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The Myth of Air Power in the Persian Gulf War and the Future of Warfare

Daryl G. Press

On February 24, 1991, U.S. ground troops, supported by British, French, and Arab forces, moved north from Saudi Arabia to liberate Kuwait and destroy the Iraqi military.¹ Four days later the job was apparently done: The Kuwaiti flag once again flew over Kuwait City, and what remained of the Iraqi military was in full retreat. Astonishingly, only sixty-three Americans were killed in a ground operation that most analysts expected would cause thousands of U.S. casualties.² How did the coalition's ground forces destroy the Iraqi army so quickly and with so few coalition casualties? Does the Persian Gulf War herald a future of U.S. military dominance and low-cost U.S. military operations? What are the lessons from the fighting for U.S. foreign policy?

The conventional wisdom among historians, military analysts, and foreign policy decisionmakers is that air power neutralized the Iraqi military before the ground war began.³ This interpretation of the Gulf War has important im-

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1. Thirty-six countries joined the coalition against Iraq, but the ground offensive can be fairly characterized as a U.S. operation with British support. The coalition's ground force comprised nine and two-thirds U.S. divisions, two-thirds of a British division (two brigades), and two-thirds of a French division (two brigades), along with several less-capable Arab divisions. Only the U.S. and British forces were given important roles in the offensive.

2. The number of U.S. soldiers and marines killed during the ground war is from Stephen T. Hosmer, *Psychological Effects of U.S. Air Operations in Four Wars, 1941–1991* (Santa Monica, Calif.: RAND, 1996), p. 155. This number excludes the twenty-eight Americans killed by a Scud missile that hit a barracks in Dhahran, Saudi Arabia, during the ground war. For an account of prewar estimates of U.S. casualties, see Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, N.Y.: Cornell University Press, 2000), p. 2.

3. For the most prominent analyses that support this view, see Eliot A. Cohen, Director, *Gulf War Air Power Survey* (Washington, D.C.: U.S. Government Printing Office [GPO], 1993), 5 vols. (hereinafter cited as GWAPS), plus *Summary Report*. See specifically *GWAPS Summary Report*, pp. 116–117;

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plications for U.S. foreign policy and for U.S. military procurement strategies. For U.S. foreign policy, the Gulf War seems to show—and the 1999 Kosovo conflict appears to confirm—that air power is now so lethal, and American air power so dominant, that the United States can win nearly cost-free military victories against its foes. For U.S. military procurement debates, the lessons are equally clear: The United States should significantly alter its military procurement priorities to favor air power over ground forces; in the future, decisive battles will be won from the air.⁴

U.S. confidence in air power is soaring, but the conventional wisdom about its decisiveness in the Gulf War has never been rigorously tested. It is undeniable that for six weeks—during the period now known as the air campaign—coalition aircraft dropped tons of bombs and missiles on Iraqi targets. It is also undeniable that Iraq's ground forces were totally ineffective against the coalition's ground forces. But those facts do not prove that the bombing caused Iraqi ineffectiveness. The questions that must be answered are: Why were the Iraqi ground forces so incapable during the ground war? Were they neutral-

GWAPS, Vol. 2, Pt. 2, p. 107; James A. Winnefeld, Preston Niblack, and Dana J. Johnson, *A League of Airmen: U.S. Air Power in the Gulf War* (Santa Monica, Calif.: RAND, 1994), pp. 5, 285, 287; Thomas A. Keaney, "The Linkage of Air and Ground Power in the Future of Conflict," *International Security*, Vol. 22, No. 2 (Fall 1997), p. 147; Michael R. Gordon and Bernard E. Trainor, *The Generals' War: The Inside Story of the Conflict in the Gulf* (Boston: Little, Brown, 1995), p. 474; Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (Boston: Houghton Mifflin, 1993), p. 495; Hosmer, *Psychological Effects of U.S. Air Operations*; Robert A. Pape, "The Limits of Precision-Guided Air Power," *Security Studies*, Vol. 7, No. 2 (Winter 1997/1998), pp. 93–114; Robert A. Pape, "The Air Force Strikes Back: A Reply to Barry Watts and John Warden," *Security Studies*, Vol. 7, No. 2 (Winter 1997/1998), pp. 191–214; Aharon Levran, *Israeli Strategy after Desert Storm: Lessons of the Second Gulf War* (London: Frank Cass, 1997), p. 29. The only academic studies that place substantial emphasis on the importance of the ground campaign are Stephen Biddle, "Victory Misunderstood: What the Gulf War Tells Us about the Future of Conflict," *International Security*, Vol. 21, No. 2 (Fall 1996), pp. 139–179; Stephen Biddle, "The Gulf War Debate Redux," *International Security*, Vol. 22, No. 2 (Fall 1997), pp. 163–174; and my response to Biddle's article in Daryl G. Press, "Lessons from Ground Combat in the Gulf: The Impact of Training and Technology," *ibid.*, pp. 137–146. Several U.S. Army-sponsored accounts place emphasis on the ground campaign. See, for example, Robert H. Scales, *Certain Victory: The U.S. Army in the Gulf War* (Washington, D.C.: Brassey's, 1997); Frank N. Schubert and Theresa L. Kraus, eds., *The Whirlwind War: The United States Army in Operations Desert Shield and Desert Storm* (Washington, D.C.: Center for Military History, 1995); and Richard M. Swain, *"Lucky War": Third Army in Desert Storm* (Fort Leavenworth, Kans.: U.S. Army Command and General Staff College Press, 1997).

4. This position appears to be guiding the current review of U.S. defense policy mandated by U.S. Secretary of Defense Donald Rumsfeld. See Thomas E. Ricks, "Rumsfeld Outlines Pentagon Overhaul," *Washington Post*, March 23, 2001, p. 1; Tom Bowman, "Pentagon Faces Transformation," *Baltimore Sun*, March 13, 2001, p. 1A; Greg Jaffe, "Pentagon Lists Potential Cuts in About 30 Weapons Programs," *Wall Street Journal*, March 26, 2001, p. A3; and Mortimer B. Zuckerman, "Rethinking the Next War," *U.S. News and World Report*, March 5, 2001, p. 64.

ized by the air campaign? Or were they simply outmatched by vastly superior U.S. and British ground forces?⁵

To test the proposition that air power neutralized the Iraqi ground forces, I divide the argument into five different versions:⁶ (1) air power prevented the Iraqis from maneuvering, which is critical in desert combat; (2) air power disrupted Iraqi command, control, communications, and intelligence (C₃I); (3) air power severed Iraqi supply lines; (4) air power attrited the Iraqi forces too heavily for them to fight effectively; and (5) air power broke Iraqi morale. Each version makes predictions about the conduct of the Iraqi ground forces during the ground operation. In this article I use detailed evidence from the ground campaign to test these five explanations.

The evidence from the ground campaign shows that the conventional wisdom about the Gulf War is wrong. Although air power played an important role in the coalition's victory, its role has been exaggerated and misunderstood. I make two primary arguments about air power during the Gulf War. First, air power was not decisive; it did not neutralize the Iraqi ground forces. At the end of the air campaign, Iraqi ground forces could still maneuver, and they still had the C₃I, supplies, numbers, and morale to fight.

Second, the six-week air campaign did not play a necessary, enabling role that made the ground war "easy" for U.S. forces. Had there been no air campaign, U.S. and British fatalities in the ground war would probably have been slightly higher. But evidence strongly suggests that with or without the air campaign, the coalition's ground attack would have led to a rout of historic proportions. In sum, air power contributed to the coalition's effort, but the air campaign was neither sufficient nor necessary for the very one-sided victory.

If air power did not neutralize the Iraqi army, why were the Iraqi ground forces totally ineffective during the ground campaign? The answer is that they were simply overmatched by the U.S. and British ground forces. In 1991 the Iraqis fielded a military that was mediocre even by third world standards, and during the Gulf War they were facing the most powerful military forces in the world on terrain ideally suited to U.S. and British military strengths. Furthermore, Iraq's timing was terrible; Iraq invaded Kuwait just after the Reagan mil-

5. An obvious third possibility is that a combination of air bombardment and the coalition's superiority on the ground neutralized the Iraqi ground forces. I test this third possibility along with the other two in this article.

6. By "air power" I mean fixed-wing aircraft, not helicopters; helicopters are fully integrated into ground forces.

itary buildup was completed and just before America's post-Cold War downsizing had begun. In sum, the United States and Great Britain took the forces that they built to fight while heavily outnumbered against the best divisions in the Soviet military, and turned them loose against Iraq. The Iraqi ground forces never had a chance.⁷

To be clear, this article does not argue that air power was irrelevant in the Gulf War. First, air power was critical for getting combat power to the Gulf quickly after the Iraqi invasion of Kuwait. When it briefly looked like Iraq might continue south from Kuwait and invade Saudi Arabia, the United States rushed combat aircraft to the Arabian Peninsula to prevent further Iraqi attacks. Transport aircraft also flew a brigade of the 82d Airborne Division to Saudi Arabia to demonstrate U.S. resolve. Because of air power, the United States was able to quickly "draw a line in the sand" and establish an early capability to defend Saudi Arabia.⁸ Second, during the coalition's offensive to liberate Kuwait, U.S. aircraft successfully carried out all of their important traditional roles: They gained air superiority, flew successful reconnaissance missions, were significantly involved in coordinating the actions of coalition air and ground forces, conducted strategic attacks on targets deep in Iraq, and reduced and disrupted Iraq's military. Air power fulfilled its traditional missions; it just did not neutralize the Iraqi forces.

What does the Gulf War tell us about U.S. foreign policy and procurement priorities? The conventional interpretation of the war has been used to support the view that there has been a fundamental shift in the relative decisiveness of air and ground forces in modern combat. Modern air power, it is now widely believed, has rendered heavy ground forces obsolete. The United States—with its large, advanced air force—should have little difficulty in defeating potential opponents, as long as America commits the full weight of its air power to the fight. This interpretation also suggests that the United States should cut heavy divisions in favor of lighter ground forces, tactical aircraft, long-range bombers, and cruise missiles.

7. This article is part one of a larger project to determine why the Iraqi ground forces were defeated so easily. In the second part, I use detailed studies of the major battles of the ground war to determine what about the ground campaign was so decisive. For example, I assess the relative importance of U.S. training, ground war technology, tactical surprise, operational surprise, and Western tactics.

8. On the pace of the deployment to the Gulf and the role of air power in Desert Shield, see Winnefeld, Niblack, and Johnson, *A League of Airmen*, pp. 25–54; and *GWAPS*, Vol. 2, Pt. 1, pp. 11–21.

My interpretation of the Gulf War, in contrast, paints a more complicated picture of the emerging relationship between air and ground forces. Air power failed to neutralize the Iraqi ground forces because destroying a largely static, defensive force from the air is inherently difficult, even in the era of information-age intelligence and precision-strike weapons. The lesson of the Gulf War is not that air power is a weak instrument of national military power, but that the capabilities of air power against mechanized ground forces on the offensive are substantially greater than air power's capabilities against defensive forces.

The implication of my analysis for U.S. foreign policy is that air power may play a decisive role in future U.S. operations to halt an enemy's mechanized assault on a U.S. ally. It will not likely be decisive, however, if the United States or its allies need to conduct an offensive to take enemy-controlled territory. For example, if North Korea attacks South Korea, or if Iraq invades Kuwait and Saudi Arabia, U.S. air assets may play a leading role in the destruction of the invading forces. But if the U.S. objective in these contingencies is to launch a counteroffensive into North Korea, or to once again evict Iraq from Kuwait, air power will be far less effective against defensively oriented North Korean, or Iraqi, forces. The force structure implications of this analysis are straightforward: If the United States envisions launching offensive operations to defeat its enemies, it will still require a balanced military that includes substantial heavy ground forces. Overemphasizing air assets may prove very costly.⁹

This article is divided into six main sections. First, I lay out five mechanisms through which air power may have neutralized the Iraqi military. In the second section, I describe what happened during the four-day ground offensive. In the third section, I use the history of the ground war to test each of the five mechanisms. In the fourth section, I test the argument that the air campaign was a necessary "enabler" for U.S. ground forces and made the ground war far

9. Maintaining an exaggerated view of the lethality of air power may impose two types of cost on the United States and its allies. First, undue hopes for a cheap victory from the air may encourage the United States to become involved in conflicts, only to be surprised when air power is not decisive. At this point the United States may be forced to choose between accepting defeat or escalating to include ground operations, both of which may be less attractive than staying out in the first place. Second, if the United States and its allies believe that air power is more lethal than it really is, they may unbalance their military forces and eliminate (or substantially reduce) heavy ground forces in favor of air assets and light ground forces. If a war occurs, they may pay a cost in higher casualties if they have too few heavy ground forces.

less costly than it would have been otherwise. In the fifth section, I address the counterargument that air power has grown much more lethal since the Gulf War, and that this war therefore tells us little about the future of warfare. In this section I describe the reasons that air power was unable to neutralize the Iraqi ground forces in 1991, and I argue that the problems that coalition air power faced in the Gulf War have not yet and will not soon go away. I conclude this argument with a brief review of the Kosovo air campaign. Finally, in the sixth section, I describe the implications of my findings for the future of U.S. force structure and American foreign policy.

Myths of Air Power in the Gulf War

Military analysts are nearly unanimous in their view that air power was decisive in the Gulf War. One of the best histories of this war explains the rout of the Iraqi ground forces by noting that the air campaign “had clearly battered the enemy to near senselessness.”¹⁰ Another excellent historical account concludes that “air attacks made it impossible for the Iraqis to mount an effective defense.”¹¹ According to air power advocate Richard Hallion, “Simply (if boldly) stated, air power won the Gulf War.”¹² Robert Pape, author of the seminal work on modern air power, wrote that “Iraq’s ground forces were decimated” by the air campaign.¹³ The two most detailed studies of the air war, the *Gulf War Air Power Survey* (GWAPS) and the RAND book *A League of Airmen*, came to the same conclusion. The authors of GWAPS concluded that “air power was the decisive factor” in the “crushing military defeat” of the Iraqis, and that “air power made [Iraqi] resistance disorganized and totally ineffective.”¹⁴ The authors of the RAND study largely agreed, arguing that “air power was indeed decisive in neutralizing Iraqi forces.”¹⁵

Despite the agreement that air power was decisive in the Gulf War, there is no consensus on how air power accomplished this objective. One view is that

10. Atkinson, *Crusade*, p. 495.

11. Gordon and Trainor, *The Generals’ War*, p. 474.

12. Richard P. Hallion, *Storm over Iraq: Air Power and the Gulf War* (Washington, D.C.: Smithsonian Institution Press, 1992), p. 2.

13. Pape, “The Limits of Precision-Guided Air Power,” p. 102, n. 13; and Pape, “The Air Force Strikes Back,” p. 201, n. 24.

14. For the first quote, see GWAPS, Vol. 2, Pt. 2, p. 104. For the second quote, see *GWAPS Summary Report*, p. 117.

15. Winnefeld, Niblack, and Johnson, *A League of Airmen*, p. 285.

air power pinned down the Iraqi ground forces and prevented them from maneuvering. As a result, the Iraqis were unable to defend themselves from the coalition's flanking attack—the “left hook.”¹⁶ A second possibility is that Iraqi forces were rendered ineffective because air power disrupted their C₃I. Air strikes against Iraqi command-and-control bunkers, power grids, telephone exchanges, and radio transmitters may have “blinded” the Iraqi ground forces. By the time of the ground war, even those Iraqi units still able to communicate were afraid to do so, because any transmission invited coalition attention in the form of air strikes. With their communications severely disrupted, the Iraqi ground forces were unable to coordinate their response to the coalition attack, allowing themselves to be destroyed piecemeal.¹⁷

A third version of the air power theory is that air strikes cut Iraqi supply lines by targeting Iraqi supply dumps and, more important, destroying thousands of Iraqi trucks meant to carry supplies to the forward Iraqi divisions. By the time the ground war began, the Iraqis were not looking for a fight; they were looking for food.¹⁸ A fourth explanation focuses on the attrition of the Iraqi forces in the Kuwaiti theater of operations (KTO). Stated simply, air power may have destroyed enough Iraqi equipment and killed enough troops

16. See *GWAPS Summary Report*. The authors of the report, Thomas A. Keaney and Eliot A. Cohen, wrote that “the most important contribution of air power . . . and a prime reason why the ground campaign was so short and so overwhelming, was the success of air interdiction in preventing the heavy divisions from moving or fighting effectively” (p. 116), and that air attacks “immobilized” the Republican Guard (p. 119). Winnefeld, Niblack, and Johnson, *A League of Airmen*, p. 153, write that “the Iraqi troops were so pinned down that it was virtually impossible to move, either day or night,” and that “this air-supported maneuver dominance was an important contributor to the coalition success during the ground war.” Thomas G. Mahnken and Barry D. Watts, “What the Gulf War Can (and Cannot) Tell Us about the Future of Warfare,” *International Security*, Vol. 22, No. 2 (Fall 1997), pp. 158–159, also claim that the Iraqis were “pinned down” by air power. See also Keaney, “The Linkage of Air and Ground Power in the Future of Conflict,” pp. 148–149; and Gordon and Trainor, *The Generals’ War*, pp. 287–288, 431.

17. Many analysts claim that air attacks on Iraqi C₃I had a major effect on the outcome of the fighting, even though they do not generally argue that these effects in themselves were decisive. See, for example, Mahnken and Watts, “What the Gulf War Can (and Cannot) Tell Us about the Future of Warfare,” pp. 158–159, who write that the air campaign left the Iraqis “blinded, bloodied, and pinned down”; Winnefeld, Niblack, and Johnson, *A League of Airmen*, pp. 130–131, argue that attacks on Iraqi C₃I “probably significantly affected the course of the war.” See also *ibid.*, pp. 152, 156–157; U.S. News and World Report, *Triumph without Victory: The Unreported History of the Persian Gulf War* (New York: Random House, 1993), p. 409; and Tom Clancy with Gen. Fred Franks, Jr. (Ret.), *Into the Storm: A Study in Command* (New York: Berkley, 1998), p. 242.

18. For arguments that place substantial emphasis on the effects of air power on the Iraqi supply situation, see Winnefeld, Niblack, and Johnson, *A League of Airmen*, p. 156; Pape, “The Limits of Precision-Guided Air Power,” p. 113; *GWAPS*, Vol. 2, Pt. 1, p. 323; *GWAPS Summary Report*, p. 116; and Keaney, “The Linkage of Air and Ground Power in the Future of Conflict,” pp. 148–149.

that when the ground war was launched, there were not enough Iraqi forces left in the theater to resist effectively.¹⁹

A fifth explanation is that six weeks of air attacks broke Iraqi morale. This explanation includes elements of the other explanations: Air attacks caused serious attrition and supply shortages, breaking the will of the Iraqi army.²⁰ The Iraqi army may still have had the capability to resist the coalition after the air campaign, but they lacked the will.²¹ To determine if any of these explanations is correct, we need to look at what happened during the ground war.

The Ground War

On January 17, 1991, the United States and its coalition partners launched Operation Desert Storm to liberate Kuwait. For the next thirty-eight days, thousands of coalition air strikes hit targets throughout Iraq, including military command bunkers, bridges, telephone exchanges, electrical power plants, and government buildings. In the KTO, coalition aircraft pummeled Iraqi forces and interdicted their supply lines. During the air campaign, the only ground fighting was a skirmish near the Saudi city of al-Khafji.²² On February 24 the

19. Ironically, despite the significant attrition that coalition aircraft inflicted on Iraqi ground forces, this explanation gets less attention than the others. For an argument that emphasizes the effects of attrition, see Pape, "The Limits of Precision-Guided Air Power," p. 113. Keaney, "The Linkage of Air and Ground Power in the Future of Conflict," pp. 148–149, notes the effects of attrition, though he says this was less important than preventing the Iraqi forces from maneuvering.

20. For the best evidence supporting this argument, see Hosmer, *Psychological Effects of U.S. Air Operations*, pp. 141–173. See also *GWAPS Summary Report*, pp. 107–108; Pape, "The Limits of Precision-Guided Air Power," p. 113; Keaney, "The Linkage of Air and Ground Power in the Future of Conflict," pp. 148–149; and Levran, *Israeli Strategy after Desert Storm*, p. 29. John Mueller, "The Perfect Enemy: Assessing the Gulf War," *Security Studies*, Vol. 5, No. 1 (Autumn 1995), pp. 108–111, argues that low Iraqi morale was decisive, but that Iraqi morale had been broken even before the air campaign began.

21. Note that the explanations focusing on attrition, C₃I, and supply all overlap with the morale explanation because severe attrition, lack of adequate command and control, or lack of adequate supply could all contribute to a collapse of Iraqi morale. I distinguish between these explanations in the following manner: If air power caused a collapse of Iraqi morale through any mechanism—incessant bombardment, attrition, supply shortages, or disruption of C₃I—I credit the collapse to the morale theory because air power had shattered the Iraqis' will, not their capability. I credit the other theories only if air power destroyed Iraqi capability. For example, if air strikes damaged Iraqi C₃I to the point that Iraqi units could not effectively coordinate their actions, this would be evidence for the C₃I explanation. But if attacks on Iraqi C₃I made Iraqi soldiers feel isolated and abandoned in the theater, and made them unwilling to fight, I code this as success for the morale explanation.

22. The al-Khafji battle was significant because three Iraqi divisions attempted to advance into Saudi Arabia but were repelled by coalition air power and severely attrited. This battle demonstrates the potential lethality of U.S. air power against forces advancing in the open, but it stands in stark contrast to the inability of U.S. air power to destroy static units, and to the failure to inter-

coalition launched a ground offensive to liberate Kuwait and destroy as many of the remaining Iraqi ground forces as possible. Only four days later, a cease-fire was initiated and the war was over.

IRAQI GROUND FORCES AND DEPLOYMENTS

To understand the ground war, it is necessary to understand the ground forces, deployments, and strategy of the Iraqi military. On the eve of the ground war, Iraq had fifty-one divisions in the KTO. Its best forces in the theater were eight Republican Guard divisions manned by professional soldiers and handpicked for their loyalty to Saddam Hussein's Ba'ath Party. They received the best training and equipment of all the Iraqi armed forces. The heavy divisions²³ of the Republican Guard were armed with the best vehicles in the Iraqi army, principally T-72 main battle tanks and BMP infantry fighting vehicles. Nevertheless, these forces were substantially inferior to U.S. and British forces in both equipment and training.²⁴

The second-best Iraqi forces in the KTO were the nine heavy divisions of the regular army. Like the Republican Guard, these divisions were composed prin-

dict the maneuvers of the other Iraqi divisions during the ground war (see below). For a good account of the al-Khafji battle, see Gordon and Trainor, *The Generals' War*, pp. 267–288; and Lambeth, *The Transformation of American Air Power*, pp. 121–124.

23. "Heavy division" refers to any division with several hundred armored vehicles. Typically, there are two types of heavy division: armored divisions and mechanized infantry divisions. Each generally has 100 or more tanks and other armored vehicles. "Light divisions," by contrast, are typically infantry divisions without substantial numbers of armored vehicles.

24. The enormous technological advantages enjoyed by U.S. forces over the Republican Guard can be glimpsed by comparing the U.S. M1 tank with the Iraqi T-72. M1s were able to detect Iraqi vehicles out to 4,000 meters and hit them—usually with their first shot—beyond 3,700 meters. T-72s, by contrast, had difficulty detecting U.S. vehicles beyond 1,000 meters. Furthermore, U.S. tank rounds had no problem penetrating Iraqi tanks from any side out to their maximum range; even the machine guns on U.S. armored vehicles could destroy Iraqi T-72s from 700 meters. At that range, T-72s could not penetrate the frontal armor of M1s with their main guns, let alone with their machine guns. For data on the ability of U.S. weapons to penetrate the armor of Iraqi vehicles, see Battlefield Assessment Team, "Armor/Antiarmor Operations in Southwest Asia," Research Paper No. 92-0002 (Quantico, Va.: Marine Corps Research Center, July 1991), p. 15; U.S. Army Armor Center, "Desert Shield and Desert Storm Emerging Observations" (Fort Knox, Ky.: U.S. Army Military History Institute, October 7, 1991), pp. 1–12. For evidence on the inability of Iraqi rounds to penetrate the front of M1 tanks, see U.S. General Accounting Office (GAO), "Operation Desert Storm: Early Performance Assessment of Bradley and Abrams," January 1992, GAO/NSIAD-92-94, p. 24; and Ezio Bonsignore, "Gulf Experience Raises Tank Survivability Issues," *Military Technology*, Vol. 16, No. 2 (February 1992), p. 67. For data on the range disparities between U.S. and Iraqi tanks, see U.S. GAO, "Operation Desert Storm," p. 33; and U.S. Army Armor Center, "Desert Shield and Desert Storm Emerging Observations," pp. 1–10. A great overview of the breadth of the technological advantages enjoyed by the West over Soviet-designed tanks was written before the Gulf War. See Malcolm Chalmers and Lutz Unterseher, "Is There a Tank Gap? Comparing NATO and Warsaw Pact Tank Fleets," *International Security*, Vol. 13, No. 1 (Summer 1988), pp. 23–45.

cially of professional soldiers, but their equipment and training were not as good. Heavy divisions of the regular army were typically armed with T-55 main battle tanks and older armored personnel carriers (APCs). Although adequate for a third world military, these forces were inferior to the Republican Guard and substantially inferior to their U.S. and British counterparts.

The third class of Iraqi soldiers in the KTO—the frontline infantry—were conscripts deployed in thirty-four divisions near the Saudi border. They were given poor equipment and perfunctory training. Furthermore, because they were drawn predominantly from Iraq's rebellious Kurdish and Shi'a populations, who generally opposed Saddam's Ba'th Party, their enthusiasm for Saddam's war over Kuwait was suspect.²⁵ Even by third world standards, the frontline infantry divisions were extremely poor military units.

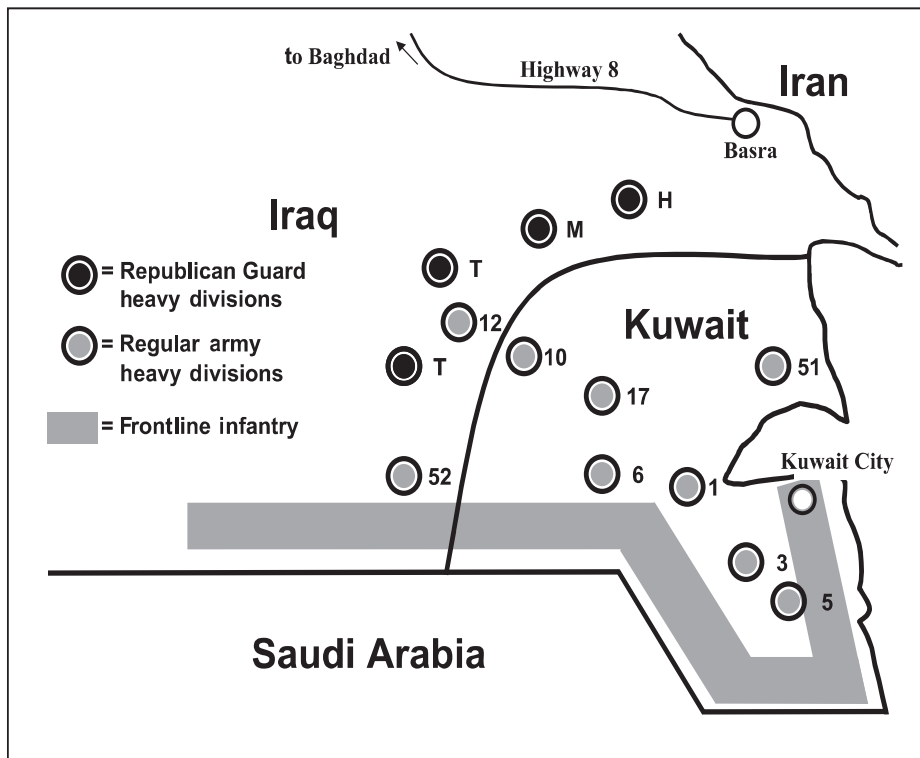
Figure 1 illustrates the approximate positions of the Iraqi forces at the beginning of the coalition's ground offensive. Iraqi frontline infantry divisions were deployed along the border between Kuwait and Saudi Arabia, along the Iraqi-Saudi border, and up the Kuwaiti coastline. Thick obstacle belts, including barbed wire and minefields, were built to buttress their positions. The frontline infantry were supported by the heavy divisions of the regular army, 25–50 kilometers to their rear. Behind these were three heavy divisions from the Republican Guard—the Tawakalna, Madinah, and Hammurabi—considered the most capable Iraqi units in the KTO.

Iraq had a reasonable strategy for defending Kuwait. The frontline infantry would slow the coalition's attack and channel it into two or three breakthrough sectors. Heavy divisions of the regular army would then counterattack into the coalition's breakthrough sectors. Finally, the heavy divisions of the Republican Guard would reinforce any parts of the Iraqi line being penetrated and counterattack the coalition forces.²⁶ Although the Iraqi deployment left their western flank exposed, the Iraqis understood how difficult it would be for the coalition forces to navigate and maintain supply lines across the nearly featureless desert. The Iraqis apparently did not anticipate the effectiveness of the U.S. global positioning system (GPS) and other navigation equipment, which

25. "According to an MIT dissertation on the Iraqi Army, by Ahmed Hashim, the front line divisions of the Iraqi Army were 70 percent Shiite and 20 percent Kurd." Cited in U.S. News and World Report, *Triumph without Victory*, p. 404.

26. Gordon and Trainor, *The Generals' War*, p. 287; and Kenneth M. Pollack, "The Influence of Arab Culture on Arab Military Effectiveness," Ph.D. dissertation, Massachusetts Institute of Technology, 1996, pp. 333–334.

Figure 1. Iraqi Ground Force Deployments.



NOTE: The Tawakalna, Madinah, and Hammurabi Divisions are indicated by T, M, and H, respectively. Note that the Tawakalna Division was divided and deployed in two locations separated by a few kilometers; it is therefore indicated in two places. Because the focus in this article is on the Iraqi heavy divisions, Iraq's light Republican Guard divisions are not indicated. See Central Intelligence Agency, *Operation Desert Storm: A Snapshot of the Battlefield*, Report IA 93-10022 (Washington, D.C.: Government Printing Office, September 1993); and Michael R. Gordon and Bernard E. Trainor, *The Generals' War: The Inside Story of the Conflict in the Gulf* (Boston: Little, Brown, 1995), p. 341.

allowed U.S. forces to move off-road across the desert without getting lost. But even U.S. commanders, who had a better sense of American capabilities, wondered whether the left hook was logistically possible.

The Iraqi leadership did not expect to "beat" the coalition ground forces. Rather, they hoped that by maneuvering their best units into the path of the coalition's offensive, they might be able to inflict several thousand U.S. casual-

ties. At that point, the Iraqis believed, the United States might be willing to negotiate a settlement to the war.²⁷

COALITION GROUND FORCES AND DEPLOYMENTS

The coalition plan for the ground war had two parts. First, two U.S. Marine divisions would attack up the middle into the teeth of the Iraqi defenses (see Figure 2). The primary goals of this attack were (1) to convince the Iraqis that this was the main coalition effort; (2) to draw the Iraqi reserves—especially the Republican Guard—south to counterattack the marines; and (3) to advance north and help the coalition’s Arab partners liberate Kuwait City.

The second part of the coalition’s plan was the U.S. Army operation. During the air campaign, the army secretly shifted its ground forces west so that they were no longer deployed south of Iraq’s main defenses in Kuwait. From this position, the army prepared to launch its left hook. The army’s offensive was supposed to start one day after the marine operation. If everything went according to plan, the Iraqis would respond to the marine attack by moving their reserves south. As this happened, the army would race around the Iraqi flank and envelop the Republican Guard.²⁸

Two U.S. Army Corps were tasked with executing the left hook. The VII Corps, the main effort, was ordered to find and destroy the Republican Guard. A lighter force, the XVIII Corps, was deployed farther west. Its mission was to advance rapidly across the mostly empty desert, get behind the Iraqi forces in the KTO, and prevent an Iraqi retreat.²⁹

DAY 1—FEBRUARY 24

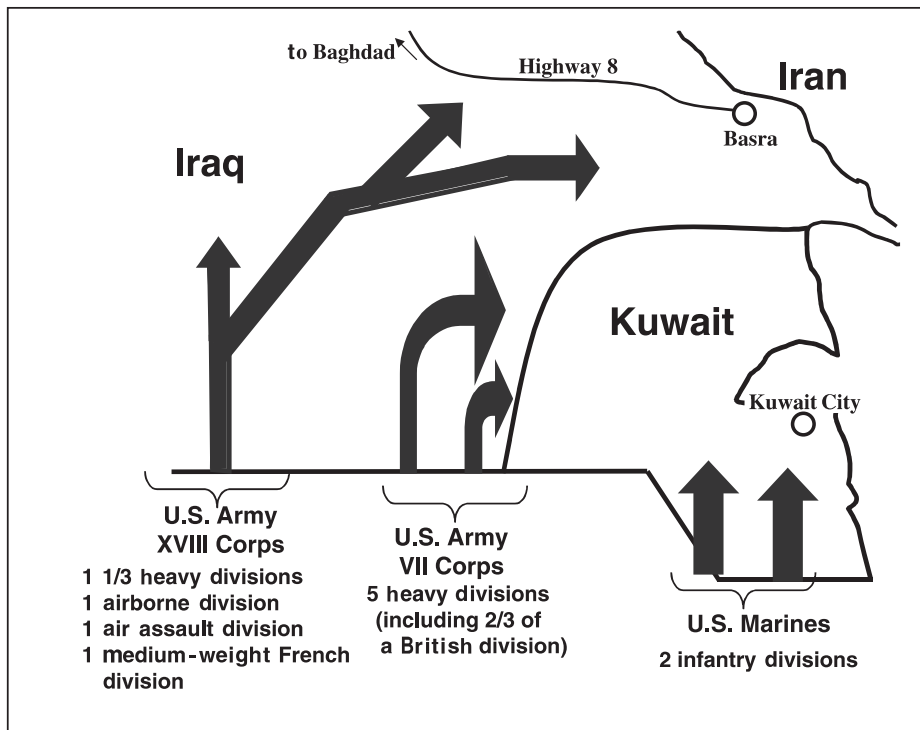
The marine ground attack started early on the morning of February 24 and began better than U.S. planners had expected. The marines met little resistance as

27. Gordon and Trainor, *The Generals’ War*, p. 180; and GWAPS, Vol. 2, Pt. 1, pp. 111–113, 125–126. For a statement that supports this view of Iraqi strategy, see Saddam Hussein, “Speech to the Islamic Conference,” *Baghdad Voice of the Masses*, January 11, 1991, in Foreign Broadcast Information Service (FBIS)—Near East 91-009; and “Interview with Yevgenni Primakov,” *Paris Europe Number One*, April 28, 1991, in FBIS—Soviet Union 91-083, p. 11. Both are cited in Pollack, “The Influence of Arab Culture on Military Effectiveness,” p. 97.

28. Some army units, such as the 82d Airborne and the 101st Air Assault Division, were supposed to start the same day as did the marines, but the main army effort was to begin the day after the marines attacked.

29. The VII Corps began the ground campaign with four heavy divisions—three and one-third U.S. heavy divisions and two-thirds of a British armored division. On the third day of the ground war, the corps was given another heavy U.S. division. The XVIII Corps, by contrast, was much lighter. Designed for quicker movement, it had one and one-third heavy divisions plus an airborne division, a helicopter–mobile air assault division, and a medium-weight French division.

Figure 2. Coalition Forces and Deployment Plans.

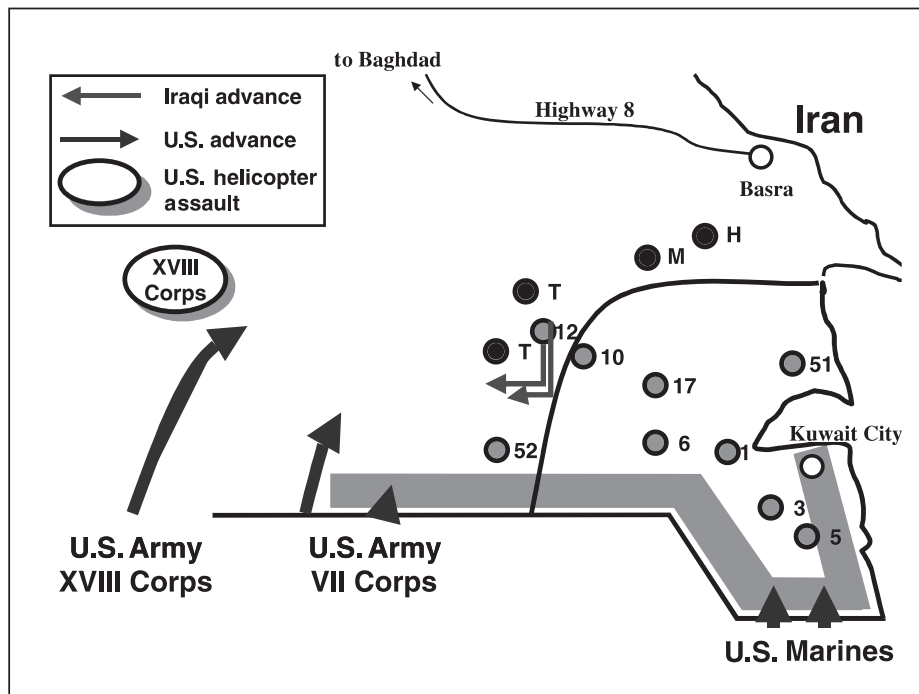


they advanced north into Kuwait. The Iraqi frontline infantry showed no interest in fighting, and thousands surrendered without firing a shot. The biggest problem for the marines on the first day was finding a way to keep track of, and care for, the Iraqi prisoners.³⁰ In fact, the marine offensive was going so well, and the Iraqis were showing so few signs of resistance, that U.S. commanders began to worry. If the Iraqis did not resist, the marine attack might not draw the Iraqi reserves south; instead the Iraqis might flee north before the U.S. Army had a chance to unleash the left hook.³¹ By midday, U.S. command-

30. See Charles J. Quilter II, *U.S. Marines in the Persian Gulf, 1990–1991: With the I Marine Expeditionary Force in Desert Shield and Desert Storm* (Washington, D.C.: Headquarters, United States Marine Corps [USMC], 1993), pp. 75–91; Gordon and Trainor, *The Generals' War*, pp. 355–363; and Scales, *Certain Victory*, pp. 221–222.

31. Gordon and Trainor, *The Generals' War*, p. 362.

Figure 3. Day 1—February 24.



ers decided to move up the army’s attack by one day, beginning its advance at dusk on February 24 (see Figure 3).

The XVIII Corps made great progress on February 24. They were deployed so far west that there were few Iraqis in front of them, so the ground element of the XVIII Corps charged quickly ahead into the Iraqi desert. A helicopter assault moved other units from the XVIII Corps 100 kilometers into Iraq toward Highway 8, the main road connecting Basra with Baghdad.³²

The VII Corps, the U.S. Army’s main force, proceeded more slowly than either the marines or the XVIII Corps. Facing nothing but open desert, the western half of the VII Corps (like the XVIII Corps to the west) charged ahead for the first few hours of the attack. But the eastern side of the VII Corps had to breach minefields and other obstacles before they could advance into Iraq.

32. Scales, *Certain Victory*, pp. 217–220, 254–256.

Rather than allowing his forces to conduct the dangerous breaching operation at night, the VII Corps commander halted both wings of the corps until dawn.³³

At the end of the first day of ground combat something unexpected happened. Late on the evening of February 24, only six hours after the army had launched its surprise attack in the west, the Iraqi military began to react to the left hook. Senior Iraqi military leaders ordered two brigades of the 12th Armored Division to move west to defend against a possible coalition attack coming from that direction (see Figure 3).³⁴ The movement of the Iraqi brigades was tracked by U.S. JSTARS surveillance aircraft.³⁵

DAY 2—FEBRUARY 25

The second day of the coalition attack involved serious fighting for the marines, but no significant engagement for the U.S. Army or British forces in the left hook. The day began with a nasty surprise for the marines. Early on the morning of February 25, as the marines prepared to advance north, forces from two Iraqi divisions counterattacked. One Iraqi brigade (from the 5th Mechanized Division), which had been deployed in the thick smoke around a burning Kuwaiti oil field, attacked the flank of a marine division. Although initially caught off guard, the marines quickly recovered and routed the Iraqis, suffering no fatalities in the process.³⁶ In the second battle, a brigade from

33. Gordon and Trainor, *The Generals' War*, pp. 375–380.

34. A brigade is approximately one-third the size of a division. Some histories have argued that a brigade of the Tawakalna Division also moved on February 24. I do not believe that this is correct, but if it is true, it strengthens my argument. I benefited from discussions with Kenneth Pollack on this point. The movement of the Iraqi reserves is described in Central Intelligence Agency (CIA), *Operation Desert Storm: A Snapshot of the Battlefield*, Report IA 93–10022 (Washington, D.C.: GPO, September 1993); Scales, *Certain Victory*, p. 238; and Swain, “*Lucky War*,” pp. 230, 233.

35. The Iraqi order to maneuver west was intercepted by U.S. intelligence. See Atkinson, *Crusade*, pp. 438–439. JSTARS, which stands for joint surveillance target attack radar system, is an aircraft with sophisticated radar equipment that allows it to track the movement of vehicles on the ground over several hundred square kilometers. JSTARS tracked the movement of the 12th Armored Division. A reproduction of a JSTARS radar picture of this Iraqi maneuver can be found in Scales, *Certain Victory*, p. 248.

36. For details on this battle, see Press, “Lessons from Ground Combat in the Gulf,” pp. 139–143, which is based on the two best high-resolution descriptions of the battle: an unpublished history by John H. Turner, USMC, “Counterattack: The Battle at Al Burqan,” March 1993; and Charles H. Cureton, USMC Reserve, *U.S. Marines in the Persian Gulf, 1990–1991: With the 1st Marine Division in Desert Shield and Desert Storm* (Washington, D.C.: Headquarters, U.S. Marine Corps, 1993), pp. 91–96. Turner was the operations officer in the regiment of the 1st Marine Division that bore the brunt of the main Iraqi attack.

another Iraqi division attacked the 2d Marine Division. The Iraqis were easily defeated.³⁷

Out west, the XVIII Corps continued its rapid advance through Iraq. U.S. light infantry units conducted a helicopter assault into positions astride Highway 8, and the ground force continued to race ahead, essentially unopposed, through the desert (see Figure 4).

The VII Corps advanced into Iraq and fought two minor battles. The British 1st Armored Division (under command of the VII Corps) overran the Iraqi 52d Armored Division, which had been targeted during the air war for especially heavy air attack, and defeated it without much of a fight. The U.S. 2d Armored Cavalry Regiment, in the western half of the VII Corps advance, encountered the lead brigade of the Iraqi 12th Armored Division, the unit that had been ordered to move west the day before. Already significantly attrited by air power as it moved west³⁸—30 of the 90 Iraqi tanks had been destroyed³⁹—the Iraqi brigade was easily defeated.

At the end of the second day of the ground war, Iraq made two surprising responses to the coalition attack. First, Baghdad radio announced that the Iraqi army, having been victorious, would pull out of Kuwait; the Iraqi army immediately began its retreat.⁴⁰ Second, Iraq shifted more of its forces west to block the left hook. Two brigades of the Tawakalna Republican Guard Division, a brigade of the 12th Armored Division, the 17th Armored Division, and two other heavy divisions of the Republican Guard—the Madinah and the Hammurabi Divisions—all began moving west.⁴¹

As the Iraqis maneuvered, U.S. surveillance aircraft detected a column of Iraqi vehicles moving north out of Kuwait City; hundreds of coalition aircraft attacked the Iraqi column along what would be known as the Highway of Death. The air attack claimed 1,400 vehicles, mostly military trucks but also some civilian vehicles. Only about 30 Iraqi armored vehicles were among those destroyed in the attack.⁴²

37. For details on the 2d Marine Division's battle, see Quilter, *With the I Marine Expeditionary Force*, pp. 91–93; and Dennis P. Mroczkowski, *U.S. Marines in the Persian Gulf, 1990–1991: With the 2nd Marine Division* (Washington, D.C.: Headquarters, U.S. Marine Corps, 1993), p. 53.

38. Air power's interdiction of this Iraqi brigade is discussed later.

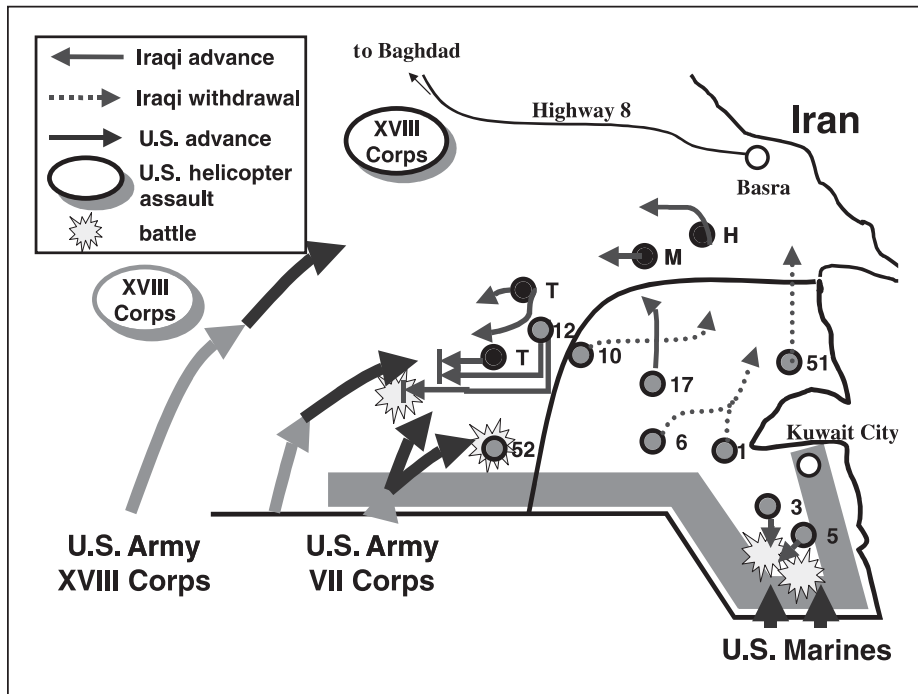
39. CIA, *Operation Desert Storm*; Scales, *Certain Victory*, pp. 233–235; and Clancy and Franks, *Into the Storm*, pp. 369–370.

40. Swain, "Lucky War," p. 250; and GWAPS, Vol. 2, Pt. 1, p. 307.

41. CIA, *Operation Desert Storm*; and Clancy and Franks, *Into the Storm*, pp. 369–370.

42. Despite the graphic pictures of the carnage, few Iraqis died along the Highway of Death. Mueller, "The Perfect Enemy," pp. 91–92. Nevertheless, the gruesome pictures of Iraqis killed in

Figure 4. Day 2—February 25.



At the end of the second day of the ground war, the battlefield was in great flux. Virtually all of Iraq's mobile forces in the Kuwaiti theater were on the move: Some were heading west to block the left hook; others were pulling out of the theater altogether. Meanwhile, the coalition forces were racing to close in on the Iraqis from the south and the west.

DAY 3—FEBRUARY 26

The third day saw the most serious ground combat of the war. U.S. Marines fought a series of small battles outside Kuwait City and then escorted Arab coalition forces to the outskirts of the city, so that the Arabs could officially liberate Kuwait. For the two marine divisions, the offensive was over.

these air attacks apparently had a powerful effect on the image of the battlefield that crystallized in the minds of war planners in Riyadh, leaders in Washington, and Americans in their living rooms. On the type of vehicles destroyed along the Highway of Death, see CIA, *Operation Desert Storm*.

For the U.S. Army, the war was just beginning. Two days after the Iraqi frontline infantry surrendered en masse, and a day after the Iraqis announced their withdrawal from Kuwait, the army finally found and engaged the Iraqi Republican Guard at their new, western-oriented lines of defense (see Figure 5).

On the western flank, the XVIII Corps continued advancing. Its heavy ground forces crossed Highway 8, fought a series of small engagements near the highway, and seized two Iraqi airfields. The 24th Infantry Division discovered supply depots filled with all kinds of Iraqi military equipment undamaged by the air campaign.⁴³

For the VII Corps, February 26 was the climactic day of the war. Throughout the day, five major battles were waged between elements of the VII Corps and two Iraqi divisions—the Tawakalna and the remnants of two brigades of the 12th Armored Division.⁴⁴ In every one of these battles, the Iraqis were on the defensive. The quality of the Iraqi defensive positions varied. Some were quite good, involving reverse-slope defenses,⁴⁵ minefields, dismounted infantry in trenches, and in some cases deep holes from which Iraqi tanks could briefly emerge, fire, and return to safety.⁴⁶ Other Iraqi positions were poor and suggest that some Iraqi units had moved into these positions only minutes before being attacked by the coalition.

The Iraqis encountered by the VII Corps on February 26 did not surrender, and in many cases they fought with courage; all their efforts, however, were futile. U.S. helicopters and tanks smashed the Iraqi armored forces they encountered; missiles fired from American helicopters, and the main guns on U.S. tanks, routinely destroyed Iraqi armored vehicles from thousands of meters away. In the dark of night, the Republican Guard infantry made easy tar-

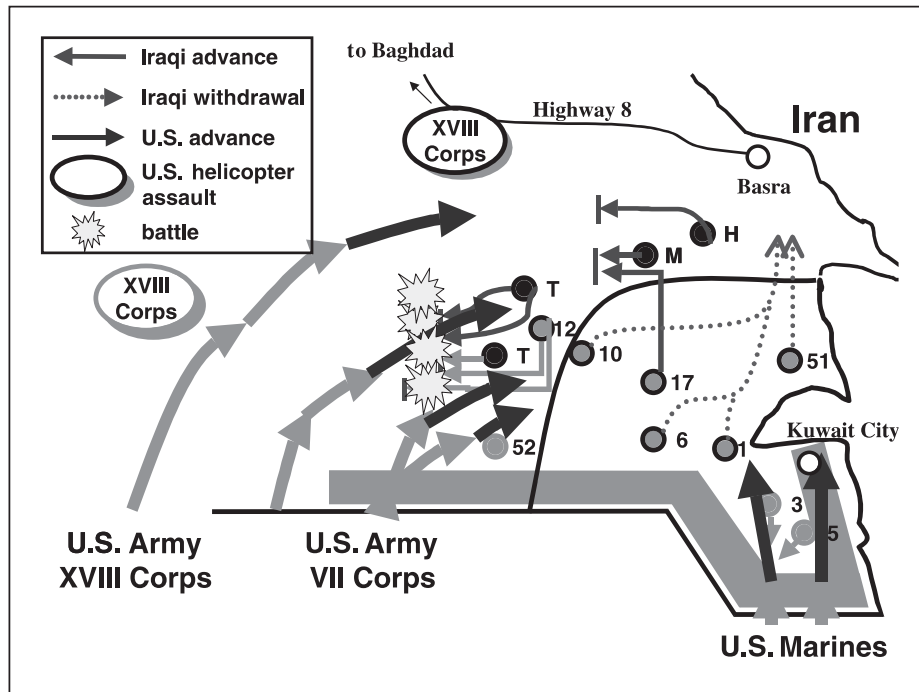
43. These supply dumps are described in more detail below. See Scales, *Certain Victory*, pp. 259, 306; and Atkinson, *Crusade*, p. 455.

44. Each of the five battles on February 26 that I call “major engagements” involved battalion-sized units or greater on both sides. An armored or mechanized battalion comprises approximately 50 armored vehicles (tanks, APCs, and infantry fighting vehicles). Of these battles, good data on both U.S. and Iraqi forces are available for three of them. These data are summarized in Table 1.

45. A reverse-slope defensive position is one established on the rear side of a hill near its crest. One purpose of this type of deployment is to neutralize an enemy’s superior weapon range. As the enemy crests the hill, defensive forces can engage them at short range.

46. Scales, *Certain Victory*, pp. 261, 270, 272–273, 284–285; U.S. News and World Report, *Triumph without Victory*, pp. 338–339; Clancy and Franks, *Into the Storm*, pp. 398–400; U.S. Army Armor Center, “Desert Shield and Desert Storm Emerging Observations,” pp. 2–33; and Pollack, “The Influence of Arab Culture,” pp. 346, 348, 352.

Figure 5. Day 3—February 26.



gets for U.S. and British tank gunners with thermal sights. And repeatedly, advanced armor protection on U.S. tanks saved American lives. Iraqi rounds ricocheted off U.S. vehicles or disabled the vehicles without killing the soldiers inside.⁴⁷

Despite the Iraqis' willingness to fight, these battles were astonishingly one-sided. In the five major battles on this day, approximately 350 Iraqi armored vehicles were destroyed. Hundreds of Iraqi soldiers in the vehicles and fighting on foot nearby were undoubtedly killed. Astonishingly, U.S. losses in these battles numbered one killed by enemy fire and twelve killed by friendly fire (see Table 1).⁴⁸

47. For a description of the technological advantages enjoyed by U.S. ground forces, see n. 24.
 48. See Biddle, "Victory Misunderstood," p. 147; Scales, *Certain Victory*, pp. 267–270, 272–281, 285; Atkinson, *Crusade*, p. 462; and U.S. News and World Report, *Triumph without Victory*, pp. 368–370.

Table 1. Major Ground Engagements in Operation Desert Storm.

Battle Number and Date	U.S. Unit (engaged elements)	Iraqi Unit	Iraq on: (offense/defense meeting)	Force Ratio (United States: Iraq)	U.S. Fatalities
#1* February 25	1st Marine Division (2 full-strength battalions)	5th ID (2 brigades at half strength)	meeting	1:1	0
#2 February 25	2d Marine Division (elements)	3d AD (elements)	meeting	NA	NA
#3 February 26	2d Marine Division	3d AD (elements)	defense	NA	NA
#4* February 26	2d ACR (3 troops, 65 armored vehicles)	Tawakalna Division (96 armored vehicles)	defense	1:1.5	1
#5 February 26	3d AD (elements of 1st and 2d Brigades)	Tawakalna Division (number of armored vehicles unknown)	defense	NA	5 (friendly fire)
#6* February 26	1st AD (1 battalion of 3d Brigade: 41 armored vehicles)	Tawakalna Division (45 armored vehicles)	defense	1:1	0
#7* February 26	1st ID (2 battalions of 1st Brigade; 120 armored vehicles)	Tawakalna Division and 12th AD (120 armored vehicles)	defense	1:1	1 (friendly fire)
#8 February 26	1st ID (3d Brigade)	12th AD	defense	NA	6 (friendly fire)
#9* February 27	1st AD (elements of 1st and 2d Brigades; 165 armored vehicles)	Madinah Division and 17th AD (110 armored vehicles)	defense	1.5:1	1

As the third day of the ground war came to a close, and the Tawakalna and the Iraqi 12th Armored Divisions were being decimated, the Madinah and Hammurabi Republican Guard Divisions continued to move west into blocking positions. Elements of the 17th Armored Division deployed alongside the Madinah. Other Iraqi units in the KTO continued to flee (see Figure 5).

DAY 4—FEBRUARY 27

The fourth day of the ground war was anticlimactic. The XVIII Corps continued its advance east, fighting several minor battles and preparing to surround the remaining Iraqi forces from the north (see Figure 6). The VII Corps had one more battle to fight. One of its divisions—the U.S. 1st Armored Division—crested a hill and discovered a brigade of the Madinah Division 3 kilometers in the distance. At that range, U.S. armored vehicles could hit the Iraqis, but Iraqi fire could not reach the Americans. The U.S. tanks, supported overhead by attack helicopters, slowly advanced while shooting at every Iraqi vehicle they could see. The 1st Armored Division destroyed the brigade of the Madinah Division; only one U.S. soldier was killed by enemy fire in this battle.⁴⁹ A cease-fire took effect early on the morning of February 28.

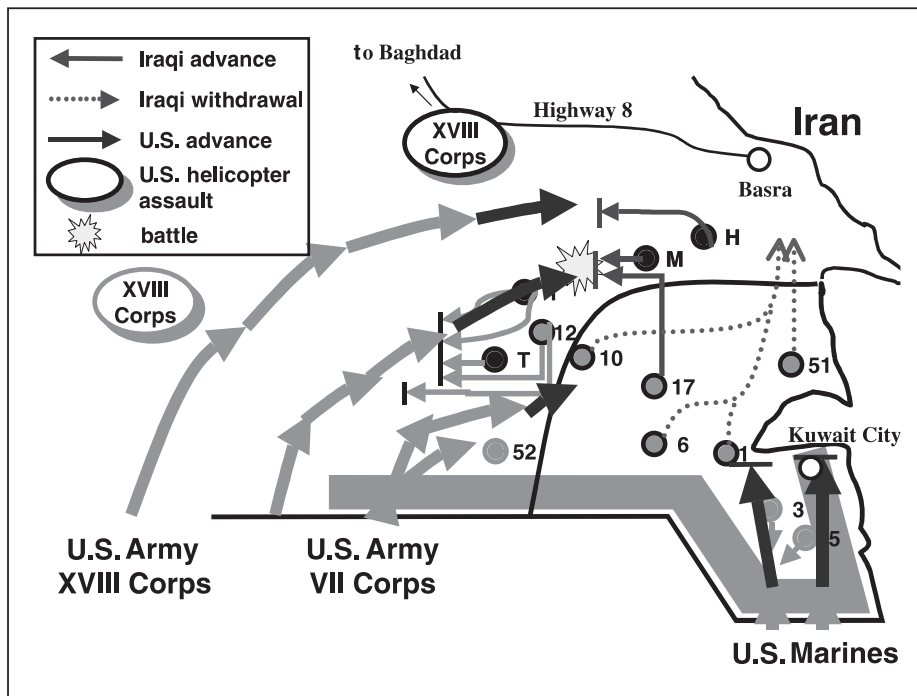
NOTE: The five battles with an asterisk next to the date (1, 4, 6, 7, and 9) are those for which there are good data about the forces on both sides. All force numbers are approximate and are based on author's analysis. In the column listing U.S. fatalities, the notation "friendly fire" indicates that all U.S. fatalities in that battle were from friendly fire.

ABBREVIATIONS: NA means the data are not available. ID is infantry division, AD is armored division, ACR is armored cavalry regiment, which equals approximately 1/3 of an armored division.

SOURCES: The data for this table were compiled from Charles H. Cureton, USMC Reserve, *U.S. Marines in the Persian Gulf, 1990–1991: With the 1st Marine Division in Desert Shield and Desert Storm* (Washington, D.C.: Headquarters, U.S. Marine Corps, 1993), pp. 91–96; Charles J. Quilter II, *U.S. Marines in the Persian Gulf, 1990–1991: With the I Marine Expeditionary Force in Desert Shield and Desert Storm* (Washington, D.C.: Headquarters, United States Marine Corps [USMC], 1993), pp. 91–93; Dennis P. Mroczkowski, *U.S. Marines in the Persian Gulf, 1990–1991: With the 2nd Marine Division* (Washington, D.C.: U.S. Marines Headquarters, 1993), p. 53; John H. Turner, "Counterattack: The Battle at Al-Burqan," unpublished manuscript, March 1993; Robert H. Scales, *Certain Victory: The U.S. Army in the Gulf War* (Washington, D.C.: Brassey's, 1997), pp. 221–222, 270, 281–285, 292–300; Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (Boston: Houghton Mifflin, 1993), pp. 466–467; Tom Donnelly and Sean Naylor, *Clash of Chariots: The Great Tank Battles* (New York: Berkley, 1996), pp. 259, 266–272; U.S. News and World Report, *Triumph without Victory: The Unreported History of the Persian Gulf War* (New York: Random House, 1993), pp. 377–391; Central Intelligence Agency, *Operation Desert Storm: A Snapshot of the Battlefield*, Report IA 93–10022 (Washington, D.C. Government Printing Office, September 1993); Richard M. Bohannon, "Dragon's Roar: 1–37 Armor in the Battle of 73 Easting," *Armor*, Vol. 101, No. 3 (May–June 1992), pp. 11–17; Gregory Fontenot, "Fright Night: Task Force 2/34 Armor," *Military Review*, Vol. 7, No. 1 (January 1993), pp. 38–52; and W.M. Christenson and Robert A. Zirkle, "73 Easting Battle Replication—A Janus Combat Simulation," P-2770 (Alexandria, Va.: Institute for Defense Analyses, September 1992), pp. A-8, 11.

49. Scales, *Certain Victory*, pp. 292–300.

Figure 6. Day 4—February 27.



Testing the Air Power Explanations

In this section I test five explanations for how air power might have neutralized the Iraqi ground forces. These explanations are that air power (1) prevented the Iraqi forces from maneuvering, (2) severed their C₃I, (3) cut Iraqi supply lines, (4) attrited the Iraqi forces, and (5) broke Iraqi morale. At the end of this section, I consider the possibility that air power neutralized the Iraqi ground forces through the cumulative effects on Iraqi maneuver, C₃I, supply, force numbers, and morale.

DID AIR POWER PREVENT THE IRAQIS FROM MANEUVERING?

The predictions from this explanation are straightforward: If this explanation is correct, the Iraqi forces, especially the mobile reserves, should have been largely stationary during the ground war. If they tried to move, this explanation predicts that they should have been attacked savagely by coalition aircraft,

either destroying them or forcing them to hunker down and abandon their attempts to maneuver.

The claim that coalition air power neutralized the Iraqi ground forces by preventing them from maneuvering is clearly wrong. During the ground war, virtually all of Iraq's mobile divisions—which comprised nearly all of Iraq's combat power—were on the move. Of the nine heavy divisions of the regular army in the KTO, two counterattacked south into the marines, two moved west into blocking positions to oppose the left hook, and four fled north after the general retreat was ordered. Only one (the 52d Armored Division) did not move; it was deployed very close to the Iraqi-Saudi border and was overrun within hours of the beginning of the ground war. All three heavy divisions of the Republican Guard moved west to block the path of the VII Corps. Coalition air power did not pin down the heavy Iraqi divisions in the KTO.⁵⁰

Furthermore, the Iraqis were not savaged by air power during their maneuvers. More than 3,000 Iraqi armored vehicles were on the move during the ground war, and only about 150 of these were destroyed in concentrations along the roads by coalition aircraft. More important, almost all of the vehicles destroyed along the roads were moving north to withdraw from the theater rather than west to oppose the left hook.⁵¹ For example, on the night of February 25, the U.S. Air Force decimated a column of retreating Iraqis along the Highway of Death; but while this was happening, all three Republican Guard heavy divisions and two heavy divisions of the Iraqi army were moving west to block the left hook. The heavy divisions moving west to fight were hardly hit as they maneuvered.⁵²

Clearly, coalition air power was capable of destroying Iraqi vehicles moving along the roads; air power did this very effectively during the battle of al-Khafji and on the Highway of Death. But coalition air power failed to pin down the good units in the Iraqi military (the Republican Guard or heavy divisions of the army) as they moved west to fight the VII Corps.⁵³

50. Air power did not pin down the light divisions of the Republican Guard either. The Adnan Division moved west to block the left hook; the Republican Guard Special Forces Division and the Baghdad Division were shifted north toward Baghdad to protect the capital, and the al-Faw Division was sent toward Basra. See CIA, *Operation Desert Storm*; and Pollack, "The Influence of Arab Culture," pp. 344–345.

51. CIA, *Operation Desert Storm*.

52. Only one concentration of 30 Iraqi vehicles was destroyed along the road by coalition air power as it headed west. Those were from the Iraqi 12th Armored Division. They were attacked as they maneuvered west during the first day of the ground war. *Ibid.*

53. Why did coalition aircraft fail to destroy the Republican Guard as it maneuvered west to fight the VII Corps? This is still a mystery, and an important one, but there are at least four plausible ex-

DID AIR POWER SEVER IRAQI C₃I?

According to this explanation, air power neutralized the Iraqi army by cutting their C₃I, effectively blinding them to the coalition's moves and making it impossible for the Iraqis to coordinate their defense. If this explanation is correct, we would expect to see an Iraqi army that either did not react to coalition moves, did not react quickly, or did not react well. The Iraqi ground forces should have been confused and disorganized.

There are signs that Iraqi C₃I suffered from coalition attacks. When Saddam Hussein ordered the attack on al-Khafji, he called the corps commander who would execute the attack back from the KTO to Baghdad to give him the orders in person. This may or may not have caused problems with the al-Khafji attack, but it is a sign that Saddam Hussein no longer trusted his C₃I capability. Another sign of Iraq's degraded C₃I capability appeared during the ground war: The Iraqi corps commander communicated emergency orders to redeploy several Iraqi divisions without encryption, allowing U.S. intelligence to intercept the conversation.

Despite the attacks on Iraq's C₃I system, the Iraqi senior military commanders retained surprisingly good command and control throughout the war.⁵⁴ For example, they identified the left hook with remarkable speed. Only six hours after the U.S. Army launched this operation, the Iraqi corps commander had a strong enough sense that something important was happening out west to maneuver two heavy brigades to new west-facing blocking positions. A day later, apparently convinced (correctly) that the main U.S. effort was coming in the left hook, he deployed his best divisions west. That he correctly identified the location of the main coalition attack so quickly is remarkable because Iraqi defenses were collapsing on all fronts. Given the speed with which Iraq's southern Kuwaiti defenses were crumbling, it is surprising that Iraqi leaders could tell that the marines' attack was not the main effort.

Not only did Iraq's senior military commanders identify the left hook quickly, but they successfully ordered a reasonable response. The Iraqi reserves

planations: (1) U.S. intelligence assets did not detect the movement of the Republican Guard or did not process the data quickly enough; (2) poor weather conditions prevented coalition aircraft from attacking the Republican Guard; (3) coordination problems existed between the coalition's air planners and the ground commanders, and the fear of fratricide prevented air attacks; and (4) old-fashioned "fog of war" prevented senior U.S. commanders in Riyadh from developing a clear picture of the chaotic battlefield, so they never recognized that the Iraqis were establishing a coherent blocking position to oppose the left hook.

54. Hosmer, *Psychological Effects of U.S. Air Operations*, p. 48, notes that Iraqi C₃I survived the air campaign in reasonably good shape. See also Scales, *Certain Victory*, pp. 332–333.

obeyed the order to maneuver into the oncoming coalition forces despite the risks involved. In sum, despite the weeks of air bombardment, Iraqi commanders still had enough capability to identify the coalition maneuver, formulate a good response, communicate it to their forces, and get the desired reaction. Iraqi commanders got their best divisions into the right place to defend against the left hook; the Iraqi military was not neutralized by air attacks on the C₃I network.

DID AIR POWER CUT IRAQI SUPPLY LINES?

There are two versions of the argument that air power neutralized the Iraqi ground forces by severing Iraqi supply lines. One version claims that air power degraded the Iraqi supply situation so significantly that it broke Iraqi morale. The second posits that air power denied Iraqi forces the supplies that they needed to fight effectively. Version one of the “supply” argument is a variant of the “morale” argument, which I address later. Here I test the second argument.

When the ground war began, Iraqi supplies in the KTO were plentiful. Many Iraqi supply dumps were enormous, with thousands of individual bunkers scattered over tens of acres.⁵⁵ Air strikes could whittle away at the enormous stockpiles of supplies, but even after five weeks of bombing, the stockpiles were only slightly down.⁵⁶ This should not be surprising; the Iraqis had five months to amass supplies in the theater before the air campaign began. Furthermore, the Iraqi ground forces were in stationary defensive positions from August 1990 through February 24, 1991, so they did not consume many of their supplies.⁵⁷ As a result, when U.S. forces advanced through Kuwait, and especially through southeast Iraq, they overran supply dumps totaling thousands of bunkers filled with food, fuel, and ammunition.⁵⁸

55. For example, one U.S. division found “an immense dump, seventy-odd square miles covered with more than a thousand storage bunkers—enough ammunition to supply an army for many months.” Atkinson, *Crusade*, p. 455. At another site, the Iraqi air base at al-Tallil, there “was the center of a ten-mile-square network of deep, well-camouflaged bunkers full of weapons, ammunition, and other supplies that had been reserved specifically to provision and maintain Iraq’s army in Kuwait.” U.S. News and World Report, *Triumph without Victory*, p. 376.

56. Winnefeld, Niblack, and Johnson, *A League of Airmen*, p. 152, write: “Supply depots were so numerous and large that they could not be eliminated; however, they were methodically attacked throughout the war, resulting in moderate reduction in stored materials.

57. *GWAPS Summary Report*, p. 99.

58. For example, on the third day of the ground war, the U.S. 1st Armored Division captured “more than 100 tons” of munitions at an Iraqi supply depot near the town of al-Busayya. Schubert and Kraus, *The Whirlwind War*, p. 188. This logistics dump “contained enough fuel, ammunition, and food to support an entire armored corps.” U.S. News and World Report, *Triumph without Victory*, p. 325. On the first day of the ground war, the British 1st Armored Division “overran several

Not only did the supply dumps survive the air war, but the supplies got to the Republican Guard and the heavy divisions of the regular army. Iraq deployed the Republican Guard and several of the army heavy divisions near major supply dumps; in many cases these divisions were located on top of huge complexes of supply bunkers.⁵⁹ The proof that the Iraqi armored and mechanized divisions had adequate supplies to maneuver and fight is that when the war started, they did maneuver and they did fight. There is no sign that supply shortages prevented the mobile Iraqi divisions from moving where they wanted to go. And rather than surrender when they made contact with coalition forces, the Republican Guard and the other heavy divisions fought.

The supply situation was much bleaker for the Iraqi frontline infantry. These divisions suffered from severe shortages of food, water, and other necessities. It is not possible to know whether the frontline infantry still had the capability to fight when the ground war began because they lacked the will to resist. Whether it was air power that broke the morale of the frontline infantry—by denying them supplies, by attriting them, or by some other effect—is discussed below in the section on morale.

Air power did not neutralize the Iraqi army by severing its supply lines. Air attacks greatly reduced the flow of critical supplies to the frontline infantry, but the heavy divisions of the Iraqi army—and all the forces in the Republican Guard—still had the food, fuel, and ammunition they needed to fight when the ground war began.

DID AIR ATTACKS ATTRIT THE IRAQIS TOO HEAVILY FOR THEM TO RESIST?

There are two versions of the argument that air power neutralized Iraq's ground forces through attrition: (1) attrition during the air campaign destroyed

huge logistics sites" in Iraq within a few kilometers of the Saudi border. Scales, *Certain Victory*, p. 245. See also Swayne, "Lucky War," p. 244; Scales, *Certain Victory*, p. 259; and Clancy and Franks, *Into the Storm*, pp. 357–358.

59. When the Tawakalna Division moved west to block the left hook, it deployed into an area that had been prepared for a defense. The new area had bunkers full of supplies. When the U.S. Army's 2d Armored Cavalry Regiment hit the Tawakalna, U.S. artillery knocked out 27 ammunition bunkers (Scales, *Certain Victory*, p. 262) containing "large stockpiles of fuel, ammunition, and other supplies," including about 65 trucks (Clancy and Franks, *Into the Storm*, pp. 357–358). A few hours later, when the U.S. 1st Infantry Division attacked another element of the Tawakalna and the Iraqi 12th Armored Division, it reported that the Iraqis were deployed next to ammunition bunkers. Secondary explosions from these bunkers proved that they were full of supplies. See U.S. News and World Report, *Triumph without Victory*, pp. 349–350; and Scales, *Certain Victory*, p. 285. When the Madinah Division deployed west to block the left hook along with the Iraqi 17th Armored Division, they both deployed next to a large Iraqi supply dump. See Scales, *Certain Victory*, 293; and Clancy and Franks, *Into the Storm*, pp. 369–370.

Iraqi morale, leading them to surrender; and (2) Iraqi ground forces were attrited so heavily during the air campaign that they were hopelessly outnumbered in the major battles of the ground war. The first version is addressed in the next section. Here I consider the second explanation.⁶⁰

Iraq's ground forces were heavily attrited during the air campaign. The best analyses of Iraqi attrition from air attacks conclude that 40 percent of Iraq's armored vehicles in the KTO were neutralized during the air war.⁶¹ This figure probably overstates the percentage destroyed by air power,⁶² but the attrition suffered by the Iraqi ground forces from air attacks was clearly very heavy.

Despite the heavy losses, the Iraqis had enough armored vehicles in the KTO to defend themselves from the coalition ground attacks. There were nine major ground engagements during the Gulf War. High-resolution data are available for five of these, making it possible to estimate the force ratios involved in these engagements (see Table 1).⁶³ One of these battles was a meeting engagement: That is, the two armies ran into each other as they moved across the desert, so neither side was on the defensive. In the other four, the Iraqis were on the tactical defense.

60. A related argument concedes that air power did not neutralize Iraq's ground forces through attrition, but argues that this attrition made the ground battles much more one-sided than they would have been otherwise. This argument is addressed later in this article; here I focus on the question: Did air attacks reduce the size of the Iraqi ground forces to the point that they were hopelessly outnumbered?

61. These estimates were made using the following method: Any Iraqi vehicle that neither moved nor fought during the ground war was coded as a casualty of the air war. Even if there was no sign that the vehicle was hit by an air-delivered weapon, it was credited as an air-war kill. This counting rule correctly accounts for both the direct and indirect effects of the air attacks. Vehicles directly destroyed by an air-dropped bomb would be included in this total, as would any vehicle indirectly neutralized by air power for one of the following reasons: its crew was killed in an air attack, the crew was scared away by an air attack, or the vehicle could not be maintained properly because its crew feared an air attack. See CIA, *Operation Desert Storm*.

62. Although the counting rule for assessing Iraqi vehicles neutralized during the air war appropriately counts both air power's direct and indirect effects on the Iraqi ground forces, it should be noted that this method probably overstates the effects of air power, because it also credits air attacks for vehicles disabled during the air war by things that had nothing to do with air power. For example, Iraqi crews who abandoned their vehicles on February 24 because they feared the ground attack would be scored as an air-war kill using this metric. So a large fraction of the 40 percent of abandoned Iraqi vehicles may have been from non-air power effects. Forty percent then should be taken as a maximum for the attrition of Iraqi ground forces during the air war.

63. In this section I examine only the numerical balance of Iraqi and coalition ground forces in the major battles; I exclude the qualitative differences between these two forces. I do this to separate two different causal explanations for the one-sided rout of the Iraqis. One explanation is that the Iraqis lacked sufficient numbers to fight, largely because of attrition during the air campaign. A competing argument is that the Iraqis were hopelessly outmatched by U.S. ground force capabilities (e.g., training and technology). By focusing here on raw numbers—specifically, the quantity of armored vehicles in these battles—I distinguish between the effects of air power (which reduced the number of Iraqi vehicles) and the effects of superior ground forces.

Military professionals and analysts have long recognized that in tactical engagements, defenders can often hold out against substantially larger attacking forces. Some analysts argue that defenders can usually stave off an enemy that is up to three times bigger; others argue that three to one is not a meaningful threshold. But most analysts agree that defenders enjoy some tactical advantages that allow them to defend against larger attacking forces.⁶⁴

In all four of the major battles in which the Iraqis were on the defensive, Iraq had sufficient numbers to fight effectively. In one of these engagements (battle 9 in Table 1), the Iraqis were slightly outnumbered (by 1.5:1)—a ratio that should have been satisfactory for Iraq given that their forces were dug into defensive positions. But in this battle, approximately 165 American armored vehicles destroyed 110 Iraqi tanks and infantry fighting vehicles, and the Iraqis killed only one U.S. soldier.⁶⁵ In two of these (battles 6 and 7), the U.S. and Iraqi forces had essentially equal numbers. In the other engagement (battle 4), the Iraqi forces had a 1.5:1 numerical advantage over the United States.⁶⁶ De-

64. In this article I do not rely on the 3:1 rule; I simply argue that given defensive advantages, Iraq had sufficient numbers in all five well-documented ground battles to fight effectively. On defender advantages, see John J. Mearsheimer, "Assessing the Conventional Balance: The 3:1 Rule and Its Critics," *International Security*, Vol. 13, No. 4 (Spring 1989), pp. 54–89; John J. Mearsheimer, "Why the Soviets Can't Win Quickly in Central Europe," *International Security*, Vol. 7, No. 1 (Summer 1982), pp. 3–39; and Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, N.Y.: Cornell University Press, 1991), pp. 72–73 (especially n. 3), pp. 119–120 (especially Table 3.7).

65. The U.S. forces were from the 1st Armored Division; the Iraqis included elements of the Madinah Republican Guard Division and the 17th Armored Division. The main engagement in this battle was between the 2d Brigade of the U.S. 1st Armored Division and the 2d Brigade of the Madinah. The U.S. forces attacked with nine tank companies in a line, totaling approximately 165 M1 tanks; they destroyed about 110 Iraqi armored vehicles (about 65 tanks and 45 armored personnel carriers). See Atkinson, *Crusade*, pp. 466–467; CIA, *Operation Desert Storm*; U.S. News and World Report, *Triumph without Victory*, pp. 377–391; Tom Donnelly and Sean Naylor, *Clash of Chariots: The Great Tank Battles* (New York: Berkley, 1996), pp. 266–272; and Scales, *Certain Victory*, pp. 292–300.

66. In battle 6, the U.S. 1st Armored Division attacked elements of the Tawakalna Division. One battalion-sized armored task force from the 3d Brigade of the U.S. 1st Armored Division attacked elements of the 29th Brigade of the Tawakalna Division. The U.S. battalion attacked with 41 M1 tanks. Almost all the sources on the battle, including firsthand reports, claim that the Iraqis lost between 40 and 45 armored vehicles. See CIA, *Operation Desert Storm*; Donnelly and Naylor, *Clash of Chariots*, p. 259; and Richard M. Bohannon, "Dragon's Roar: 1–37 Armor in the Battle of 73 Easting," *Armor*, Vol. 101, No. 3 (May–June 1992), pp. 11–17. The only account that lists substantially higher numbers for the Iraqis is Scales, *Certain Victory*, p. 270, who reports that 150 Iraqi armored vehicles were destroyed.

In battle 7, the U.S. 1st Infantry Division fought elements of two Iraqi divisions: the Tawakalna and 12th Armored Division. There is more uncertainty about the numbers in this battle, but the biggest engagement between these divisions involved two U.S. battalion-sized task forces from the 1st Brigade of the 1st Infantry Division (which totaled about 120 armored vehicles) against 100–140 Iraqi armored vehicles. The number of Iraqi vehicles can be estimated from Scales, *Certain Victory*,

spite Iraq's defensive advantages and these favorable force ratios, the Iraqis managed to kill only one U.S. soldier in these four battles, while they lost more than 250 armored vehicles.⁶⁷

In the meeting engagement (battle 1), the Iraqis and the marines had roughly equal numbers of forces. Nevertheless, the Iraqis were defeated in another extraordinarily one-sided fight. More than 100 Iraqi vehicles were destroyed, and no marines were killed. The Iraqis had sufficient numbers in this battle, but they were nevertheless totally ineffective.⁶⁸

Taken together, the one-sidedness of all nine battles is shocking. Judging by force size alone, the Iraqis should have won most of the major engagements. Instead they were defeated in all nine, lost more than 600 armored vehicles, and killed only two U.S. soldiers.⁶⁹ The Iraqis were entirely ineffective against U.S. ground forces, but air power had not neutralized them by reducing their numbers too far; Iraqi ground forces were simply unable to compete with the better-equipped and better-trained U.S. and British divisions.⁷⁰

DID AIR POWER BREAK IRAQI MORALE?

It is impossible to measure the morale of the Iraqi ground forces directly because morale exists in the minds of people. Morale must therefore be measured indirectly by examining behavior. More specifically, to assess the morale of any unit, one must evaluate the actions of the unit along two key dimensions: Did the unit follow orders, and did the unit fight? Based on these criteria, the morale of the heavy divisions of the Iraqi regular army, and especially the Republican Guard, appears to have been more than adequate when the ground war began.

pp. 281–285; and a firsthand account by Gregory Fontenot, "Fright Night: Task Force 2/34 Armor," *Military Review*, Vol. 73, No. 1 (January 1993), pp. 38–52.

Battle 4, between the U.S. 2d Armored Cavalry Regiment and elements of the Tawakalna Division and the 12th Armored Division, is one of the most carefully studied ground battles of the war. U.S. forces comprised 29 tanks and 37 Bradley armored vehicles. The Iraqis had approximately 96 armored vehicles, including 58 tanks and 38 APCs. See W.M. Christenson and Robert A. Zirkle, "73 Easting Battle Replication—A Janus Combat Simulation," P-2770 (Alexandria, Va.: Institute for Defense Analyses, September 1992), pp. A-8, 11.

67. *Ibid.*

68. See Press, "Lessons from Ground Combat in the Gulf," pp. 139–143; Turner, "Counterattack"; and Cureton, *U.S. Marines in the Persian Gulf War*, pp. 91–96.

69. The data on the number of Iraqi vehicles destroyed in each battle are undoubtedly imperfect. But because these engagements were so one-sided, errors in the size of the Iraqi forces are unlikely to change the conclusions.

70. For a preliminary exploration of some of the aspects of coalition ground forces that gave them such huge advantages over Iraqi ground forces, see Press, "Lessons from Ground Combat in the Gulf." For a conflicting view, see Biddle, "Victory Misunderstood."

Obeying some orders requires more esprit de corps than obeying others. For example, an order to “hold position and fight” requires greater morale from the soldiers executing it than an order to withdraw. An order to maneuver into the path of an enemy force requires an even higher level of morale. This is the order that the heavy divisions of the Republican Guard, and half the heavy divisions of the Iraqi army, received and obeyed on February 25 and 26.

All three heavy divisions of the Republican Guard received orders to move west to block the left hook, which they obeyed immediately.⁷¹ In fact, the morale of the Republican Guard was surprisingly high, given that they had just endured five weeks of aerial bombardment that had significantly reduced their forces. It would not have been surprising if the Republican Guard units had disobeyed orders and held their positions or fled north out of Kuwait. But two of these heavy divisions (the Tawakalna and the Madinah) maneuvered and then fought against the coalition; the other (the Hammurabi) moved toward the coalition and then withdrew after the cease-fire. Perhaps even more surprising, four of the heavy divisions in the regular army maneuvered to fight the coalition ground forces. Two of them maneuvered west, as ordered, and fought alongside the Republican Guard against the left hook; the other two counterattacked south.⁷² The four heavy divisions of the regular army that withdrew north were ordered to do so; there is no evidence that any of the heavy divisions—from the Republican Guard or the regular Iraqi army—refused to fight.⁷³

Furthermore, in the battles between the U.S. Army and the Iraqi heavy ground forces, there are numerous reports of Iraqi soldiers fighting with notable courage, especially among the Republican Guard. Dismounted Iraqi Republican Guard infantry attacked U.S. tanks from bunkers and trenches,

71. Two light Republican Guard divisions were also ordered to block the left hook, which they did. CIA, *Operation Desert Storm*.

72. The Iraqi 12th and 17th Divisions moved west to help block the left hook. The 3d and 5th Divisions attacked south into the marines.

73. In fact, the heavy divisions of the Iraqi army that stayed and fought were, on average, attrited more heavily during the air war than those that pulled out of the theater. This confirms that the heavy divisions that pulled out did so because of the orders we know they received, not because their morale was broken. This is based on data in *ibid.* and my analysis. The only heavy division of the Iraqi army that remained stationary during the ground war was the 52d Armored Division. It was deployed so close to the Saudi border that it was overrun almost immediately by the British 1st Armored Division without a fight. The British attack occurred after an intense aerial bombing and fierce artillery raid against the 52d Armored Division.

repeatedly hitting their targets with their ineffective handheld antitank weapons.⁷⁴ On several occasions, Iraqi infantry feigned death and then, once bypassed, jumped up and shot at the rear of U.S. vehicles.⁷⁵ Some Iraqi infantry jumped onto passing U.S. tanks, only to be shot off by trailing U.S. armored vehicles.⁷⁶ Several U.S. divisions reported encountering Iraqi tanks waiting with their engines off to avoid detection by the thermal sights on American armored vehicles. When the U.S. tanks passed the Iraqi positions, the Iraqi tanks would fire at the more vulnerable side or rear of the American vehicles.⁷⁷ And in several instances, Iraqi infantry and armor repeatedly counterattacked U.S. armored formations after American tanks had destroyed entire battalions of Iraqi armor in a matter of minutes.⁷⁸ Iraqi soldiers—even the professionals—were not well trained. Their shooting was extremely inaccurate, and they were hopelessly outgunned by U.S. technology. But the evidence does not suggest that the Iraqis were cowards. Many of them—particularly those in the Republican Guard—fought and died bravely.

Unlike the Republican Guard and the heavy divisions of the Iraqi army, the Iraqi frontline infantry melted away at first contact with coalition ground forces. There are no reports of the frontline infantry fighting with even moder-

74. U.S. tankers reported that when Iraqi antitank weapons (RPGs) hit their tanks, the weapons merely damaged the personal effects that the tank crews frequently strapped to the tops of their vehicles. Scales, *Certain Victory*, pp. 284–285.

75. The 2d Armored Cavalry Regiment reported Iraqis feigning death and then shooting antitank weapons at U.S. tanks from the rear. Atkinson, *Crusade*, pp. 443–445; and U.S. News and World Report, *Triumph without Victory*, p. 338. The 1st Infantry Division reported Iraqi infantry allowing themselves to be bypassed and then taking shots with their RPGs at the rear of U.S. tanks. Scales, *Certain Victory*, pp. 284–285; and Clancy and Franks, *Into the Storm*, p. 396.

76. See Clancy and Franks, *Into the Storm*, pp. 394–396; and Atkinson, *Crusade*, pp. 443–445.

77. The U.S. 1st Infantry Division experienced this with the Tawakalna. See Scales, *Certain Victory*, pp. 284–285. The 2d Armored Cavalry Regiment found Iraqis sitting with their vehicle engines off. U.S. News and World Report, *Triumph without Victory*, pp. 445–447.

78. The U.S. 3d Armored Division reported that infantry from the Tawakalna kept fighting and counterattacking its positions even after their armor was destroyed. Scales, *Certain Victory*, p. 279. The U.S. 1st Infantry Division reported that Iraqi antitank infantry teams from the Tawakalna kept hitting U.S. tanks, but to no effect. Then, “throughout the night, stubborn Iraqi antitank teams repeatedly emerged from previously bypassed positions to stalk the tanks and Bradleys. . . . American tankers had little trouble detecting the approaching Iraqis through thermal sights, and they cut them down like wheat with long bursts of coaxial machine-gun fire.” For a description of Iraqi resistance and counterattacks, see *ibid.*, pp. 284–285; and U.S. News and World Report, *Triumph without Victory*, pp. 368–370. The 2d Armored Cavalry Regiment reports that there were Iraqi company-sized counterattacks after the Battle of 73 Easting. Atkinson, *Crusade*, pp. 445–447. The U.S. 3d Armored Division reported a battalion-sized Iraqi armored counterattack early on the morning of February 27. Clancy and Franks, *Into the Storm*, pp. 398–400.

ate conviction, let alone demonstrating heroism.⁷⁹ What is clear about the frontline infantry is that they had very low morale when the ground war began; what is less clear is the reason for this low morale.

The best evidence in support of the argument that air attacks shattered the will of the Iraqi frontline infantry comes from Stephen Hosmer of the RAND Corporation. Hosmer reviewed transcripts of thousands of interviews with Iraqi prisoners of war conducted by the United States and Saudi Arabia in 1991. Most of the prisoners were frontline infantry, and almost all of them had surrendered without putting up a fight. The majority reported that the air bombardment had played a large role in their decision to surrender.⁸⁰

Hosmer's research is excellent, but other evidence suggests that air power may not have been the sole cause of the frontline infantry's collapse. The frontline infantry divisions suffered very different levels of bombing. Some along the Kuwaiti-Saudi border were attacked by thousands of coalition sorties, including large numbers of devastating B-52 strikes, and they surrendered. Others were hit with much less intensity, and few B-52 strikes, yet they also surrendered.⁸¹ In other words, there was considerable variation across the theater in how hard the Kurdish and Shi'a conscripts were bombed. Some of the divisions were not hit hard, but the result was the same everywhere: The frontline infantry did not fight.

More generally, the intensity with which a division was hit during the air war does not correspond to that division's willingness to fight. The heavy divisions of the Republican Guard were hit the hardest, but they were willing to fight. The Iraqi frontline infantry ahead of the marines, and many of the heavy divisions of the Iraqi regular army, were hit almost as hard as the Republican Guard; the heavy divisions fought, but the frontline infantry surrendered.⁸²

Skeptical readers might argue that the fact that there were so few U.S. casualties in these battles between U.S. forces and heavy Iraqi divisions proves that

79. See Quilter, *With the I Marine Expeditionary Force*, pp. 75–91; Gordon and Trainor, *The Generals' War*, pp. 355–363; and Scales, *Certain Victory*, pp. 221–222.

80. Hosmer, *Psychological Effects of U.S. Air Operations*, pp. 152–176.

81. The frontline infantry divisions far out in the west along the Iraqi-Saudi border were not hit hard during the air war because the coalition did not want to warn Iraq about the left hook, and because it wanted to maximize its effort to weaken the divisions in front of the marines. Yet even these western Iraqi divisions also surrendered immediately. For maps showing the location of each Iraqi division in the KTO and the distribution of coalition attacks against these forces, see *GWAPS*, Vol. 2, Pt. 1, pp. 211, 287.

82. *Ibid.*

the Iraqis did not fight.⁸³ But history shows that very one-sided outcomes such those in the Gulf War have happened before, when forces from the world's leading military power fights troops from the less developed world. When tactics and terrain allow the leading military power to bring its superior technology and training to bear, the results can be catastrophic for the locals. For example, in 1879 at the Battle of Ulundi in southern Africa, a British force using early machine guns achieved an exchange ratio in excess of 100:1 against the Zulu army, even though the Zulus reportedly fought bravely. A few years later, at the Battle of Omdurman in northern Africa, the British achieved an exchange ratio greater than 200:1.⁸⁴ The Gulf War was not a colonial war to acquire empire for the United States, but from the standpoint of military technology and training, the comparison is useful. Like the colonial troops, U.S. soldiers used superior technology and training to decimate their enemy in engagements in which the enemy had little chance of reciprocating. Even when the locals fought bravely, they never had a chance.⁸⁵

In sum, did the air campaign affect Iraqi morale? The answer is yes. Air power certainly contributed to the utter collapse of the frontline infantry, and it might be true that it single-handedly caused the infantry to disintegrate. But even after five weeks of bombing, the best Iraqi units—the Republican Guard and the heavy units of the regular army—were willing to maneuver into the path of U.S. forces and fight. Air attacks did not neutralize the Iraqi force by crippling their morale.

THE CUMULATIVE EFFECTS OF AIR POWER ON THE IRAQI GROUND FORCES

Air power did not neutralize the Iraqi army by destroying its ability to maneuver or its C₃I, supply, force numbers, or morale. But perhaps air attacks weak-

83. "You can hardly march two armored divisions past each other during peacetime without producing more casualties than those so-called battles," quipped a friend.

84. Bryan Perrett, *The Battle Book: Crucial Conflicts in History from 1449 to the Present* (New York: Sterling, 1992), pp. 225, 292; and Thomas Harbottle, *Dictionary of Battles* (New York: Stein and Day, 1971), pp. 208–209, 290.

85. The list of the U.S. technological advantages over Iraqi ground forces—including advanced sights that allowed U.S. tanks and APCs to see Iraqi vehicles four times as far as the Iraqis could see U.S. forces; fire-control computers that allowed U.S. tanks to kill Iraqi vehicles on the first shot four times further than the Iraqis could hit U.S. vehicles; thermal sights that allowed U.S. forces to see the enemy equally well at night and during the day, while the Iraqis were nearly blind in the dark; ammunition that allowed U.S. tanks to destroy Iraqi tanks from the front, side, or rear, out to 4 kilometers, compared to Iraqi tank ammunition that could not penetrate the frontal armor of U.S. tanks at any range; and the navigation equipment that allowed the U.S. forces to advance off-road through the barren desert, compared with Iraqi forces that were anchored to the roads—suggests

ened each of these, and the net effect led to the collapse of the Iraqi forces. If this hypothesis is correct, Iraqi ground forces should have been in disarray prior to their major engagements with the coalition ground forces.

This explanation fails, too. Although the Iraqi frontline infantry did collapse prior to the ground war, Iraq's heavy divisions—those in the Republican Guard and in the regular army—were functioning, organized military units until they were engaged and destroyed in ground combat.⁸⁶ As proof, when the ground war began, Iraqi commanders successfully maneuvered their best divisions into defensive positions in the path of the coalition's left hook. The Iraqi soldiers in these divisions followed orders and fought against the coalition ground forces. Despite their defensive positions and favorable force ratios, the Iraqis had no chance in the open desert against the much better trained and well-equipped U.S. and British divisions. The problem that the Iraqi divisions inevitably faced was not the effects of sustained bombardment on their ability to maneuver, C₃I, supply, force numbers, and morale. Their problem was that they were simply out of their league.

Did Air Power Make the One-Sided Victory Possible?

The conventional wisdom about the Gulf War is that air power neutralized the Iraqi ground forces. Above I refuted this argument and showed that, at the end of the air war, the best Iraqi divisions were still ready and willing to maneuver and fight. But there is a weaker version of the air power argument that must be considered: Although air attacks did not neutralize the Iraqis, perhaps they were necessary for the one-sided coalition victory. In other words, it could be argued that without the air campaign, many more coalition soldiers and marines would have been killed.

The weaker version of the air power argument also appears to be untrue. Evidence from the Gulf War suggests that even if there had been no significant air campaign, the ground war would not have been substantially different. There may have been a few more coalition casualties (maybe an additional 20–200 dead), but the result would still have been a rout of historic proportions. U.S. commanders were wise to conduct the lengthy air campaign because they

that the analogy between Gulf War armored battles and British battles against the Zulus may be fully justified.

86. The light divisions of the Republican Guard, not the focus of this article, retained their cohesion too, despite heavy bombardment. CIA, *Operation Desert Storm*.

could not be sure that coalition casualties would be so low. But if the left hook had been launched without a long air campaign to soften up the Iraqi forces, the coalition ground forces would still have greatly overmatched their Iraqi opponents.

The most significant effect that the air campaign had on the ground war is that it substantially attrited the Iraqi ground forces before the ground war began. At most, 40 percent of Iraqi armored vehicles were neutralized by the air campaign. But a close look at the ground battles strongly suggests that these vehicles would not have caused many additional coalition casualties had there been no air war.

One of the most surprising aspects of the major ground battles in the Gulf War is that U.S. losses correlate with neither the total number of Iraqi forces in the battle nor with the force ratios between the Iraqis and the coalition. In the five battles for which there is good information, only two U.S. soldiers were killed by enemy fire. In the battle in which the United States enjoyed the biggest numerical advantage, one American died. And in the one battle in which the Iraqis had numerical superiority, the United States lost one soldier.

The consistent pattern across all of the battles is that greater numbers of Iraqi forces simply produced greater numbers of Iraqi casualties. This suggests that had there been 40 percent more Iraqi tanks in these battles (i.e., had the air war not happened), there would have been 40 percent more Iraqi casualties during the ground campaign. The evidence from the major ground battles does not support the argument that many more coalition soldiers would have been killed.

But suppose, despite the evidence to the contrary, that if the Iraqis had 40 percent more tanks and other armored vehicles in each of the major ground battles, they were able to inflict 40 percent more U.S. fatalities. If we increase the number of U.S. fatalities during the ground war (the total was sixty-three) by 40 percent, the total number of U.S. soldiers and marines killed in the ground war rises to eighty-eight.⁸⁷

Predicting exact numbers of losses in a war is impossible, but given what we now know about the one-sided outcome of every ground engagement during the Gulf War, it is difficult to support the claim that the air campaign was necessary to soften up the Iraqi forces for a successful ground operation. The

87. Many battlefield relationships are nonlinear; so to be even more conservative, if 40 percent more Iraqi vehicles could have increased American losses by 300 percent, total U.S. fatalities in the operation from Iraqi attacks would have risen to only 189.

ground attack would likely have gone very well for the coalition even if there had been no extended air war.

Air Power in the Gulf and over Kosovo

The lessons from the Gulf War about military technology and the relationship between air and ground forces are still relevant and will likely remain so. In this section I briefly discuss why coalition air power was unable to neutralize the Iraqi ground forces and argue that these factors have not changed. I then support this argument with a brief description of NATO's air campaign against the Serbian army in Kosovo. I show that the same problems that the coalition experienced as it tried to target the Iraqi army in 1991 greatly hampered NATO's efforts against Serbia in 1999.

Coalition air power was unable to do more damage to Iraqi ground forces during the air campaign because of one key fact: The Iraqis were deployed in static defensive positions. Static forces, especially those not engaged in combat, require fewer supplies than either units on the attack or units conducting a mobile defense. They burn far less fuel, require fewer spare parts, and consume less food and water. They also require minimal communication bandwidth. A division sitting still in the desert, or even conducting a single counter-maneuver (e.g., the Iraqi response to the coalition's left hook), requires relatively little communication among its officers or between the division's leaders and their superiors. Local commanders do not need to communicate nearly as much among themselves, or with senior commanders out of the theater, as they would in a more mobile defense or an offensive operation. Thus, even if air attacks can choke off most of an enemy's supply throughput around the battlefield, and can significantly reduce its C₃I bandwidth, they may have little effect on an enemy in static positions.

This is precisely what happened in the Gulf War. Coalition air power successfully reduced road traffic into Kuwait by 90 percent,⁸⁸ and it hindered Iraqi C₃I. But because the Iraqis were not conducting long, complicated maneuvers, and because the ground battles were so short, their stockpiles were sufficient to sustain their forces.⁸⁹ Similarly, the mission given to the Iraqi ground forces was relatively simple: Defend current positions and then maneuver west to

88. *GWAPS*, Vol. 2, Pt. 1, p. 281; and *GWAPS Summary Report*, pp. 95–96.

89. *GWAPS Summary Report*, p. 99.

block a coalition flanking attack. Given the simplicity of these operations, Iraq's degraded C₃I system could still be effective. The implication is that whenever the United States faces static, defensively oriented foes, air power will have great difficulty hampering—let alone neutralizing—them by attacking supply and C₃I targets.

A second fundamental problem resulted from Iraq's defensive posture: Static forces are very difficult to detect from the air, even when they are in the desert and even with information-age sensors. Static forces give few signs of their location; they emit little heat, noise, or radio traffic. In addition, it is easy to create simple decoys that are nearly indistinguishable from stationary military forces. From an aircraft flying at 10,000 feet, it is very difficult to discern a tank half-buried in the sand from a sheet of corrugated metal half-buried in the sand. Stationary forces are both inherently difficult to observe and even more difficult to distinguish from simple decoys.

Identifying stationary vehicles and discerning real vehicles from decoys were big problems for coalition aircraft during Desert Storm. From high altitude, distinguishing between "living" and "dead" Iraqi vehicles was also difficult—so much so that it led to multiple hits on the same target.⁹⁰ Even worse, the Iraqis learned that U.S. aircraft could easily be tricked and constructed decoys to mimic live targets, often putting wreckage near "living" vehicles to make them appear "dead."⁹¹

The problems that coalition air power faced in its attacks on stationary Iraqi ground forces were complex, and it appears that the United States has made little progress in solving them over the last decade. The same problems hamstrung NATO efforts to destroy Serbian ground forces in Kosovo in 1999.⁹² For

90. Much has been made of the "tank plinking" in the Gulf War, in which U.S. aircraft used their infrared sensors to detect the warmth radiated by Iraqi tanks partially buried in the sand. What is not usually mentioned is that "living" Iraqi tanks create the same heat signal when warmed by the desert sun as vehicles already destroyed. Furthermore, both "living" and "dead" Iraqi vehicles were very hard to distinguish from simple metal decoys, such as sheets of corrugated metal attached to short sections of thick pipe, buried in the sand.

91. The best account of Iraqi efforts to use decoys to protect their ground forces from coalition air attacks is William F. Andrews, *Airpower against an Army: Challenge and Response in CENTAF's Duel with the Republican Guard* (Maxwell Air Force Base, Ala.: Air University Press, 1998), pp. 42–46.

92. One implication of this article is that initial analyses of wars—frequently conducted before adequate information is available for careful analysis—should be treated with substantial skepticism. This applies to the analyses of the Kosovo war on which I rely here. The problems that NATO experienced during the Kosovo war seem similar to those that the coalition experienced in the Gulf War, but the conclusions about the war in Kosovo are preliminary.

eleven weeks NATO aircraft flew thousands of sorties over Kosovo to disrupt the Serbs' C₃I and to attrit their forces through precision attacks, leading NATO spokespeople to confidently assess that NATO air strikes had reduced Serbian ground forces by one-third. But after the war, it became apparent that NATO had greatly overestimated the effectiveness of its attacks.⁹³ In fact, NATO analysts who inspected the hulks of destroyed Serbian weapons reportedly found that "fewer than 20 Serbian tanks, a similar number of artillery pieces, and fewer than ten armored personnel carriers" had been knocked out.⁹⁴

NATO's bombing raids against Serbian ground forces ran into many of the same problems that coalition forces faced in the Gulf War. Serbian forces were easy to hide from patrolling aircraft, and the Serbs made extensive use of decoys that look like real targets from 10,000 feet.⁹⁵ A decade has passed since the Gulf War, but the problems inherent in finding a static, defensively oriented army from the air, and distinguishing real targets from decoys, remain.

Implications for U.S. Foreign Policy and Force Structure

Historians, military analysts, and policymakers have drawn the wrong lessons from the Gulf War, and this may have serious implications for U.S. foreign policy and U.S. force structure. Air power is now significantly more lethal against ground targets than it was before. Almost any target that is detected and identified can be destroyed from the air with precision munitions.⁹⁶ But air

93. For a detailed discussion of the various NATO estimates over time, and for alternative estimates of the damage that NATO did to the Serb army, see Barry R. Posen, "The War for Kosovo: Serbia's Political-Military Strategy," *International Security*, Vol. 24, No. 4 (Spring 2000), pp. 64–66.

94. Richard J. Newman, "A Kosovo Numbers Game: So Where Are All the Tanks NATO Killed?" *U.S. News and World Report*, July 12, 1999, p. 36. See also Steven Lee Myers, "Damage to Serb Military Less Than Expected," *New York Times*, June 28, 1999, p. 1; "NATO's Game of Chicken," *Newsweek*, July 26, 1999, p. 59; and Tim Butcher and Patrick Bishop, "NATO Admits Air Campaign Failed," *London Daily Telegraph*, July 22, 1999, p. 1.

95. For brief descriptions of Serb decoys, see Myers, "Damage to Serb Military Less Than Expected"; and "NATO's Game of Chicken," *Newsweek*, July 26, 1999, p. 59.

96. There are several important caveats to this generalization. First, bad weather continues to inhibit air attacks because most sensors still cannot "see" through clouds and because laser-designators, a key component of many precision weapons, cannot penetrate clouds. GPS-guided weapons can accurately hit targets in bad weather but depend on weather-sensitive reconnaissance to determine the precise location of the targets. Second, some targets can be protected from air attack by locating them near civilians sites, raising the risks of collateral casualties to an unacceptable level. Third, targets can be protected from air strikes by burying them in deep bunkers. Despite these ca-

power still has limited effectiveness against defensively oriented enemy ground forces. Locating enemy ground forces in the desert is maddeningly difficult; in forest or mountainous terrain, or in urban areas, it is even harder. And distinguishing real targets from decoys frustrated the United States in both the Gulf War and Kosovo.

There are many contingencies in which the United States or its allies may need to destroy a defensively oriented enemy ground force. A U.S.–South Korean counterattack into North Korea; a U.S.-led counteroffensive into Iraq; a U.S. invasion of Kosovo, Montenegro, or Serbia; or an Israeli offensive to retake the Golan Heights or southern Lebanon would probably all require overcoming defensively oriented enemy ground forces. In all of these cases, air power would probably have only limited effects on enemy defenses; success would hinge on the effectiveness of ground forces.

At least two policy implications follow from this analysis. First, the United States and its allies should not overestimate the effectiveness of air attacks and undertake offensive military operations with the expectation that air power will provide a cheap victory. When enemy ground forces must be ejected from the territory they occupy, success or failure will be determined on the ground, and the price will depend on the ability of U.S. and allied ground forces to overmatch the enemy.

Second, the geography and foreign policy of the United States require that it maintain a balanced military force structure. Because the United States has global military commitments, it must have a military that can deploy rapidly to defend faraway allies. Air power is ideal for this mission: It can get to distant battlefields quickly and—as al-Khafji and the Highway of Death show—it can be lethal against enemy ground forces on the move. However, because its allies are far away, the United States often joins wars late. Allied territory often must be recaptured, and sometimes enemy territory must be taken. For these missions, the United States needs ground forces that can dominate the battlefield. Unless the United States military maintains large, well-trained, and well-armed ground forces, it will not be prepared to achieve more one-sided victories like the Gulf War.

A decade has passed since the Gulf War, but the six weeks of fighting—the long air campaign and the short ground war—still offer the clearest view we have of the capabilities of modern, high-technology militaries, especially when

veats, the generalization is still valid—if an enemy target is identified and is within range of precision-strike munitions, it can usually be destroyed.

they are pitted against third world opponents. Air power is a more powerful tool of national policy than it once was, but it still does not dominate the battlefield. Understanding the relationship between air and ground forces is necessary to make sound foreign policy decisions, to create a force structure that can meet the challenges that the United States will face in the coming decades, and in the end, to save American lives.