAF. Second, the regulation allowed air units to be directly assigned to ground units, an option exercised by General Dwight D. Eisenhower, the commanding officer of Operation Torch, the invasion of French North

[49] John Terraine, *The Right of the Line: The Role of the RAF in World War II* (Barnsley: Pen & Sword Aviation, 1985), 348; Roderic Owen, *The Desert Air Force* (London: Hutchinson & Co., 1948), 64.
[50] Shelford Bidwell and Dominick Graham, *Fire-Power: British Army Weapons and Theories of War 1904–1945* (London: George Allen & Unwin, 1982), 271; Smyth, "From Coningham to Project Coningham-Keyes," 268.
[51] Hall, *Learning How to Fight Together*, 16.
[52] Smyth, "From Coningham to Project Coningham-Keyes," 269.
[53] War Department FM 31-35 *Basic Field Manual Aviation in Support of Ground Forces*, April 9, 1942 (Washington, DC: General Printing Officer, 1942).

Africa.[54] By December 1942, however, RAF Air Marshal Tedder had convinced Eisenhower of the error in dispersing the American air forces and the necessity to reorganize Allied Forces in North Africa, a decision ratified at the Casablanca Conference in January 1943. Unfortunately, Eisenhower was still restructuring his forces when, in February, the defeat of the US Army's II Corps by Rommel's Afrika Corps in western Tunisia revealed the disadvantage of dispersed air forces.[55] The American humiliation at Kasserine Pass highlighted the need for updating US tactical air doctrine. All air forces in theater must be under the command of a single airman, with priority given to first gaining air superiority. With the freedom to operate obtained, air power's inherent flexibility would allow air forces to be allocated where they were most needed. In July 1943, a new US field manual, FM 100-20 *Command and Employment of Air Power*, reflected these fundamental principles for the employment of tactical air forces.[56]

Uppercase letters in the first bullet on the first page of FM 100-20 declared, "LAND POWER AND AIR POWER ARE COEQUAL AND INTERDEPENDENT FORCES; NEITHER IS AN AUXILIARY OF THE OTHER." The second bullet further emphasized that "THE GAINING OF AIR SUPERIORITY IS THE FIRST REQUIREMENT FOR THE SUCCESS OF ANY MAJOR LAND OPERATION."[57] The remainder of the fourteen-page document explained that, because of its inherent flexibility, air forces should be under the control of a theater air commander, subordinate only to the overall joint force commander. Importantly, FM 100-20 also provided targeting priority for tactical air forces.[58] First, the emphasis would be to gain air superiority by destroying hostile air forces and attacking their bases. The second priority would be the interdiction of the enemy's lines of communication to prevent the movement of troops and supplies into and within the theater. The last priority would be CAS, as such efforts were complex, required detailed coordination to avoid fratricide, and targets were dispersed and therefore less lucrative.[59] A combination of factors contributed to CAS's tertiary consideration. It had become

[54] Eduard Mark, *Aerial Interdiction: Air Power and the Land Battle in Three American Wars* (Washington, DC: Center for Air Force History, 1994), 30.
[55] Richard Hallion, *Strike from the Sky: The History of Battlefield Air Attack, 1911–1945* (Washington, DC: Smithsonian, 1989), 171.
[56] *War Department Field Manual FM 100-20: Command and Employment of Air Power* July 21, 1943 (Washington, DC: Government Printing Office, 1943).
[57] *FM 100-20*, 1.
[58] Michael Doubler, *Closing with the Enemy: How GIs Fought the War in Europe, 1944–1945* (Lawrence, KS: University Press of Kansas, 1994), 64.
[59] FM 100-20, 2, 8, 10, 11.

evident that it was too difficult to conduct combined arms operations without air superiority. The USAAF also had not yet developed effective CAS procedures. And finally, airmen anticipated artillery would be more effective, efficient, and available to engage the enemy's fielded forces near the battlefront.

FM 100-20 became the baseline for air–land cooperation between US air forces and armies. Operations in Sicily in 1943 and later the static fighting in Italy through 1944 allowed for further maturation of the US tactical air doctrine. The first element was the genuine cooperation required between air and army commanders and their staffs. Air liaisons assigned at intermediate levels of army command assisted in collaboration and coordination. The second element was a responsive tactical air request network and efficient command-and-control system for tactical airstrikes with standardized preplanned and on-call missions. Improvements included more effective forward air controllers, such as the rover system, first used by the British, which deployed experienced combat pilots alongside soldiers on the front lines with radios to communicate directly with assigned strike aircraft.[60] Enhancements also included airborne forward air controllers (AFAC), where an army advisor flew alongside a pilot in an L-5 observation aircraft.[61] By the time of the invasion of France in June 1944, the United States had in place the template for air–ground coordination that would persist throughout and after the war.[62]

Meanwhile, the US Navy and US Marine Corps (USMC) developed a tactical air control system for amphibious operations in the Pacific. Their approach was like that employed in Europe in that air commanders controlled their air forces and gave air superiority primary consideration. However, the Navy–Marine Corps doctrine viewed CAS and interdiction, called DAS (direct or deep air support) against fixed targets that did not require direct control, as equally important.[63] Emphasis on direct attack was partly due to the Marines not having as much artillery as the

[60] Doubler, *Closing with the Enemy*, 69.

[61] Alan Wilt, "Allied Cooperation in Sicily and Italy 1943–45" in Benjamin Cooling, ed., *Case Studies in the Development of Close Air Support* (Washington, DC: Office of Air Force History, 1990), 208, 209, 213, 217, 226; Doubler, *Closing with the Enemy*, 65.

[62] It would still take the crucible of combat in Europe to perfect the procedures for the implementation of effective direct attack. Doubler, *Closing with the Enemy*, 63–86; Allan Millet, "Korea, 1950–1953" in Cooling, ed., *Case Studies in the Development of Close Air Support*, 347–348; Thomas Hughes, *Overlord: General Pete Quesada and the Triumph of Tactical Air Power in World War II* (New York: Free Press,1995), 128, 129.

[63] Peter Davies, *Marine Corps F-4 Phantom II Units of the Vietnam War* (Long Island City, NY: Osprey, 2012), 26.

Army.[64] The Navy–Marine Corps system focused on speed by delegating responsibility for prioritizing air requests to Marine aviators assigned to tactical air control parties (TACP) in frontline units. These experienced airmen further served as ground FACs. The Navy–Marine Corps maintained their air–ground coordination system after the war, while the Army–Air Force system suffered from neglect.[65]

The US Air Force (USAF) gained its independence in 1947, but its leaders still promised to support the Army as it had in World War II. By September 1950, the Army and Air Force had developed FM 31-35 *Joint Training Directive for Air–Ground Operations.*[66] The instruction recognized three tactical air power missions: air superiority, interdiction, and close air support. Significantly, the doctrine differentiated two types of interdiction missions. Bombers and tactical aircraft would cut off enemy lines of communication by attacking fixed targets, including roads, bridges, railroads, and waterways, or by attacking concentrated troops along with their equipment and supplies.[67] This disruption of the enemy's lines of communication would later become known as air interdiction. In addition, tacair on armed recce (reconnaissance) missions would search for and engage suitable targets in designated areas beyond the bomb line. The direct attack of fielded forces short of the bomb line but beyond the range of CAS was not yet recognized – it would later be called battlefield interdiction. While the Air Force retained this doctrine for air–ground operations, it failed to maintain the requisite personnel, equipment, or training of the air–ground operation system (AGOS) to execute direct attack missions when war came to Korea.[68]

When North Korean troops marched south of the 38th parallel in June 1950, neither the US Army nor the Air Force had prepared for combined arms operations.[69] The Air Force had transitioned to jet aircraft, which flew from bases in Japan. US fighters quickly gained air superiority over the Korean peninsula, but the jets had limited loiter time. USAF tacair pilots struggled to conduct CAS or armed recce due to reduced time on station, increased airspeeds of jet aircraft, and

[64] Robert Futrell, *The United States Air Force in Korea* (Washington, DC: Office of Air Force History, 1983), 705.
[65] Millet, "Korea, 1950–1953," 352.
[66] Terrance McCaffrey, *What Happened to Battlefield Air Interdiction? Army and Air Force Battlefield Doctrine Development from Pre-Desert Storm to 2001* (Maxwell AFB, AL: Air University Press, 2004), 13.
[67] McCaffrey, *What Happened to Battlefield Air Interdiction?*, 13.
[68] Millet, "Korea, 1950–1953," 349.
[69] Millet, "Korea, 1950–1953," 363; Conrad Crane, *American Airpower Strategy in Korea 1950–53* (Lawrence: University Press of Kansas, 2000), 30.

minimal prior air-to-ground training. Tacair compensated by relying on airborne FACs, which controlled 90 percent of all Air Force direct attack missions. Most of these strikes fell well beyond the location of friendly forces and therefore did not require the detailed coordination and deconfliction of CAS. Though recorded as CAS missions at the time, they are better characterized as armed recce.[70]

By contrast, Navy and Marine Corps aviation operated prop-driven aircraft from carriers offshore.[71] These dedicated air assets could quickly respond to requests by ground FACs that controlled close strikes in front of Marine ground forces.[72] The lack of responsiveness of the Army–Air Force air–ground system drew criticism compared to the Navy–Marine Corps. However, reproach did not alter the USAF prioritization of air superiority, strategic bombing, air interdiction, and, only as a last resort, the direct attack of fielded forces.[73]

After the Korean War, USAF air–ground doctrine was revised in 1954 and again in 1957, recognizing that armed recce could also be conducted short of the bomb line but beyond the range of CAS.[74] At the beginning of the Vietnam War, in 1964, *Tactical Air Command Manual* (TACM) 1-1 finally acknowledged in Air Force doctrine that armed recce missions against enemy fielded forces required coordination with ground commanders. TACM 1-1 referred to these armed recce missions as battlefield interdiction. Unfortunately, two years later, in the midst of combined arms operations in South Vietnam, the USAF revised TACM 1-1, removing any reference to battlefield interdiction.[75]

During the Vietnam War, it would be armed recce, missions tasked with locating and attacking fielded forces beyond the frontlines, that would be the primary means by which US air forces directly attacked the North Vietnamese Army and Viet Cong (NVA/VC). CAS occurred less frequently than armed recce, as there were fewer opportunities to attack enemy forces close to friendlies. The lopsided ratio of armed recce to CAS missions is not unique to Vietnam, as this has been the norm for modern air warfare.

Interestingly, the reverse has been the case for counterinsurgency operations, where CAS has proven essential when friendly forces

[70] Millet, "Korea, 1950–1953," 364–365; Futrell, *The United States Air Force in Korea*, 705.
[71] Davies, *Marine Corps F-4 Phantom II Units of the Vietnam War*, 26.
[72] Millet, "Korea, 1950–1953," 367; Crane, *American Airpower Strategy in Korea*, 29.
[73] Millet, "Korea, 1950–1953," 397; Futrell, *The United States Air Force in Korea*, 706.
[74] AFMAN 1-7 *Theater Air Forces in Counterair, Interdiction and Close Air Support* March 1, 1954 (Washington, DC: Department of the Air Force, 1954); *Tactical Air Command Manual* (TACM) 55-3; McCaffrey, *What Happened to Battlefield Air Interdiction?*, 14.
[75] McCaffrey, *What Happened to Battlefield Air Interdiction?*, 15–16.

disperse to occupy territory. Under these conditions, troops often do not have the organic firepower to react to insurgent attacks. Also, during counterinsurgencies, tactical aircrew on armed recce missions have found it challenging to differentiate insurgents from civilians and friendly forces. In counterinsurgent operations ground tactical air controllers are crucial for employing CAS while minimizing collateral damage and the risk of fratricide.[76]

Returning to modern mechanized warfare, it would not be until the late 1970s that cooperation between the US Army and Air Force improved. Their joint effort to bolster conventional deterrence in Europe resulted in the Army's AirLand Battle doctrine and NATO's Follow-On Force Attack. In both doctrines, tacair played a critical role in gaining air superiority and conducting armed recce. The Air Force named the armed recce mission as battlefield air interdiction (BAI). BAI would halt the Soviet Army's Operational Maneuver Groups (OMGs). Held in reserve, the OMGs were designed to exploit breakthroughs in the battle lines.[77]

BAI would remain a USAF tacair mission until 1991 during Desert Storm, when Lieutenant General Chuck Horner, the air commander of the coalition forces in the Middle East, omitted BAI missions from the air tasking order (ATO). By doing so, Horner excluded Army commanders from the target prioritization process by not apportioning CAS sorties until the start of the ground campaign. When the ground war began, Horner did not assign any BAI missions but instead substituted a push CAS system, like the British Cabrank procedures employed in the Mediterranean theater in World War II.[78] Upon check-in with their assigned FACs, if there were no available CAS targets, as was common, tacair would then flow to preplanned interdiction targets or predesignated armed recce areas. Ground commanders had the advantage of having readily available CAS, but without BAI they no longer had a say in the priority of targets for the deeper battle. After Desert Storm, Air Force leaders struck BAI from doctrine just as they had removed battlefield interdiction during the Vietnam War. As a result, Army commanders could no longer interfere with prioritizing targets beyond the front.[79]

[76] The author commanded an A-10 squadron in Afghanistan in 2004, which was responsible for providing CAS to support friendly ground forces conducting counterinsurgent operations.
[77] Phil Haun, "Peacetime Military Innovation through Inter Service Cooperation" *Journal of Strategic Studies* 43:5 (2020), 10.
[78] Wilt, "Allied Cooperation in Sicily and Italy," 209.
[79] United States Air Force, *Air Force Doctrine Document* (September 1, 1997).

Today, there remains no doctrinal distinction in USAF doctrine between interdiction missions that directly target fielded forces beyond the forward line of own troops (FLOT) and missions that target the enemy's lines of communication by striking fixed targets, such as roads, bridges, and railways. Armed recce, which has always been the most systematic way tacair has directly targeted fielded forces, is no longer identified as a specified mission in USAF doctrine.[80] The result has been neglect in acquiring aircraft, sensors, and specially designed weapons for armed recce. There has also been inattention to improving tactics, techniques, and procedures (TTP) and insufficient training for this crucial mission.

By contrast, the Marine Corps maintains the armed recce mission. Marine Corps aviation doctrine separates close air support and deep air support.[81] CAS missions "are in close proximity to friendly forces. CAS requires detailed integration of each air mission with the fire and movement of friendly forces." DAS does not require such detailed coordination. DAS is flown on either side of the fire support coordination line (FSCL), formerly the bomb line. DAS further divides air interdiction and armed recce. Air interdiction "destroys, neutralizes, or delays the enemy military potential before it can be brought to bear effectively against friendly forces." While air interdiction is against known targets, armed recce requires aircrew to locate targets of opportunity, attacking enemy materiel, personnel, or facilities in assigned areas on either side of the FSCL.[82]

The tactical air doctrine of the Luftwaffe, VVS, RAF, USAF, and USMC informed airmen, soldiers, sailors, and marines how to organize and employ their air and land forces in combined arms operations. However, the doctrines did not, and still do not, explain how and why air power can be effectively employed against enemy armies. The next section introduces tactical air power theory to provide these explanations. The most common way US air forces fight modern conventional wars is by directly attacking fielded forces by armed recce, not CAS. That the USAF does not recognize armed recce or BAI as a separate mission from air interdiction is indicative of the view long held by advocates of an

[80] United States Air Force, *Counterland Operations* AFDP 3-03 (2020), www.doctrine.af.mil/Portals/61/documents/AFDP_3-03/3-03-AFDP-COUNTERLAND.pdf, 6.

[81] Jack Shulimson and Charles Johnson, *U.S. Marines in Vietnam: The Landing and the Buildup 1965* (Washington, DC: History and Museums Division Headquarters Marine Corps, 1978), 154; US Marine Corps, *Aviation Operations MCWP 3-2* (Washington, DC: HQ USMC, 2000), 1–2.

[82] US Marine Corps, *Aviation Operations MCWP 3-20* (Washington, DC: Marine Corps Headquarters, 2018), 2-1–2-2.

independent air force that air power is better considered as a substitute for land power rather than a complement.[83]

Tactical Air Power (TAP) Theory

When fighting an army, an air force has two options: attack its fielded forces or interdict its lines of communication, operation, and retreat. As demonstrated in the following chapters, direct attack has proven more effective.[84] Yet the few air power theorists who recommend targeting militaries instead advocate an indirect approach.[85] While theoretically appealing, in practice air power alone is usually not effective in interdicting an enemy's lines of communication or disrupting its lines of operation.[86] Figure 2.1 uses the Clausewitzian triangle to model the state as consisting of its population, military, and government (see Appendix A).[87] The arrows in Figure 2.1 illustrate the theory of victory for direct attack where sufficient pressure is placed on the military to change the political calculations of the targeted nation's leaders.

A military's ability to mass and maneuver is essential; it is so fundamental that mass and maneuver are principles of war.[88] Clausewitz maintained that the primary operational objective of an army was to concentrate at the decisive point.[89] However, the challenge facing

[83] Phil Haun, "Foundation Bias: The Impact of the Air Corps Tactical School on United States Air Force Doctrine" *Journal of Military History* 85:2 (2021), 453–474.

[84] From Table 1.1, direct attack campaigns succeeded militarily 73 percent of the time (eight of eleven) and politically 45 percent (five of eleven). In comparison, air interdiction succeeded militarily only 17 percent of the time (one of six) and politically never (none of six), and strategic bombing campaigns succeeded politically 33 percent (two of six).

[85] Slessor, *Airpower and Armies*. Robert Pape also argues that interdiction is contingent on the type of enemy army, with interdiction against conventional mechanized forces being effective. Pape, *Bombing to Win*, 74.

[86] Air interdiction of sea lines of communication may have better results, as the US Navy and Coast Guard achieved off the Vietnamese coast in Operation Market Time. Alex Larzelere, *The Coast Guard at War, Vietnam 1965–1975* (Annapolis, MD: Naval Institute Press, 1997). The enemy develops alternative LOC and works to reopen its primary LOC quickly. In addition, armies can neutralize the impact of attacks on their LOC by stockpiling supplies. Also, when on the offensive an attacker gets to decide when to strike and only does so when its LOC are secured. By contrast, defending armies do not extend their LOC, expend overall less energy than on attack, and consume fewer supplies. Richard Hallion, "Battlefield Air Support: A Retrospective Assessment" *Airpower Journal* (Spring 1990), 11–12; Phil Haun and Colin Jackson, "Breaker of Armies: Air Power in the Easter Offensive and the Myth of Linebacker I and II in the Vietnam War" *International Security* (Winter 2015/16), 139–178.

[87] Clausewitz, *On War*, 89.

[88] US Joint Doctrine Pub 1 (July 12, 2017), I-3, https://irp.fas.org/doddir/dod/jp1.pdf.

[89] Clausewitz, *On War*, 204.

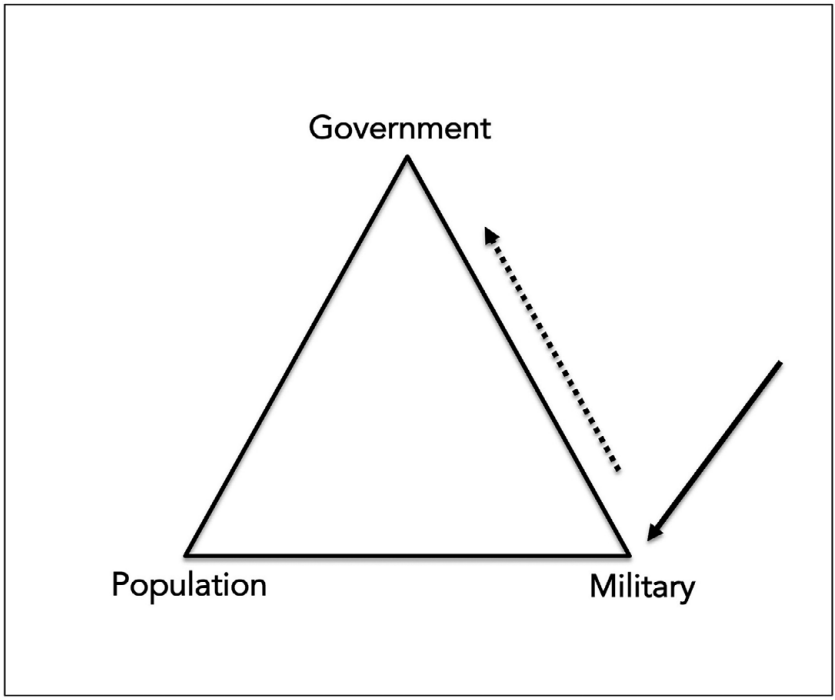

Figure 2.1 Targeting the military

modern ground forces is how to mass, maneuver, and *survive*, given the marked rise in the lethality of weaponry. In *Military Power: Explaining Victory and Defeat in Modern Battle*, Stephen Biddle highlights that "by 1914, firepower had become so lethal that exposed mass movement in the open had become suicidal. Subsequent technological change has only increased the range over which exposure can be fatal."[90] Biddle explains that armies can only reduce their vulnerability by utilizing what he terms the *modern system*. This technique is "a tightly interrelated complex of cover, concealment, dispersion, suppression, small-unit independent maneuver, and combined arms at the tactical level, and depth, reserves, and differential concentration at the operational level."[91]

The risk/reward tradeoff in a contested environment is between survivability and lethality. Concentrating and closing with the enemy

[90] Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, NJ: Princeton University Press, 2004), 3.
[91] Biddle, *Military Power*, 3.

https://doi.org/10.1017/9781009364201.003 Published online by Cambridge University Press

improves the ability to locate, identify, and attack, but it may provide an even better opportunity for the defender to do the same. Focusing solely on offensive capability while leaving oneself vulnerable to attack has proven to be a recipe for disaster, as the NVA discovered at Khe Sanh (see Chapter 4). The same can also be true for air forces, as evidenced by the defeat of American bombers at the hands of Luftwaffe fighters in 1943.[92] While Biddle's modern system may be a solution for a mechanized army's survival on the battlefield, for air forces the pressing challenge is to gain and maintain sufficient air superiority to conduct air-to-ground operations with acceptable losses.[93]

With air superiority secured, the lethality of an air force resides in its asymmetric advantage of observing ground forces when they mass or maneuver. Though Clausewitz lived before the invention of the airplane, in *On War* he discussed the benefits of commanding the heights, where a characteristic relevant to air power is having a *wider view*.[94] Observing the battlefield from above reduces the vertical surface obstructions, which restrict the horizontal line of sight for ground forces. From above, air forces can locate and destroy massed armies in the open and on the move.

Even with the advantage of a *wider view*, most tacair operate at high speeds and high altitude, making it difficult to identify small targets, such as a tank in a tree line or well-camouflaged guerrillas. By contrast, a large, mechanized ground unit struggles to conceal its position, leaving it vulnerable to detection from above. Massed units have fewer places to hide and emit more visual, infrared, and electromagnetic cues to be identified and tracked. In addition to being easier to find, massed formations provide an opportunity for multiple airstrikes, increasing the efficiency of a single sortie.

Movement, like mass, also exposes ground forces. The contrast of a vehicle in motion against a static background attracts the eye's attention or that of a radar's moving target indicator.[95] Though dynamic targets have historically been harder to hit than fixed targets, airmen have

[92] Phil Haun, *Lectures of the Air Corps Tactical School and American Strategic Bombing in World War II* (Lexington: University Press of Kentucky, 2019), 204.

[93] Acceptable attrition is determined not by the number of airstrikes required to achieve the military objective but by the losses accrued weighed against the political value of the objective. For non-vital national objectives, the value of the object may be so low that the survivability of aircrew may outweigh the value of any airstrike.

[94] Clausewitz witnessed one of the earliest attempts to employ air forces when, in 1795 as a teen, he saw the French deploy tethered balloons to observe the enemy's positions and movement at the siege of Mainz. Clausewitz, *On War*, 352–354.

[95] Moving target indicators utilize doppler radar to distinguish moving targets from the static background.

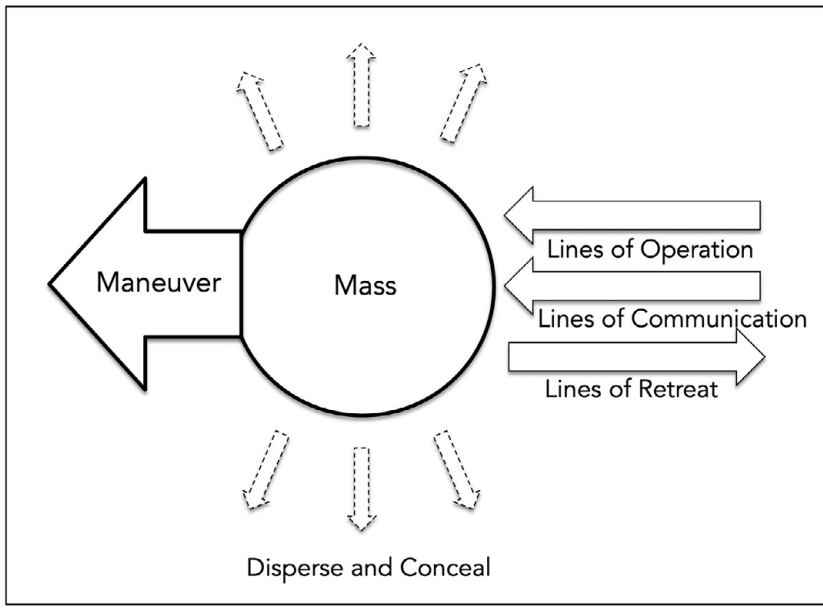

Figure 2.2 When armies are vulnerable to air attack

adapted their tactics and weaponry to be lethal against movers as well.[96] Armies that both mass and maneuver are particularly at risk, as the NVA discovered at the battles of An Loc and Kontum during the Easter Offensive (see Chapter 7).

Figure 2.2 illustrates the conditions when ground forces are most susceptible to air attack and the measures taken to reduce vulnerability. The large circle represents massed forces. Again, massed armies are more likely to be identified from the air, and their concentration increases the lethality of air attacks. The large arrow left of the circle represents concentrated forces on the move. These forces have the double disadvantage of being large and dynamic, making them easier to observe.

The three parallel arrows right of the circle represent an army's lines of operation, lines of communication, and lines of retreat. Lines of operation are how an army gets to the battlefield, the initial deployment of

[96] Tacair utilizes precision-guided weapons to engage moving targets such as the fire-and-forget Maverick air-to-surface missile. Recently A-10 aircraft have employed laser-guided rockets against ISIS. Kris Osborn, "America's A-10 Warthogs Need More Laser-Guided Rockets against ISIS" *The National Interest*, nationalinterest.org/blog/the-buzz/americas-10-warthogs-need-more-laser-guided-rockets-attack-21147.

https://doi.org/10.1017/9781009364201.003 Published online by Cambridge University Press

forces, and subsequent reinforcements. Likewise, the LOC, with the inflow of ammunition and supplies, are vital for continued operations, especially for mechanized units. As such, LOC have long been a target for air interdiction. Finally, an army in retreat is exposed, particularly in a hasty withdrawal. Though these lines of communication, operation, and retreat are, in theory, vulnerable to attack, they have proven less so in practice than when armies mass and maneuver on the battlefield. For example, the North Vietnamese usually kept the Ho Chi Minh Trail sufficiently open to supply operations in South Vietnam. US air forces were even less effective in interdicting the NVA's line of operation as troops continuously marched southward throughout the war (see Chapter 6).

In contrast to the circle and horizontal arrows represented in Figure 2.2, where the larger size denotes when armies are most vulnerable, the smaller dashed arrows radiating from the circle indicate an army's reaction when threatened. When able, troops disperse and conceal their positions to reduce detection and lessen the impact of airstrikes. Air power alone rarely defeats armies because of their ability to scatter and hide. Chapters 4 and 7 examine two rare cases where the NVA chose instead to concentrate and maneuver. As part of combined arms operations, US air power destroyed two North Vietnamese divisions during the Battle of Khe Sanh and again defeated fourteen NVA divisions in the Easter Offensive. In both cases, the North Vietnamese sacrificed their armies in an attempt to achieve broader political goals.

Under the lethal threat from airstrikes, most army commanders will not expose their forces but instead order their troops to disperse and hide. They find concealment under ground cover, dig defensive positions for protection, and move only at night and in bad weather to avoid detection. However, such defensive reactions come at a price. Air power overhead prevents an army from massing to conduct offensive operations and leaves it dispersed and vulnerable to an opposed ground force attack. Though not intuitive, air power's most significant impact against an enemy's fielded forces is usually not measured by the number of soldiers killed or tanks destroyed but by how the threat of airstrikes disrupts the enemy's strategy. An example of air power deterring ground forces from concentrating and maneuvering occurred during the lead-up to the invasion of Iraq in 2003. Anticipating an air-only operation, Iraq dispersed its forces. Such action may have diminished the direct impact of airstrikes, but it left Iraq vulnerable to the subsequent US ground invasion.

Unfortunately, instead of evaluating the effect air power has had on the enemy's overall strategy, military analysts have often focused on

measuring the attrition of enemy ground forces.[97] Such an approach – examining the battlefield to determine what weapons destroyed which tanks – may be necessary for the tactical analysis of the lethality of specific munitions. However, it is not a measure of the overall operational effectiveness of air power and misses the broader point. It is usually not how many targets have been destroyed that determines the outcome but how the threat of further attack impacts enemy decision-making and subsequent action or inaction. The dead make no decisions and take no actions on the battlefield. Instead, it is the threat of death that deters and coerces. When effective, air forces strike few targets as the enemy anticipates such losses and reacts by dispersing and concealing to survive. Doing so may decrease the enemy army's vulnerability to air attack but diminishes its ability to execute its preferred strategy and, as previously mentioned, leaves it vulnerable to a ground attack.

As demonstrated in the following chapters, air power's most significant impact is what does not occur on the battlefield – the dogs that do not bark. This includes enemy air strikes that do not happen, enemy reserves that do not make it to the battlefield because they have been harassed and delayed along the way, and enemy forces that disperse instead of massing and maneuvering. The most significant impact of air power in warfare has often been neglected and misunderstood because of its unobserved effects, those actions that do not take place but would have had air power not been present. In addition, there has been little incentive for Army generals to highlight air power's vital role in their battlefield victories. Nor have Air Force generals, predisposed to prefer air power to be employed independently, advocated for what they perceive as a supporting role. There has also been little interest by military analysts or historians to analyze and write about military operations that have not taken place. Clausewitz, however, cautions against such omissions when he warns that the outcomes of possible engagements must be regarded as real because of their consequences.[98]

While explaining how and why air power works against ground forces, TAP theory does not predict that air forces will always be effective. Contextual variables, discussed in detail in Chapter 8, significantly impact the effectiveness of air power in specific conflicts. Operational factors of air superiority, air-to-ground capabilities, friendly and enemy ground force capabilities, along with environmental factors of weather,

[97] For an example of an analyst basing air power effectiveness on enemy attrition, see Kenneth Pollack, "Air Power in the Six-Day War" *Journal of Strategic Studies* 28:3 (2005), 471–503.

[98] Clausewitz, *On War*, 181.

lighting, geography and terrain, civilians, and cover and concealment work to enhance or limit the ability of air power to deter an army from executing its preferred strategy.

Conclusion

This chapter introduced a theory of tactical air power. As Chapters 3–7 will demonstrate, in the Vietnam War strategic bombing and air interdiction largely failed. Instead, air power proved more effective in directly attacking fielded forces as part of combined arms operations. Air power proved most lethal against ground forces when the enemy massed and maneuvered. As a result, armies usually dispersed and hid when threatened from above. Rather than attrit an enemy force, air power instead deterred armies from concentrating and maneuvering, denying the enemy two principles of war necessary to achieve battlefield victory or avoid defeat.