DESERT STORM:
WAR, TIME, AND SUBSTITUTION REVISITED

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The military student does not seek to learn from history the minutiae of method and technique. In every age these are decisively influenced by the characteristics of weapons currently available and by means at hand for maneuvering, supplying and controlling combat forces. But research does bring to light those fundamental principles, and their combinations and applications, which, in the past have been productive of success. These principles know no limitation of time.

Gen Douglas MacArthur

IN MY BOOK *The Air War in Southeast Asia: Case Studies of Selected Campaigns*, the final chapter, entitled "On War, Time, and the Principle of Substitution," is devoted to a discussion of the powerful roles that time and substitution play in the art of warfare.[1] Traditionally, nations under attack—given sufficient time—effect both product and factor substitution to a degree that in large measure attenuates the economic impact of military strikes against their industrial and logistics sectors. The chapter cites examples of this phenomenon from World War II, the Korean conflict, and the protracted war in Southeast Asia.

The above analysis calls for a return to the concept of blitzkrieg. The greatest successes of both air and ground forces in modern times came in short, intense combined-arms campaigns: the German blitzkriegs of World War II, the Normandy invasion, and the Six-Day War in the Mideast, to name a few. These successes suggest that military doctrine should be structured so that airpower is used in conjunction with other forces in fast and dramatic moves that give no opportunity for the principle of substitution to come into play.

It certainly appears that the experience in Operation Desert Storm was consistent with that hypothesis. Without a doubt, the coalition succeeded in rapidly crushing Iraq's military forces in Kuwait and southern Iraq, and airpower was a decisive factor in this success. The entire campaign lasted only 43 days and required only 100 hours of ground warfare to rout Iraqi forces completely. The campaign thus stands as an embodiment of the philosophy advocated in my chapter "On War, Time, and the Principle of Substitution."

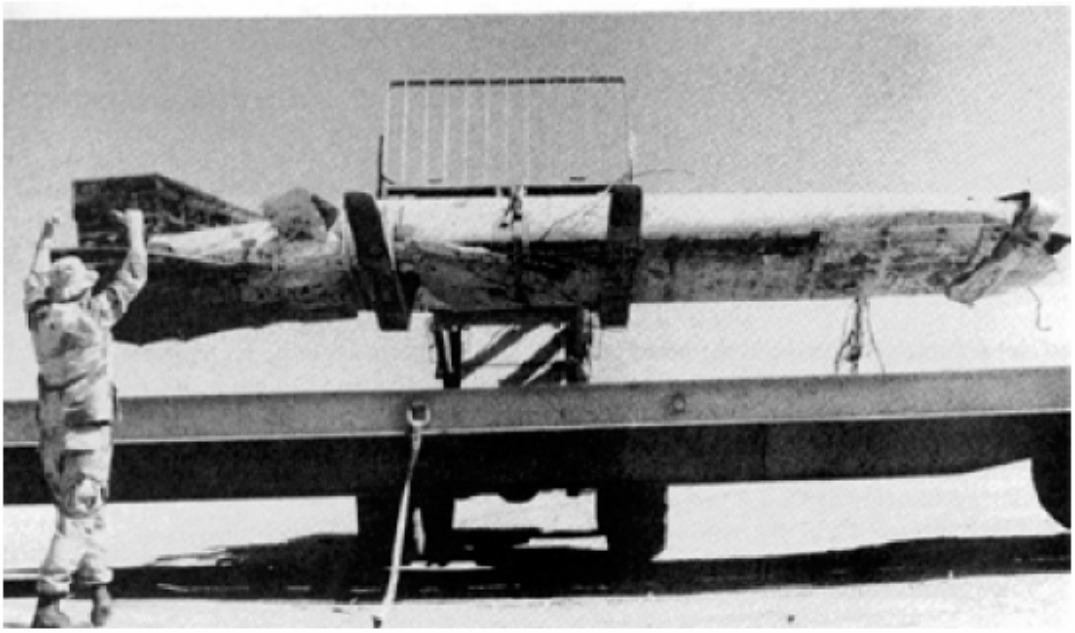
Although coalition air forces performed brilliantly, it later became apparent that we had not completely overcome the limitations of airpower revealed in past wars. The purpose of this article is to update our experience with substitution and outline which phenomena of past wars continued to play a moderating role during Desert Storm.

Since I viewed this war from afar—not firsthand, as in Southeast Asia—I had to rely on other sources for data and discussions about the effectiveness of airpower. A primary source was the *Gulf War Air Power Survey (GWAPS)*, commissioned by the secretary of the Air Force and directed by Prof Eliot Cohen of Johns Hopkins University.[2] This five-volume study, produced by a team of civilian and military analysts, is probably the most comprehensive evaluation to date of airpower in the Gulf War. I gleaned additional detail from *Crusade: The Untold Story of the Persian Gulf War* by Rick Atkinson,[3] whose interviews with some 500 participants of the war provide additional insight into aerial effectiveness and the interaction between the military services and their commanders.

Course of the Air Campaign

Desert Storm began on 16 January 1991 after a buildup of coalition forces over the preceding five months.[4] During the first two days, some of these forces executed the most thoroughly planned and complex air operations of the war. They struck virtually all target sets but directed their heaviest effort against air defenses, airfields, and command elements of the Iraqi regime. Air strikes also hit Iraq's electric power system and its nuclear, biological, and chemical (NBC) capability. Attacks against oil facilities, railroads, and bridges followed, as did an increasing number of strikes in the Kuwaiti theater of operations (KTO) to prepare the battlefield.

Two significant deviations occurred in the planned execution of the air campaign. The first began on the third day of the war, when Iraq launched Scud missiles at Israel. As a result of the political significance of the strikes against Israel, the coalition began intense operations to find, destroy, or suppress the mobile missile launchers. This effort continued throughout the war. The second redirection involved the destruction of Iraqi aircraft shelters in which the Iraqi air force had essentially "hunkered down" to protect itself. The strikes sought to destroy the sheltered aircraft so that the Iraqis could not use them later in a surprise "Tet-like" offensive.



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From the second week on, the coalition directed an increasing concentration of sorties against the KTO. Strike operations in Kuwait aimed at sealing off the area from resupply, attacking traffic within the area, and attriting the Iraqi army. To effect this attrition, commanders lowered altitude restrictions for some aircraft to improve bombing accuracy, and aircraft employed laser guided bombs (LGB) against Iraqi armor and artillery in a procedure referred to as "tank plinking." As the ground offensive approached, the weight of effort shifted from the Republican Guard and theater reserve units to attacks on Iraqi frontline divisions.

During the short ground offensive, which began on 24 February, close air support (CAS) had sparse opportunity to operate. The lack of Iraqi resistance and the speed with which coalition forces advanced negated the need for much air support. Most destruction was caused by aircraft striking strategic reserves and retreating columns of the Iraqi army as it attempted to flee Kuwait along avenues such as the so-called highway of death. The war ended on 28 February with the Iraqi army driven completely out of Kuwait into a small corner of southeastern Iraq.

Strike Results

Air strikes during Desert Storm generally fall into three categories: those against the Iraqi army, those against targets that controlled the air and sea, and those against strategic targets (fig. 1).[5] Most strikes (approximately 70 percent) targeted the Iraqi army. Those against air and sea control targets made up about 15 percent of the total and consisted of attacks on airfields, air defense sites, and Iraqi naval and coastal facilities. Strategic targets, the primary subject of this review, comprised the remaining 15 percent. For purposes of the following discussion, I group these targets under four headings: key production, deployed ballistic missile forces, lines of communications (LOC), and command and control (C^2). This breakdown provides a more valid comparison with results attained against similar targets in past wars.

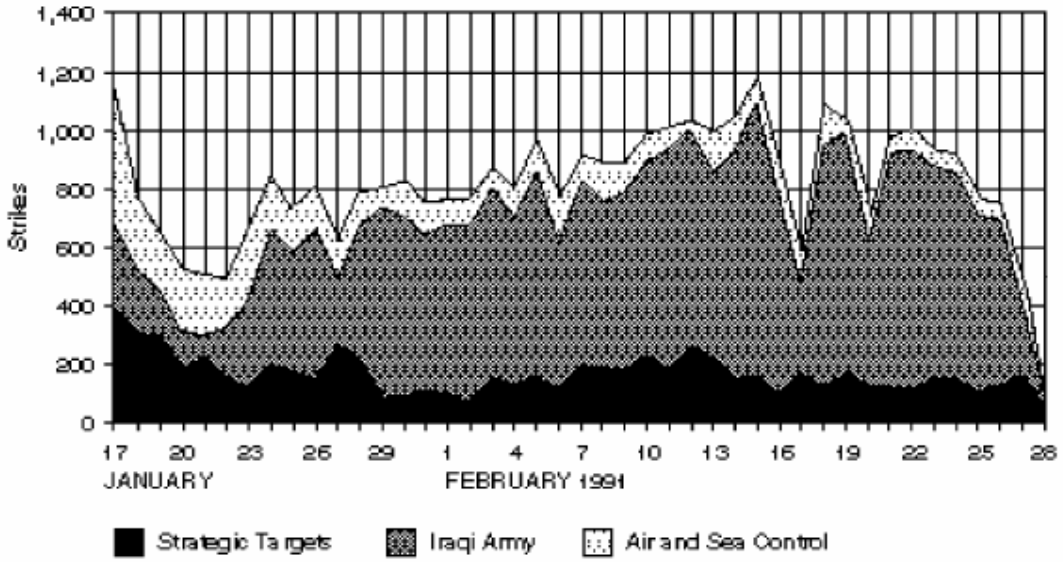

Figure 1. Coalition Air Strikes by Day against Iraqi Targets (from Eliot A. Cohen and Thomas Keaney, Gulf War Air Power Survey: Summary Report [Washington, D.C.: Government Printing Office, 1993], 13)

Key Production

Key production targets in Iraq included electric power facilities, oil facilities, and nuclear facilities. Strikes against electric power[6] facilities came early in the campaign, destroying or damaging an estimated 88 percent of Iraq's installed generation capacity. Lights went out in Baghdad, and available evidence indicates that electric power throughout central and southern Iraq was largely shut down during the initial days of the war.

During the Linebacker II campaign in December 1972—the closest historical analog to the strategic portion of the Desert Storm air campaign—US air strikes reduced North Vietnam's electrical capacity by some 75 percent. The North Vietnamese, however, met essential requirements for electrical power by cutting back nonessential functions and relying on the system's inherent redundancy.[7] Obviously, a similar response occurred in Iraq, which possessed a relatively modern, redundant, and flexible power system and normally used less than 55 percent of its capacity. The decreased capacity caused by coalition air strikes probably forced the leadership and military onto backup power and resulted in major inconveniences; nevertheless, we could detect no evidence of disaffection toward the Iraqi leadership—one of the hoped-for objectives of the strikes against electric power.

The peak effort against oil facilities[8] came toward the middle of the campaign. The Central Intelligence Agency (CIA) concluded that more than 90 percent of Iraq's petroleum-refining capacity was rendered inoperative. The ironic aspect of all this is that Iraqi forces required very little petroleum. The Iraqi air force essentially sat out the war, and ground forces in Kuwait used Kuwaiti refining capabilities and oil stocks. Even after the coalition initiated air strikes against Kuwaiti facilities, sufficient stocks were available for weeks of combat. Although it appeared prudent to strike oil facilities to limit Iraq's ability to wage a protracted ground war, in actuality the attacks bore no significant military results—given the Iraqis' inability to mount a coherent or protracted defense on the ground. One might say that the impact of strikes against oil facilities was limited by the success of the air campaign against other target systems.

This situation is in sharp contrast to the one in which Germany found itself during the last year of World War II.[9] Fighting a two-front war severely strained the German economy, so the country had a critical need for oil. Consequently, the German oil industry proved to be a lucrative target. Strikes against North Vietnam's oil-storage capacity, however, proved less lucrative. Although an estimated 70 percent of its oil capacity was destroyed during Operation Rolling Thunder (1965–68), North Vietnam's mode of operation required a minimum of oil. It could import whatever it needed from Communist allies.

An explicit military objective of Desert Storm was destruction of Iraq's nuclear capabilities.[10] After the Israeli strike on an Iraqi nuclear reactor in 1981, Iraq restructured its nuclear program to minimize its vulnerability. The Iraqis initiated redundant methods for producing fissionable material and made each method less vulnerable to air attack through concealment, dispersal, hardening, and deception. Consequently, strategic air attacks against nuclear facilities were far less effective than had been expected.

The *GWAPS* team concluded that Iraq's nuclear program was far more extensive and dispersed than coalition planners realized, that the Iraqis moved elements of the program away from coalition bombing after the conflict started, and that significant pieces of it either were not identified or not understood by the time of the cease-fire.[11] As a result, the United Nations (UN) inspection teams identified and destroyed more of the Iraqi nuclear program *after* the war than did the air campaign *during* the war. Likewise, the UN team uncovered some 150,000 dispersed chemical weapons that air strikes had not destroyed.

These results are reminiscent of our experience with Germany in World War II and North Vietnam during the war in Southeast Asia. German dispersal of ball-bearing, aircraft, and other production plants, for example, helped attenuate the impact of strategic bombing during World War II. Although primarily an agricultural country with little industry, North Vietnam also dispersed portions of its industrial sector. In addition, the North Vietnamese made extensive use of dispersal to protect limited stores of fuels, supplies, and equipment from air attack.[12] Iraq's successful use of dispersal indicates that this stratagem remains a viable counter to air attack—a factor with which airpower must continue to deal.

Deployed Missile Forces

If dispersal proved to be a nemesis to strategic air attack, mobility was even more so. This fact was particularly true of Iraq's Scud missile capability[13], which was of great political significance because Iraqi Scud launches at Israel could have drawn that country into the war and split the coalition of Arab nations. Countering this threat required a major diversion of coalition air resources for Scud search and attack. By war's end, nearly every type of strike and reconnaissance aircraft used in the war had participated in the effort to bring the threat under control. This effort included conducting continuous airborne surveillance of Iraq, positioning strike aircraft over Scud launch areas for immediate targeting, attacking communication circuits thought to be transmitting Scud launch authorizations, and attacking suspected Scud hiding places. Although Scud launches decreased after the first week of the war, they rose again during the final weeks (fig. 2). Postwar searches indicated that coalition air strikes destroyed few, if any, mobile launchers and that 19 survived the war.

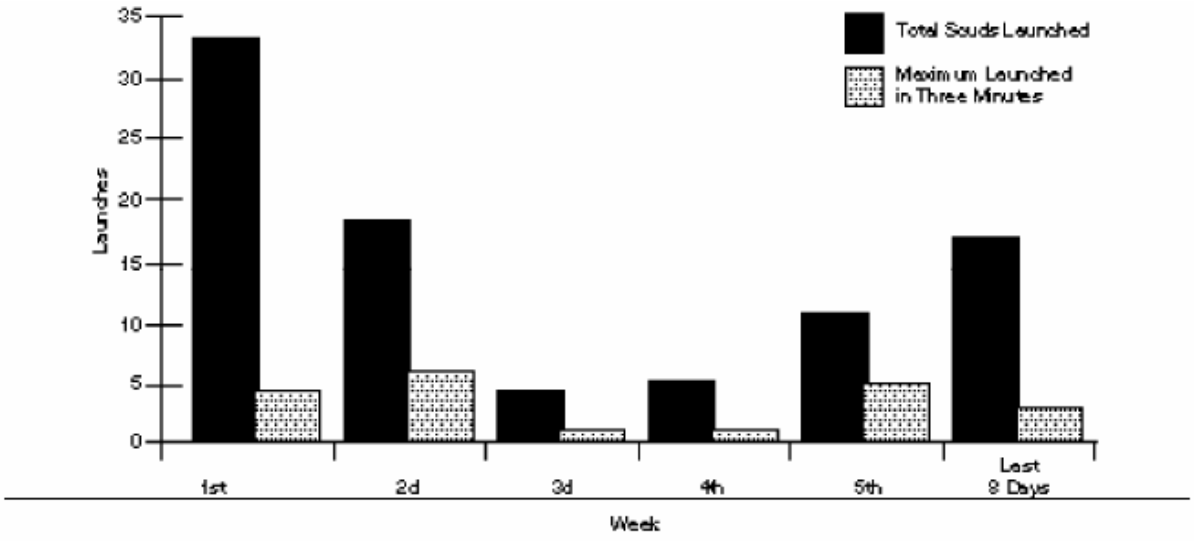

Figure 2. By-week Launch Totals and Mximum Salvo Size for Iraq: Scuds (from Eliot A. Cohen and Thomas Keaney, *Gulf War Air Power Survey*: Summary Report [Washington, D.C.: Government Printing Office, 1993], 88).

Mobile Scud crews were capable of moving from hiding sites, firing, and—within minutes—hiding again before aircraft could attack them. Moreover, the Iraqis reduced prelaunch electromagnetic emissions that might give away their locations prior to launch and seeded the launch areas with high-fidelity decoys and other vehicles. They displayed ingenuity in the use of decoys by placing mock missiles among barrels of diesel fuel to simulate secondary explosions when hit and by installing aluminum reflectors to emit confusing radar signatures and heat generators to baffle infrared detectors.[14] Consequently, confirming the destruction of any Iraqi mobile launchers during the war proved impossible. Although aircrews reported destroying around 80 mobile launchers, most reports reflected destruction of decoys and objects that provided Scud-like infrared or radar signatures.

During Linebacker II, our forces experienced the same problems with surface-to-air (SAM) missile sites. The North Vietnamese were able to relocate their SAM sites rapidly—within four hours. Consequently, only two of 13 SAM sites attacked during the campaign were damaged.[15] Even in Desert Storm, despite our initial success against the Kari air defense system, the Iraqis found ways to regenerate portions of the system and fire radar-guided SAMs right to the end of the war. Likewise, Silkworm sites used in Iraq's coastal defense remained a threat to the end.[16]

Lines of Communications

Although Desert Storm planners included LOCs[17] in the strategic category, strikes against the enemy's road and railroad network traditionally have been considered part of the interdiction effort—and probably still should be. The objective of these strikes during Desert Storm was to isolate the KTO and disrupt Iraq's ability to resupply its forces. Because the LOCs frequently crossed rivers, bridges became key targets of air operations to isolate the theater.

The interaction between coalition and Iraqi forces in the air-interdiction sphere reads much like a script from Southeast Asia. To offset the destruction of their bridges, the Iraqis rerouted traffic to secondary routes, constructed temporary bridges, used amphibious ferry vehicles, and built earthen causeways. The Iraqi army possessed a variety of bridging equipment, including pontoon sections, ribbon bridges, and self-propelled ferries. Much of this equipment was prepositioned and concealed near key bridges

that might be targets of air attack. The ingenuity of the Iraqis in coping with coalition strikes against the LOC network was aptly described by Gen Charles Horner, the coalition air commander:

> Anybody that does a campaign against transportation systems had better beware! It looks deceivingly easy. It is a tough nut to crack. The Iraqis were very ingenious and industrious in repairing them or bypassing them.… I have never seen so many pontoon bridges. When the canals near Basra were bombed, they just filled them in with dirt and drove across the dirt.[18]

Another problem that has surfaced continually in past wars is that route capacity was considerably greater than that needed for resupply of combat forces. Whereas total route capacity stood at around 200,000 tons per day, Iraqi resupply required only 10 to 20 percent of this figure. To become less detectable by air, the Iraqis (as did the North Vietnamese) shifted from multivehicle convoys to single trucks, traveling largely at night. Moreover, sizable stocks of ammunition, petroleum, food, and water had been accumulated in the KTO—enough to support 35 to 40 days of combat—to hedge against any LOC vulnerability.

In spite of sufficient supply tonnages for combat operations, the Iraqis quickly gave way when the ground offensive began. Spot shortages of food and other supplies developed, and the Iraqis found it impossible to counter coalition thrusts. As with the Germans during Operation Strangle in Italy and the North Vietnamese during their invasion of South Vietnam in 1972, airpower severely limited the Iraqis' ability to position men and materiel in the right place at the right time.[19] Mobility denial rather than supply denial again had been the key to coalition success.

Iraqi Command and Control

With these strikes, the campaign planners hoped to disrupt the central nervous system of Saddam Hussein's regime.[20] They targeted the various government facilities used by Saddam and his associates to rule the country, maintain control over the people, and direct military operations. Some planners felt that these strikes would lead to the overthrow of Saddam's Baathist regime and the severance of communications between Baghdad and Iraqi military forces in the KTO—somewhat reminiscent of the hunt for Ben Franklin's "horseshoe nail" that would critically cripple Germany's war effort. In this case, the focus would be enemy leadership rather than production.

Looking first at the communications network, we find that the Iraqis possessed a modern, computerized, and highly redundant system. Completely severing a system this flexible and redundant would be extremely difficult—if not impossible. By the second week, it had become apparent that Iraq's national-level telecommunications system had not collapsed as a result of attacks on central switching facilities and microwave relays. Although we noted some disruption, the system turned out to be more redundant and more able to reconstruct itself than originally anticipated. The search to find the telecommunications "straw that would break the camel's back" continued to the end of the war—but to no avail.

During Linebacker II, we struck five of North Vietnam's telecommunications facilities, but they did not prove to be lucrative targets. The strikes had the effect only of producing a few brief periods of interrupted operations. The redundancy in the system, however, allowed the North Vietnamese to maintain all necessary operations. Poststrike analysis indicated that we achieved little of military value and that the psychological impact was questionable.[21]

The impact of Desert Storm strikes against command and leadership targets was also questionable. Although we noted considerable disruption, coalition forces did not succeed in toppling Saddam Hussein or completely severing his communications with the KTO during the 43-day war.[22] Saddam Hussein survived not only the war itself but, in its aftermath, retained enough military power to quell Kurdish and Shiite uprisings in the north and south, respectively.[23] He was also able to continue radio broadcasts to his subjects throughout the war.

Through the ages, airpower apparently has been unable to affect political stability or a population's will to continue the fight.[24] As noted by the *GWAPS* team, Iraq's military forces proved to be the weak link—not its political regime. The Germans never overthrew Hitler after the massive area bombings of Germany's cities, nor did the North Vietnamese ever turn on Ho Chi Minh.[25] Even after the intensive Linebacker II bombings of Hanoi and Haiphong, nothing indicated that the North Vietnamese leadership had lost control of the situation.[26]

Allied Air Management

While on the subject of C^2, one should pay attention to the concept of a single manager for air, which was inaugurated to direct the coalition air war during Desert Storm. One of the primary campaign lessons from Linebacker II was the need for a single manager for air resources.[27] The separation of the strike effort by geographical areas, with Air Force strikes confined to one area of North Vietnam and US Navy strikes to the other, prevented the optimal integration of forces and ordnance in each of the areas. Moreover, the complexity of C^2 for employment of B-52s was a major problem. Scheduling and support of B-52 strikes required constant coordination between major command elements, including Strategic Air Command, the overall commander of US forces (Military Assistance Command, Vietnam [COMUSMACV]), Headquarters Seventh Air Force in Vietnam, and the Navy's Task Force 77 in the Gulf of Tonkin. A single command authority in control of all air assets could have better insured proper allocation of air resources to various areas and could have made maximum use of aircraft and ordnance mixes.

During the fall of 1990, Gen Norman Schwarzkopf, commander in chief (CINC) for Desert Storm, designated General Horner of the Air Force as the joint force air component commander (JFACC) for all coalition air forces. Thus empowered, Horner could concentrate his air resources where he thought they could best support the CINC's overall war objectives. In spite of this authority, interservice rivalry at times constrained Horner's ability to function with supreme authority. From the beginning, the Army, Navy, and Marine Corps were concerned about someone else having control of their air assets.

The Navy resented the aircraft rules of engagement, which discriminated against Navy planes because they lacked the electronic means of distinguishing friend from foe at a distance; further, the Navy wanted control of its aircraft to defend the fleet.[28] Determined to avoid fratricide, the CINC supported Horner's more restrictive rules. Likewise, the Marine Corps thought that the very existence of its integrated air-ground team meant that the Corps should control its own aircraft.[29] In the end, the Navy and Marine Corps were allowed to reserve many sorties for their own use.

The Army accepted the notion of a single manager for air, but corps commanders worried about whether their needs would receive adequate attention from an Air Force that might wish to fight the war its own way. Disputes with the Army persisted until a greater weight of effort shifted from strategic targets in Iraq to battlefield preparation in Kuwait. Even so, disputes continued. During one

such incident, the CINC ordered heavy bombing of Iraq's Republican Guard, while the corps commanders—unaware of the CINC's direction—called for strikes against Iraqi artillery in the frontline forces.[30]

In spite of such frictions, the concept of a single manager for air was an improvement over the diverse control exercised in previous wars. Moreover, as the *GWAPS* team stated, the superabundance of coalition aircraft, the absence of serious opposition in the air or of effective attack against coalition air bases, and the ability of the coalition to choose the timing of the war's beginning all meant that neither the CINC nor the JFACC had to make harsh choices in unfavorable circumstances. They never had to strip the Marines of air support provided by Marine aircraft or endanger the fleet by leaving it with less than full air defenses, and they never had to remove air cover from soldiers in the face of an enemy attack.[31]

Conclusion

Regardless of the shortcomings discussed above, there is no doubt that the United States and its allies scored a brilliant victory in the Gulf. The war saw the full emergence of airpower as a preeminent factor in modern combat, a fact which led some advocates to declare that airpower had come of age—that technology had finally caught up with doctrine and that airpower alone could win future conflicts, à la Douhet.[32] Some people even considered airpower the linchpin of a new Pax Americana, just as land power had characterized Pax Romana and sea power had characterized Pax Britannica. Other airpower adherents, including the Air Force chief of staff and the JFACC for Desert Storm, recommended caution, citing the environment in which Desert Storm was fought.[33] First, the Gulf War took place in open-desert terrain well suited to the effective employment of airpower. Historically, battles fought in the desert tend to be decisive; armies cannot rely on topography, as did the North Vietnamese in Southeast Asia, to cover their actions. As Rick Atkinson observes, bones litter the world's deserts to prove the point. In Operation Compass in December 1940, the British completely annihilated 10 Italian divisions in North Africa, capturing 130,000 prisoners. At El Alamein, Rommel lost 55,000 men and 450 tanks in a fight that marked the beginning of the end of the Third Reich. "Just as the desert is incapable of compromise, battles fought therein result in total victory or total defeat."[34]

Second, although Desert Storm was touted as a high-technology war characterized by precision strikes by advanced aircraft and missiles, the data indicate that certain reservations are warranted. Some of the oldest aircraft in the Air Force inventory—including the B-52, F-111, A-10, and KC-135—were in greatest demand, and of the total number of weapons expended during the war, only about 8 percent were precision guided.[35] Even the more accurate delivery systems experienced their share of misses. For example, of the 167 LGBs dropped during the first five nights of combat by Air Force F-117s, 76 missed their targets because of pilot error, mechanical or electronic malfunctions, or poor weather.[36] Of 288 Tomahawk cruise missiles fired by the Navy, only about half struck their targets.[37] And the Army subsequently found that only 9 percent of its Patriot engagements resulted in confirmed Scud kills.[38]

Weather was a major factor in strike accuracy and the ability to use precision guided weapons. In the first three weeks of the war, approximately half of the attack sorties into Iraq had to be diverted to other targets or cancelled because of weather-related problems.[39] Although the weather was worse than forecast, it was better than aircraft might experience in other areas of operation. During Linebacker II, for instance, on only three afternoons of the 12-day campaign was cloud cover high

enough to deliver LGBs.[40] The call for a better all-weather bombing capability remained largely unanswered in the Gulf War. Technology, at least at the time of Desert Storm, still had a way to go.

A final factor affecting the war was that the coalition command had greatly overestimated the size and capability of Iraqi forces. Although the command estimated 540,000 Iraqi troops in the KTO, the *GWAPS* team estimated only 336,000 in place at the start of the air campaign, with not more than 200,000 to 222,000 remaining when the ground offensive began.[41] Against this force, the coalition had marshaled some 700,000 troops. The relative inferiority of the Iraqi forces became apparent even before the ground offensive—at the battle of Khafji, in which the Iraqis performed so ineptly.

Did Desert Storm marshal in a new era for military forces—a revolution in warfare?[42] I have my doubts. The conditions and environment under which coalition forces operated during Desert Storm were close to ideal. We may never again face an adversary under circumstances so congenial to airpower. We need only look back to the war in Southeast Asia to remember the limitations of airpower against a determined foe sheltered by mountains and thick foliage.

Even more important is the fact that many of the actions taken in the past to alleviate the impact of strategic bombardment remained effective during Desert Storm. Dispersal, deception, redundancy, and improvisation are the nemeses. These counters require costly, labor-intensive substitutions, but such costs are normally tolerable. The limits of strategic air attack encountered as far back as World War II manifested themselves again over Iraq in 1991. Substitution did not die with Desert Storm but remains an enduring facet of warfare.[43]

What in large part was nullified in Desert Storm was the mitigating effect of time. Allied forces used airpower in conjunction with other forces in fast and dramatic moves that gave little opportunity for the enemy to respond or for the principle of substitution to come fully into play. That was the success and the lasting legacy of Desert Storm.

Notes

[1] Herman L. Gilster, *The Air War in Southeast Asia: Case Studies of Selected Campaigns* (Maxwell AFB, Ala.: Air University Press, October 1993), 117–36.

[2] Eliot A. Cohen, *Gulf War Air Power Survey*, 5 vols. (Washington, D.C.: Government Printing Office, 1993).

[3] Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (New York: Houghton Mifflin Co., 1993).

[4] Cohen, vol. 2, part 2, *Effects and Effectiveness*, 95–104. Most of the details in this and the following section on strike results were extracted from this volume. Some of the same information is also available in the more concise *Gulf War Air Power Survey: Summary Report* (Washington, D.C.: Government Printing Office, 1993), coauthored by Cohen and Thomas Keaney.

[5] Cohen, vol. 2, part 2, 78–95.

[6] Ibid, 290–308.

[7] Gilster, 129–30.

[8] Cohen, vol. 2, part 2, 309–12.

[9] Gilster, 130–32.

[10] Cohen, vol. 2, part 2, 312–30.

[11] Ibid, 343.

[12] Gilster, 124-25

[13] Cohen, vol 2, part 2, 330-40.

[14] Atkinson, 175.

[15] Gilster, 90–92.

[16] Cohen, vol. 2, part 2, 139, 229.

[17] Ibid, 170–202.

[18] Ibid, 186.

[19] Gilster, 9–10, 27.

Notes

[20] Cohen, vol. 2, part 2, 274–90.

[21] Gilster, 84–86.

[22] What remains unknown is whether the periods of disruption correlated with periods in which Saddam especially needed reliable, timely communications to maneuver his forces. Also, the fact that the Iraqis limited radio communications before the ground war does not necessarily mean that more secure communications links were always available. They may have chosen to limit radio communications rather than have their messages intercepted.

[23] Ironically, the strikes against Iraqi C^2 may have encouraged the Kurdish and Shiite rebellions.

[24] Literature provides ample evidence of the political impact of strategic warfare on a nation's population. Stephen A. Garrett, in a study of the British bombing of German cities, states that although the Strategic Bombing Survey tended to stress the power of the police state over its people to stymie their dissatisfaction, there also exists a "tendency of a population to rally around its leaders in times of crisis (especially wartime) and to commit one's resources and will to the nation at a time of maximum peril." *Ethics and Airpower in World War II: The British Bombing of German Cities* (New York: St. Martin's Press, 1993), 158.

Bruce D. Porter, in an analysis of the impact of warfare on the evolution of modern states over five centuries, concludes that "a kingdom at war may be a kingdom at peace. The exigencies of military conflict promote internal rallying: state and society unite in the common effort; economic and political cooperation increase; factionalism and partisanship are diminished; consonance reigns. A distinguished line of political philosophers from Bodin to Hegel have observed that war unites nations, checks domestic strife, and consolidates the power of the state. There are striking historical examples of this, when badly divided polities are suddenly united in war." Porter carries this assessment even further in stating that "mindful of the rallying effect of war, the leaders of divided states may be tempted to engage in divergence, promoting unity by resorting to foreign adventure—'to busy giddy minds with foreign quarrels' in the words of Shakespeare's Henry IV." *War and the Rise of the State: The Military Foundations of Modern Politics* (New York: Free Press, 1994), 12.

[25] One might argue, however, that the devastation rained on Germany and Japan during World War II resulted in the conversion of these nations from militarism to pacificism after the war.

[26] Gilster, 114. For an evaluation of the earlier bombing effects of 1965–66, see Oleg Hoeffding, *Bombing North Vietnam: An Appraisal of Economic and Political Effects,* RAND Memorandum RM-5216-ISA (Santa Monica, Calif.: RAND, 1966).

[27] Ibid, 113. To the credit of Desert Storm operatives, the major campaign lessons listed in the "Linebacker II USAF Bombing Survey" (ibid, 107–13) were incorporated into Desert Storm. The partial exception concerned the call for improved all-weather capability, which, of course, is more a function of technology than strike control.

[28] Atkinson, 151–52.

[29] Ibid, 219.

[30] Ibid, 216–23, 338–40. See also Cohen and Keaney, 153–57.

[31] Cohen and Keaney, 160.

[32] Atkinson, 494; and Giulio Douhet, *The Command of the Air,* trans. Dino Ferrari (1942; new imprint, Washington, D.C.: Office of Air Force History, 1983). Douhet is often credited as the original advocate of strategic bombardment to win wars.

[33] Public Broadcasting Service, "Can Bombing Win the War?" NOVA, WBGH Educational Foundation, 1993. Qualifying remarks by Gen Merrill A. McPeak and General Horner occur near the end of the one-hour telecast.

[34] Atkinson, 250–51.

[35] Cohen and Keaney, 226. It is interesting to note the important roles of older, less sophisticated equipment in past wars. After World War II, Gen Dwight D. Eisenhower identified the following as the five most important pieces of equipment that contributed to success in Africa and Europe: the "duck" amphibious vehicle, the bulldozer, the jeep, the two and one half ton truck, and the C–47 aircraft—none of which were designed for combat. Crusade in Europe (Garden City, N.Y.: Doubleday & Co., 1948), 163–64. During the war in Southeast Asia, the AC–130 gunship was by far the most effective weapons system over the Ho Chi Minh Trail in Laos. Gilster, 31–58.

[36] Atkinson, 160.

[37] Ibid, 224.

[38] Ibid, 278.

[39] Cohen, vol. 2, part 2, 99–100.

[40] Gilster, 101.

[41] Cohen, vol. 2, part 2, 220.

[42] Ibid, see chap. 7 for a comprehensive discussion on whether Desert Storm heralded a revolution in warfare.

[43] Perhaps the only way to limit substitution and recovery is to target a nation's manpower base. Jack Hirshleifer of RAND conducted an in-depth investigation of historical disasters and recoveries. After evaluating the recovery of the

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South after the Civil War, Russia after World War I and the Communist Revolution, and Germany and Japan following World War II, Hirshleifer concluded that the "speed and success of recovery in the observed historical instances have been due in large part to the proportionally smaller destruction of population than of material resources." He also found that completely depopulated cities (e.g., Saint Pierre, Melos, Babylon, and Carthage) often failed to regain their former size and prosperity compared to cities destroyed physically but with large portions of their population intact; further, population was more likely to survive bombing and combat damage than was property. *Disaster and Recovery: A Historical Survey*, RAND Report RM-3079-PR (Santa Monica, Calif.: RAND, 1963), 121–22. Along this same line, over a century ago, economist John Stuart Mill noted that "the possibility of rapid repair of their disasters mainly depends on whether the country has been depopulated." *Principles of Political Economy* (London: Longmans, Green & Co., 1923), 75. A strategy that deliberately targets people, of course, would be unacceptable to a democracy such as the United States.

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