Gulf War

Air Power Survey

Volume II

Operations

and

Effects and Effectiveness

Washington, D. C.
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Gulf War Air Power Survey

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Gulf War Air Power Survey

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Foreword

From 16 January through 28 February 1991, the United States and its allies conducted one of the most operationally successful wars in history, a conflict in which air operations played a preeminent role. The Gulf War Air Power Survey was commissioned on 22 August 1991 to review all aspects of air warfare in the Persian Gulf for use by the United States Air Force, but it was not to confine itself to discussion of that institution. The Survey has produced reports on planning, the conduct of operations, the effects of the air campaign, command and control, logistics, air base support, space, weapons and tactics, as well as a chronology and a compendium of statistics on the war. It has prepared as well a summary report and some shorter papers and assembled an archive composed of paper, microfilm, and electronic records, all of which have been deposited at the Air Force Historical Research Agency at Maxwell Air Force Base, Alabama. The Survey was just that, an attempt to provide a comprehensive and documented account of the war. It is not a definitive history: that will await the passage of time and the opening of sources (Iraqi records, for example) that were not available to Survey researchers. Nor is it a summary of lessons learned: other organizations, including many within the Air Force have already done that. Rather, the Survey provides an analytical and evidentiary point of departure for future studies of the air campaign. It concentrates on an analysis of the operational level of war in the belief that this level of warfare is at once one of the most difficult to characterize and one of the most important to understand.

The Survey was directed by Dr. Eliot Cohen of Johns Hopkins University's School of Advanced International Studies and was staffed by a mixture of civilian and military analysts, including retired officers from the Army, Navy, and Marine Corps. It was divided into task forces, most of which were run by civilians working temporarily for the Air Force. The work produced by the Survey was examined by a distinguished review committee, that included scholars, retired general officers from the Air Force, Navy, and Army, as well as former and current senior government officials. Throughout, the Survey strived to conduct its research in a spirit of impartiality and scholarly rigor. Its members had as their standard the observation of Mr. Franklin D'Olier, chairman of the United States Strategic Bombing Survey during and after the second World War: "We wanted to burn into everybody's souls that fact that the survey's responsibility . . . was to ascertain facts and to seek truth, eliminating completely any preconceived theories or dogmas."

The Survey attempted to create a body of data common to all of the reports. Because one group of researchers compiled this core material while other task forces were researching and drafting other, more narrowly focused studies, it is possible that discrepancies exist among the reports with regard to points of detail. More importantly, authors were given discretion, within the bounds of evidence and plausibility, to interpret events as they saw them. In some cases, task forces came to differing conclusions about particular aspects of this war. Such divergences of view were expected and even desired: the Survey was intended to serve as a point of departure for those who read its reports, and not their analytical terminus.

This volume consists of two reports. The first, *Operations*, focuses on the employment of air power as part of Coalition's military efforts to destroy Iraq's military forces and potential, and to liberate Kuwait; in this framework, it examines objectives and dissects problems associated with air operations. The second report, *Effects and Effectiveness*, surveys the accomplishments of Coalition air power at the operational level relative to the military and political objectives for which the war was fought.

Acknowledgments

The Survey's members owe a great debt of gratitude to Secretary of the Air Force Donald B. Rice, who conceived of the project, provided it with resources, and set for it the highest standards of independence and objectivity. Many organizations and individuals gave generously of their resources and time to support this effort. Various branches and commands of the Air Force were particularly helpful in providing material for and, in some cases, personnel to conduct the study. The United States Navy, Marine Corps, and Army aided with this study in different ways, including the sharing of data pertaining to the air war. A number of the United States' Coalition partners also made available individuals and records that were vital to the Survey's work. Many participants in the war, including senior political officials and officers from all of the Services were willing to speak with the Survey and share their recollections of Desert Shield and Desert Storm. Private students of the Gulf War also made available their knowledge of the crisis and conflict. Wherever possible and appropriate such assistance has been acknowledged in the text.

The Survey's independence was its reason for being. Each report is the product of the authors who wrote it and does not necessarily represent the views of the Review Committee, the Air Force or the Department of Defense.

Security Review

The Gulf War Air Power Survey reports were submitted to the Department of Defense for policy and security review. In accordance with this review, certain information has been removed from the original text. These areas have been annotated as [DELETED].

Gulf War Air Power Survey
Reports

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(**Note:** Each of the two reports retained pagination independent of the other. Accordingly, the table of contents for each report accompanies each report independently of this table of contents).

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Report Acknowledgements

Innumerable people cooperated in the production of this report. Wayne Thompson and Gary Cox helped immeasurably in the research and writing of different sections. In particular, Dave Deptula gave unstintingly of his time to discuss his experiences in the war; Maj. Gen. Buster Glosson and Larry Henry were equally helpful. My colleagues in GWAPS, in particular, Barry Watts, Eliot Cohen, and Thomas Keaney provided support, encouragement, along with reading and honestly criticizing numerous drafts of this report. Lt. Col. Robert Eskridge of GWAPS and Maj. Mike Nichols of Checkmate were also very helpful in explaining crucial elements of the air campaign and its operations. Without the support of the Naval War College in giving me a Secretary of the Navy Fellowship for the 1991-92 academic year, I would not have been able to begin the initial research for this volume; therefore, Adm. Joseph Strasser, President of the College, and Professor William Fuller, Chairman of the Strategy Department deserve special thanks. Finally, I would be remiss if I did not thank Cecelia French and especially Peggy Kramer for the patience, fortitude, and good humor in bearing with my demands that everything be accomplished yesterday. Most of the credit for whatever success this report enjoys is due to those named above as well as others. Whatever errors or faults it contains are my responsibility alone.

Introduction

In many ways "Desert Storm" represents a watershed in history; for much of the war, it consisted entirely of the application of massive doses of air power to the economic and bureaucratic infrastructure of Iraq and its military forces. How the Coalition applied air power differed greatly from previous wars in which air forces had played major roles. In this case, air power proved itself capable of use as both a rapier-like instrument and as a bludgeon. By itself, the air campaign achieved considerable effects on the Iraqi military, its infrastructure, its command and control, and even the political stability of the Ba'thist tyranny.

Yet many things remain unclear about the campaign's impact on Iraq.[1] Even the question of how many tanks, armored personnel carriers, artillery pieces, and other numerical indices of military power the campaign destroyed or damaged is open to dispute. As for the impact of air power on Iraq's military system, its military industrial complex, and even the regime itself, much of that remains opaque.

Nevertheless, even with the imponderables the air campaign suggests that the military balance between air and ground has changed in fundamental ways. Bernard Trainor, the former Marine Corps general, former *New York Times* military correspondent and current professor at the JFK School of Government at Harvard, underlined that shift in a lecture to the Naval War College in October 1991. He noted that for the first time in history the ground campaign had supported the air campaign.[2]

This study focuses on the air war's *operational* conduct against Iraq and its military forces.[3] For our purposes, the USAF's 1992 basic doctrinal manual provides a useful definition of "operational art," the focus of this report:

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[1]And unfortunately will remain unclear until Iraqi records become available to historians–an unlikely occurrence, at least for the foreseeable future. Even then one wonders, given the nature of the Iraqi tyranny, how much trust one can place in the written record of Saddam Hussein's regime.

[2]I am indebted to General Trainor for permission to use this comment.

[3]For more detailed examinations of the strategic and tactical frameworks within which the air war was waged, the reader should consult the appropriate reports in this survey of the war.

> **Operational art.** The employment of military forces to attain strategic or operational objectives in a theater of war or in a theater of operations through the design, organization, and conduct of campaigns and major operations. Operational art translates theater strategy into operational and, ultimately, tactical action.[4]

This report, consequently, focuses on the employment of air power as a part of Coalition military efforts to destroy Iraq's military forces and potential, and to liberate Kuwait. Within that framework, the air campaign attempted a wide variety of objectives. This apparent diversion of effort reflected both the enormous resources mobilized in the Gulf by the Coalition and fears of military commanders that the Iraqis would exit the war at an early point, thereby preserving much of their military power.

The study of war in the air raises issues that reflect the nature of war as well as the particular problems associated with air operations. How well did air commanders think out the application of air power to attacking enemy centers of gravity? How did unforeseen frictions and chance affect operations? The purpose of *Gulf War Air Power Survey* is to address such questions.[5] The aim of this study is to provide the reader with a framework for understanding the conduct of the air campaign on the operational level. Above all, this work does not aim at finding fault

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[4]Air Force Manual 1-1, "Basic Aerospace Doctrine of the United States Air Force," Vol. II, Maxwell AFB, Mar 1992, pp 295-96. The term operational art is relatively new, introduced into US conceptions of the conduct of war by the Army in the early 1980s from German and Soviet usage. It provides a more systematic conceptualization of the complex interaction of military forces to achieve goals above the tactical level of war. For example the German exploitation of their breakthrough on the Meuse in May 1940 is not tactics–the actual battlefield concepts of military forces–nor is it strategy–the achievement of national goals. Consequently, the development of the term operations fills the void in the area that was at one time termed grand tactics or theater strategy, both of which muddied the discussions of military events.

[5]The series of studies that come under this survey represent an attempt to deal with the Gulf War in a fashion similar to the great *Strategic Bombing Survey* that grappled with the impact of the U.S. strategic bombing campaigns against Germany and to a lesser extent against Japan. There are, however, two substantial differences between this effort ant its predecessor. First, *The Strategic Bombing Survey* was able to study the impact of the bombing campaign through extensive use of captured enemy documents. That is obviously not possible in the case of the Gulf War. Secondly, *The Strategic Bombing Survey* only examined the economic effects of the bombing efforts; the Gulf War Survey on the other hand aims to examine the military as well as the economic impacts of the bombing. Hence this report on the operational conduct of the war.

with those who held the responsibility for conducting the air war with all its intractable problems. Rather it hopes to give the reader insight into the war that occurred in 1991.

The Nature of War in the Air

Before one can properly understand the conduct of an air campaign, one must understand the political and strategic context within which the Coalition waged the air war, as well as the conditions that war imposed on those who flew and directed the effort. As the great German military thinker, Karl von Clausewitz suggested, war is an instrument of policy aiming at political objectives, but it also is a phenomenon involving the full range of human emotions and irrationalities. It possesses a dynamic of its own, created by the violence that lies at its core and which unleashes such incalculable factors as anger, fear, revenge, and hatred. Above all, war involves the effort to compel our opponent "to do our will."[6] Its fundamental essence is violence aimed at destroying the enemy's ability *and* willingness to continue the struggle.

War creates a terrifying environment–an environment which peacetime conditions rarely replicate. Yet military professionals perform their tasks in combat only once or twice in a career and then often under very different circumstances from those for which they had prepared. "It is as if a surgeon had to practice throughout his life on dummies for one real operation; or a barrister only appeared once or twice in court towards the close of his career; or a professional swimmer had to spend his life practicing on dry land for an Olympic championship on which the future of his nation depended."[7]

A number of serious impediments exist to successful military operations; they lie at the heart of the conduct of war. Clausewitz grouped such factors under the overarching concept of what he termed "friction."

> Everything in war is very simple, but the simplest thing is difficult. The difficulties accumulate and end in producing a kind of friction that

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[6]Carl von Clausewitz, *On War*, ed. and translated by Michael Howard and Peter Paret (Princeton, NJ, 1984), p 95.

[7]Michael Howard, "The Use and Abuse of Military History," *Journal of the Royal United Services Institute*, Feb 1962, p 6.

> is inconceivable unless one has experienced war. . . . Countless minor incidents–the kind you can never foresee–combine to lower the general level of performance, so that one always falls short of the intended goal . . . .[8]

The frictions of combat vary from chance encounters, to the difficulties involved in getting individuals to act with a common purpose, to unexpected patterns of weather.

The Gulf War underlined again the profound hold that friction exercises over the conduct of military operations. From mid-January to the end of February, the Persian Gulf saw one of the longest sustained periods of bad weather that the region has seen in recent history. Unfortunately, the arrival of that period of bad weather coincided exactly with the course of the war.

For air commanders and planners who had spent the previous five months in a hectic environment, but one in which sighting small clouds were major events, the sustained bad weather was a nasty surprise. By the tenth day of the war, the weather had affected the campaign to the extent that Coalition air forces had only reached the point where they had planned to be by day four or five.[9] To the end, weather exercised a serious impact on the conduct of air operations. On the forty-first day, when planners aimed to clear up many crucial leadership and military support targets that still remained, a ferocious storm system cancelled of all F-117 strikes, the only night on which this was the case. On the next night, the weather did not improve much; F-117s dropped only ten weapons–barely one-fifth of their average for the war.[10]

Such, however, are the physical limitations under which all wars occur. Under conditions of discomfort, danger, physical exertion, exhaustion, chance, and chaos, individuals attempt to function in a coherent and intelligent fashion. Nevertheless, what is obvious to the historian with the luxuries of time and calm may not have been so apparent to those holding the responsibilities of leadership in wartime.

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[8]Clausewitz, *On War*, p 119.

[9]Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 14 Apr 1992.

[10]GWAPS Missions Database.

Perhaps the most serious friction is what historians refer to as the "fog of war," that pervasive atmosphere of uncertainty, ambiguity, breakdowns in communication, and general lack of knowledge as to what is occurring. Because military organizations fight human enemies who fight in accordance with their aims and objectives, it is difficult to estimate how any combat situation will evolve. Although we may calculate what our opponent *might* do, there are few certainties or absolutes, and when one calculates in certainties and absolutes, one flirts with disaster.

Yet commanders in war are not inanimate objects. They can indeed place the strengths of their forces against the enemy's weaknesses, and in effect maximize the frictions with which the enemy's military organizations will have to deal. The plan drawn "Desert Shield" in fact aimed at maximizing the frictions inherent in the Iraqi military system. By disrupting crucial nodes in Iraq's air defense system (particularly its control centers), by attacking early warning and SAM radar sites, by disrupting electrical power for much of the country–thereby forcing many Iraqi military installations to go to back up power–and by bombing communication centers, planners caused maximum friction and confusion within Saddam's command structure.[11] The aim was not destruction of one particular target set–which would have left much of Iraq's military infrastructure intact–but rather a synergistic degradation of the whole, in which friction, confusion, and uncertainty would combine to make the defenses generally ineffectual. The fact that Coalition air forces lost only a single F/A-18 in the first night's operations underlines the success of that air plan in imposing unacceptable levels of friction on the enemy.

The factors that govern, and *limit*, the conduct of war on the ground or at sea equally affect air operations.[12] As an historian of the Combined Bomber Offensive has observed about strategic bombing in World War II:

> Thus we are left with one clear reminder of a painful truth: The [conditions] of war applied as much to the strategic air offensive waged over

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[11]Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, Thomas Keaney), 9 and 14 Apr 1992; oral interview, Lt Col David Deptula with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 20 and 21 Dec 1991.

[12]This, however, has not been the traditional view of air power theorists, particularly in the period before World War II.

> Europe's skies through five-and-a-half bitter years as they did to the sailors and soldiers on the distant seas or in the mud and sand below. Occasionally, the airman may have felt himself living and fighting in a new dimension, just as the air force commander may have sometimes felt he enjoyed a freedom of manoeuvre denied to admirals and generals. But the airman died, and the air force commander was defeated and stalemated unless the laws were kept. When they were kept, success came; until they could be kept, hope was kept alive by courage alone.[13]

The same conditions that limit and detract from military operations on land and sea govern the conduct of war in the air. Nevertheless, war in the third dimension presents historians and analysts with intractable problems in determining a coherent picture of operations or even in determining the effects of such operations. In most respects, the history on ground and naval wars has been relatively easy to write.[14] Ground war, with its ebb and flow, provides ready patterns on which to construct narratives. The key events announce themselves, victors and vanquished are generally obvious, and one can trace outcomes to specific events and trends that give rise to climactic or crucial moments on the battlefield. Similarly, the conduct of naval operations, with its clash of fleets, seemingly possesses clarity and simplicity; logs and position reports allow considerable certitude as to what has transpired.[15]

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[13]Anthony Verrier, *The Bomber Offensive* (London, 1968), p 327.

[14]Nevertheless, as John Keegan in *The Face of Battle* (London, 1976) suggested to us in the mid 1970s, there have been a number of highly distortional factors in the writing of traditional military history. Upon closer examination, as his ground-breaking work serves to underline, the clear blue and red arrows on the pages of traditional military histories dissolve into complex and difficult to reconstruct actions of individuals and units.

[15]Nevertheless, it is important to note that in the two most important naval campaigns of the 20th Century, namely the battle for control of the Atlantic, present considerable problems in estimating the net advantage gained by control of the sea: How much impact did the blockade exercise over the German war economies in two world wars? What advantages did the Allies gain from the capacity to project power onto the European continent? Were there any crucial battles or decisive operations in the conduct of the Battle of the Atlantic? Or was the course of the campaign only reflected in the cold, hard numbers of ships or U-boats sunk and numbers of convoys slipping across the Atlantic? Arguably, the best examination of the war in the Atlantic during World War II still remains a novel written immediately after the war by a junior officer engaged in the struggle: Nicholas Monserat, *The Cruel Sea* (New York: Knopf, 1951).

Air war, on the other hand, possesses none of this clarity. One might best characterize the differences between air war and other forms of war by looking at how differently air units fight in comparison with their comrades in other dimensions. Air forces divide themselves into subdivisions similar to those of armies: commands (armies), numbered air forces (corps and divisions), wings (brigades and regiments), squadrons (battalions), and flights (companies).

And yet where ground forces fight as groups under command of individuals who enjoy some limited control even under the worst of circumstances, air forces in combat almost immediately break down into their smallest units, into groups as small as flights of four or elements of two. Fighter combat often turns into vast gaggles of aircraft; the conditions of combat degenerate into chaos and the efforts of individuals to survive. The inherent chaos, speed, and lack of discernable landmarks in the sky make it difficult to grasp what is occurring, much less to reconstruct events. The failure of the Iraqi air force to mount serious opposition to early Coalition control of the air undoubtedly mitigates some of this difficulty in writing an operational history of this air campaign. Nevertheless, the inherent speed of high performance aircraft and the fog of war often make it inherently difficult to reconstruct plausible and coherent explanations for individual events.

There is an additional problem: how to calculate air power's effect on the enemy's capacity to conduct operations or even to manage his economy. Here, one deals with intangibles: what options might the enemy have exercised either militarily or economically had he not been under air attack? Did an air offensive lower his civilian or military morale, and, if so, what impact, if any, did such a fall in morale have on the capacity to fight or produce? What levels of production could enemy industry have reached but for the damage occasioned by air attacks? Such questions remain no closer to closure in the historical community in regard to World War II than they were at the end of that conflict. Not surprisingly, then answers to such questions on air operations in the Gulf without any Iraqi records must remain tentative for the foreseeable future.

When ground fighting is over, no matter how inconclusive, armies have casualties, equipment, or lost territory to tally up; navies can count the number of ships lost or even the number of convoys delivered. But air forces, outside of the fall of bombs or numbers of aircraft shot down, have little direct evidence on which to calculate the indirect or even the

direct impact of their attacks on the enemy. Admittedly, there are at times VTR tapes of weapons impacting on target. But not all aircraft have the equipment for such evidence.[16] Nor are conditions always such that one can make an accurate assessment of weapons effectiveness; weather, dust, or even the debris from explosives can obscure what has happened to the target. Finally, one must note that the effects of destruction or damage to a target may well remain unclear until after a war is over. Those who assess the impact of a strike, or series of strikes, or even a campaign may never be able to move beyond estimating the possible effects of attacks on the enemy's economy or military forces.

Consequently, evaluating the conduct of air war on the operational level raises considerable problems for the historian.[17] In tracing the genesis as well as the conduct of Allied bombing campaigns against Germany, for example, the simplicity of surface campaigns is seldom evident. As the official historians of the Army Air Forces in World War II have suggested:

> The nature of the bombardment campaign imposes on the historian a problem of presentation as novel as the concept of war. The heavy bomber offensive was an impersonal sort of war and monotonous in its own particular way. Day after day, as weather and equipment permitted, B-17's and B-24's went out, dropped their deadly loads, and turned homeward. The immediate result of their strikes could be photographed and assessed by intelligence officers in categories reminiscent of high school "grades"–bombing was excellent, good, fair, or poor. But rarely was a single mission or series of missions decisive. . . .The effects of the bombing were gradual, cumulative, and during the course of the campaign rarely measurable with any degree of assurance. Bomber crews went back time and again to hit targets which they had seemingly demolished before. Only near the end of the war when the bottom

[16]One of the striking aspects of the Gulf War was the number of platforms which did not have film evidence as to whether their weapons had in fact struck the target. This stands in contrast with World War II, when British and American strategic bombers (Lancasters, Halifaxes, B-17s, B-24s, and B-29s) all provided a snap shot of what they had dropped on–although of course under conditions of winter all that intelligence got was a picture of clouds.

[17]And this is perhaps a major factor in explaining why military historians have shied away from air power history in spite of the fact that it raises some of the most important issues of technological and social adaptation in the twentieth century–for civil society as well as military organizations.

> dropped out of the German defense did the full results of the Combined Bomber Offensive become apparent; before that the "phases" of the long drawn-out campaign seldom achieved the sharp focus they had shown in the early plans. Drama hovered close to each plane which sortied . . . but as drama the big show itself was in 1942-1943 flat, repetitive, without climax.[18]

Fortunately for Allied air forces, Iraqi air power proved almost completely incapable of intervention against the aerial tide that swept into the Mesopotamian Valley on 17 January 1991 and over succeeding weeks. But while the enemy was incapable of standing and fighting, the impact of the blows that he received remained unclear for much of the war. His air defense system was soon in tatters, his electrical system badly damaged, his communications in disarray, his army lying exposed in the open, pounded day and night; yet to the end of the war, it remained unclear how extensively air power was damaging his capacity to resist. Even if the documents concerning Iraq's conduct of the war were available, a number of crucial factors might well remain unclear: how much did bombing electrical and communication sites contribute to the collapse of the Iraqi air defense system? When did the morale of the Iraqi soldiers begin to collapse? Given the Iraqi political system which often punished bearers of bad news, did the high command in Baghdad ever recognize the extent of the damage? Could Coalition forces have moved earlier on the ground? For how long a period did air attacks set back Iraqi nuclear, chemical, and biological programs, in which the Saddam's regime had invested so much of its capital?

This account of the air campaign against Iraq has broken its subject into discreet chronological topics. The first chapter discusses the outbreak of the crisis, deployment of U.S. forces to the Persian Gulf, and the planning that established the framework within which Coalition air forces would fight. The next chapter turns to a net assessment of opposing forces. Here the emphasis will be on laying out the factors beyond "bean counts" to understand the complex balances of training, preparation, doctrine, and technological capabilities that factored into the combat equation in the Gulf War.

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[18]Wesley Frank Craven and James Lee Cate, *The Army Air Forces in World War II*, Vol. II (Washington, DC, 1983), p ix.

The rest of the report will concentrate on the conduct of operations. It will emphasize the first days of the campaign, for it was in that critical period that Coalition air forces effectively gutted Iraqi capabilities to defend their nation. These chapters will also examine succeeding weeks in the strategic air campaign against Iraq and the impact that frictions such as weather and Scud attacks had on the campaign. Finally, the last chapters will examine the air campaign against Iraqi ground forces and its contribution to the ground war.

This account of the air campaign against Iraq aims to convey the ambiguities and difficulties that confronted air commanders in their war against Iraq. It does not provide simple answers but rather evaluates the difficult choices made at the time, more often than not on the basis of incomplete information. Moreover, it relies on the incomplete information in the records; and the reader must remember that, in contrast to World War II, the Allied effort in this short, swift, and ferocious air offensive did not result in the collapse of the Saddam's regime. As a result, enemy assessments, the damage to his system, the actions and reactions of Iraqi commanders remain unclear. One can only surmise why the enemy reacted as he did. On that basis, nevertheless, this survey aims to achieve an intelligent and useful account.

1

Desert Shield

In 1989, as the power of the Soviet Union drained away, U.S. Central Command began reassessing its mission. The Reagan administration had created the command in 1983 to block a possible Soviet drive through Iran to Persian Gulf oil. Since that threat seemed no longer credible, the new Chairman of the Joint Chiefs, Gen. Colin Powell, encouraged the command to turn its attention to Iraq.

The successful conclusion of its long war with Iran in 1988 had left Iraq with an enormous debt, but also with one of the largest armies and air forces in the Middle East (with the possible exception of Israel). To the south, in apparently weaker countries, lay approximately half the world's proven oil reserves. By spring 1990, Central Command had drafted a revision of its Operations Plan 1002 to deal with an Iraqi invasion of Saudi Arabia through Kuwait. This draft plan, 1002-90, came none too soon.[1]

Central Command's first exercise of its new draft plan had just begun in Florida, when on 17 July 1990, Iraq's dictator, Saddam Hussein, publicly threatened Kuwait and the United Arab Emirates. In private, the Iraqis had repeatedly made known over the preceding six months a set of demands to their smaller neighbors: forgive Iraq's war debt, reduce oil production to raise the price of oil, and compensate Iraq both for its war against Iran and (in the case of Kuwait) for pumping oil from Iraq's portion of the Rumayla oil field. Within a week, credible intelligence reporting indicated the presence of two Iraqi armored divisions on Kuwait's northern border. Like most observers around the world, the

[1](S/NF) OPLAN, USCINCCENT 1002-90, 2d draft, 18 Jul 1990, GWAPS NA 41. See also 1st draft of outline plan, 16 Apr 1990, GWAPS, CHC 13. Gen H. Norman Schwarzkopf with Peter Petre, *It Doesn't Take a Hero* (New York: Bantam, 1992) gives a somewhat different version of the genesis of 1002-90 than the GWAPS Planning report. Schwarzkopf, who was then in charge of Central Command, says that he had the idea and sold it to Powell.

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Kuwaitis believed that Saddam was bluffing. The United Arab Emirates, on the other hand, asked the United States for two KC-135 air refueling tankers to aid its Mirage fighters in maintaining an around-the-clock patrol over that country's offshore oil platforms. Although the KC-135s began operations in the United Arab Emirates on 24 July, this American involvement failed to deter Iraq from its invasion of Kuwait.[2]

Meanwhile, Central Command's command post exercise, Internal Look, had run its course. The exercise laid out basic conceptual problems in defending the region against Iraq. In particular, Internal Look examined military and operational problems involved in dealing with Iraq's military forces on the ground and in the air. Unfortunately, several problem areas emerged from the exercise–such as intelligence weaknesses–that subsequent events would more than confirm. Nevertheless, given the focus of the American military over the previous forty years, the fact that considerable weaknesses existed in preparations to deal with a crisis in the Middle East should not be surprising. Whatever the defects of Internal Look, it represented an excellent primer for those who soon found themselves engaged in a full-blown Middle Eastern crisis.

Iraq's invasion of Kuwait began at 0100 hours on 2 August 1990; three of Saddam's elite Republican Guard divisions crossed the border on the ground, while a fourth launched a helicopter assault against the capital. Kuwait City fell by seven that morning. The Kuwaitis had failed to place their troops on alert and many fell into Iraqi hands at their normal duty posts rather than in forward prepared positions. The Kuwaitis did get six Mirages in the air early in the morning; those aircraft shot down a number of enemy helicopters before Iraqi fighters entered the battle and attacked all three Kuwaiti air bases at 0500. During the day, Iraqi tanks reached the airfields, and most of Kuwait's air force fled to Saudi Arabia; the Iraqis captured the airmen who remained and sent them on to Iraq.[3] It appeared possible that Saddam's forces would soon round up the

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[2][DELETED] (S/NF) msg, US Embassy Abu Dhabi to Secretary of State, subj: UAE Fears Iraqi Air attack, 21:142Z Jul 90.

[3]Intvw, Kuwaiti Air Force officers captured in summer 1990 with GWAPS personnel, 14 Jul 1992.

American embassy staff and more than two thousand Americans working in Kuwait.[4]

The American Response

That same day, President George Bush met for the first time with Gen. H. Norman Schwarzkopf, commander of Central Command or "CENTCOM" [pronounced "Sent Com"] as most military people called it. The President warned Schwarzkopf that he should be prepared to fight if Iraq took the embassy staff hostage or extended its invasion into Saudi Arabia. Two days later at Camp David, Schwarzkopf and his air commander, Lt. Gen. Charles A. Horner, briefed the President on possible military responses. In peacetime, Horner commanded Ninth Air Force; in a Middle Eastern crisis that tactical command became Central Air Forces or CENTAF (pronounced "Sen Taf").[5]

By the time Schwarzkopf and Horner spoke to the President at Camp David, the Iraqis had moved approximately eleven divisions into or near Kuwait, nearly 200,000 men; some of these were already on Kuwait's border with Saudi Arabia. More than half a million Iraqi regulars and reservists remained at home, where that country's armed forces equaled approximately half the number of active duty U.S. forces worldwide. Few Americans, however, were in the Middle East. European Command had fourteen F-111Es and four F-16s in Turkey, but the U.S. did not know whether the Turks would allow air strikes against Iraq. Two aircraft carriers would reach the Red Sea and the Gulf of Oman in a few days, but this was all Schwarzkopf and Horner could offer unless Saudi Arabia or other Middle Eastern nations accepted American forces.[6]

Bush then sent Secretary of Defense Richard B. Cheney, Schwarzkopf, and Horner to Saudi Arabia to persuade King Fahd to allow implementation of CENTCOM's Operations Plan 1002-90. The plan called for deploying a quarter million U.S. troops to Saudi Arabia, where American ways–for example, American women in uniform–seemed likely to

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[4]Intvw, GWAPS with Col Saber Al-Suwaidin, Acting Cmdr, Kuwait AF, 14 Jul 1992, GWAPS NA 377.

[5]Schwarzkopf, *Hero*, pp 297-302.

[6](S) Transcript, Lt Gen Horner's taped responses to written questions of CMSgt John Burton, CENTAF historian, Mar 1991, GWAPS CHP 13A; Schwarzkopf, *Hero*, pp 298-302.

upset traditional Muslims. But satellite photography underlined the threatening nature of Iraqi deployments on the Saudi frontier. On 6 August King Fahd invited the Americans to deploy their forces into his nation.[7]

The deployment that followed Fahd's decision was unprecedented in its combination of speed, size, and distance. The Americans called it Operation Desert Shield, to emphasize its defensive purpose. Most of the quarter million troops, the thousand aircraft, and the millions of tons of equipment and supplies ticketed by Operations Plan 1002-90 moved at least seven thousand miles from the continental United States during the next three months. While they arrived, the United States and Saudi Arabia moved their strategic conceptions beyond defense of Saudi Arabia toward Operation Desert Storm, the expulsion of Iraqi forces from Kuwait and the elimination of Iraq's capability to threaten its neighbors. For that strategic purpose another eight hundred U.S. aircraft eventually arrived in the theater along with another quarter million American troops–this time mostly from Europe, where the Soviet decline made their presence less necessary.[8]

Whether from the continental U.S. or Europe, a flight to Saudi Arabia took hours rather than the weeks required for ships to bring the cargo required to equip and sustain those forces. However, the Marines and the Air Force had stored munitions and other supplies in neighboring Oman as well as at the Indian Ocean island of Diego Garcia and the Pacific island of Guam; supply ships at Diego Garcia and Guam, already loaded with ammunition and supplies, moved when the deployment began. Luckily, the Saudis reduced U.S. logistic requirements considerably by providing gasoline and other petroleum needs to Coalition forces from their own refineries.

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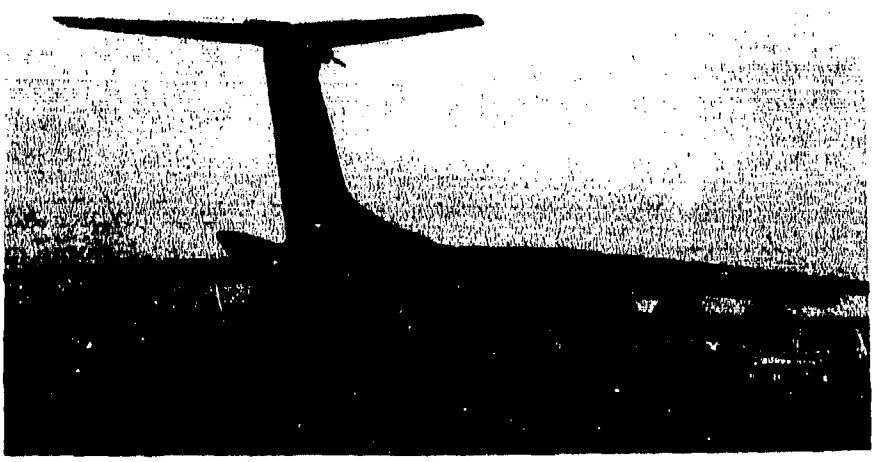
[7]Schwarzkopf, *Hero*, pp 302-08; OPLAN 1002-90 (July). In fact, the Iraqis may have only aimed at intimidating the Saudis, but by this time no one was particularly interested in taking chances with Saddam's regime.

[8]The CWAPS Logistics report treats the deployment. On the deployment's first phase, see also the (S/NF) monograph by William T. Y'Blood, "The Eagle and the Scorpion" (Washington: Center for Air Force History, 1991).

The burden of flying troops and urgently needed equipment fell on Military Airlift Command (MAC), which called on its long-range transports (C-5s and C-141s) as well as commercial air liners, especially Boeing 747s from American civilian carriers. MAC's C-5s were equally big and better suited for oversize cargo. Each C-5 could carry three times the lift-weight of C-141s, so that the fleet of approximately 120 active and reserve C-5s had a greater capacity than the 260 C-141s. However, commercial air liners carried almost two-thirds of the military passengers to the theater, as well as more than a fourth of the cargo delivered by air.[9]



C-141 off-loading equipment in Saudi Arabia.

Even with substantial commercial help, MAC's planes and crews worked to the breaking point. C-141s especially concerned MAC commanders, because of their age (more than two decades old) and the fact that they suffered from wing cracks. But an old C-5 was the only transport to crash; on 29 August taking off from Ramstein Air Base, Germany, with a load of medical supplies, the aircraft went down due to a mechanical problem and killed thirteen of seventeen on board. Although airlift crews were often as tired as their planes, the system provided some relief

[9]See the GWAPS Statistics report.

by establishing pools of pilots at European bases that served as halfway stops on the long flights between the United States and the principal aerial port at Dhahran.[10]

The Navy carriers were first to arrive on station. They provided substantial strike capacity, while Air Force units were deploying from the continental United States. The first Air Force aircraft to reach Saudi Arabia were F-15C fighters from Langley Air Force Base, Virginia. During the afternoon of 8 August, a squadron of twenty-three air superiority fighters touched down at Dhahran Air Base two hundred miles south of Kuwait. Refueled seven times en route by SAC KC-10 tankers, the F-15s arrived fully armed.[11] Upon landing, they were told by their Saudi hosts to get out of the heat (120 degrees Fahrenheit) and rest while Saudi F-15s flew combat air patrols. When the Americans were ready, Saudi pilots (including veterans of "Red Flag" exercises at Nellis Air Force Base) took them on orientation flights. Meanwhile, a second F-15 squadron arrived from Langley.[12]

By mid-September nearly eight hundred U.S. aircraft (mostly Air Force, but including approximately 100 Marine aircraft) had deployed to airfields on the Arabian Peninsula.[13]

Their arrival doubled the number of military aircraft normally available to Saudi Arabia and other states on the Arabian Peninsula–neighboring Oman, the United Arab Emirates, Qatar, and Bahrain. Nearly two hundred aircraft from the United Kingdom, France, Canada, and Italy had joined U.S. and Arab aircraft on these bases. In addition, throughout the fall of 1990 the U.S. Navy maintained three carriers (with

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[10](S) Hist, MAC, 1990, especially pp 198-200. The European bases that provided the half way staging bases were Zaragoza and Torrejon in Spain and Rhein Main and Ramstein in Germany.

[11]The F-15s were armed for two reasons: in case they ran into Iraqi aircraft contesting their landing, and as a means of ferrying ammunition to the theater.

[12]Five unarmed E-3 Airborne Warning and Control System (AWACS) aircraft arrived at Riyadh just before the F-15Cs reached Dhahran. (S) Contingency Hist Rpt, 1st Tactical Fighter Wing, Aug-Sep 1990, AFHRA 881102; intvw, OWAPS with Col (Prince) Bandar A Bin Mohammed (RSAF), Cmdr, 13th Squadron (F-15s), Dhahran, 13 Jul 1992.

[13]For the deployment of US aircraft to the theater see Appendix 1.

more than two hundred aircraft) in the Eastern Mediterranean, the Red Sea, and the Gulf of Oman–all within striking distance of enemy forces.[14]

The deployment of so many aircraft and troops to the Arabian Peninsula proceeded more quickly than smoothly. CENTAF had to change the destination of some aircraft en route, while the deployment involved shuffling some squadrons from one base to another before the onset of the campaign. American aircraft soon crowded Arab airfields, an inviting target for air or terrorist attack. Once deployment sorted itself out, U.S. and other foreign aircraft fit reasonably well in an exceptionally complex operational environment of more than twenty airfields. The second deployment phase in December and January stretched base infrastructure to its limits. Fortunately, since World War II, the U.S. Army Corps of Engineers has helped to build the airfields on the peninsula; in the last forty years they constructed more than was strictly necessary to house the Saudi air forces. One suspects that the Saudis themselves were taking out an insurance policy to allow substantial reinforcement from abroad. The "overbuilding" proved to be a remarkably astute investment.[15]

Operations Plan 1002-90 did not specify which American aircraft would deploy to which airfield. Central Command possessed no peacetime forces of its own other than its small headquarters in Florida; Arab nations had not even permitted the Americans to locate their headquarters in the Middle East, let alone station substantial forces in the area. Consequently, U.S. planners could not be sure which airfields Arab nations would allow them to use in wartime. CENTCOM would receive its combat forces from other commands (like Tactical Air Command, Strategic Air Command, United States Air Forces in Europe, and Military Airlift Command) and it was still working out the details of an automated time-phased force and deployment list. Lacking a complete list in August 1990, CENTCOM had to improvise.[16]

With King Fahd's request for deployment of American forces on 6 August, Schwarzkopf returned to Florida where he could initiate de-

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[14]For US Navy and Marine deployments, see the Center for Naval Analyses (S) rpts, *Desert Storm Reconstruction Report* and *Marine Corps Desert Storm Reconstruction Report* (Alexandria, VA, 1991-92).

[15]See the GWAPS report on supporting the air base.

[16]See the GWAPS Planning report.

ployment of ground forces and communicate more easily with Washington. He left Horner in Saudi Arabia as the acting commander of CENTCOM forward, since most early arrivals would be air force squadrons. Horner located his headquarters in the Saudi Ministry of Defense and Aviation at Riyadh, the capital about three hundred miles south of Iraq and two hundred miles west of the Persian Gulf. This command arrangement lasted three weeks until Schwarzkopf returned on 26 August. Meanwhile, Horner's deputy, Maj. Gen. Thomas R. Olsen, handled CENTAF's deployment from an office in Royal Saudi Air Force headquarters, also in Riyadh. Olsen reached Riyadh on 8 August with a portion of Ninth Air Force's staff from Shaw Air Force Base to form the nucleus of CENTAF headquarters.[17]

With most of Ninth Air Force's headquarters in Saudi Arabia, those remaining at Shaw could not handle a deployment for which so little planning existed. Immersed in the problems involved in bedding down arriving units in the face of potential Iraqi invasion, those in Riyadh had difficulty communicating with bases in the United States and with the small group that remained at Shaw. Consequently, Tactical Air Command headquarters at Langley, became CENTAF's rear headquarters.[18]

The establishment of the Riyadh headquarters for CENTCOM and CENTAF was the first of many changes in deployment planning. [DELETED].[19]

[DELETED]

CENTAF had stored bombs at Seeb before the crisis broke, and Horner had planned to deploy some of his strike aircraft there: F-15Es and F-111s, together with EF-111 jammers. But, not surprisingly, it turned out that Oman did not want American strike aircraft prominently displayed at its international airport. The F-111s went to Taif, and the F-15Es to an isolated bare base at Thumrait, Oman, before eventually moving to another bare base at Al Kharj near Riyadh. Similarly, A-10 ground attack aircraft, originally scheduled for Riyadh's King Khalid International

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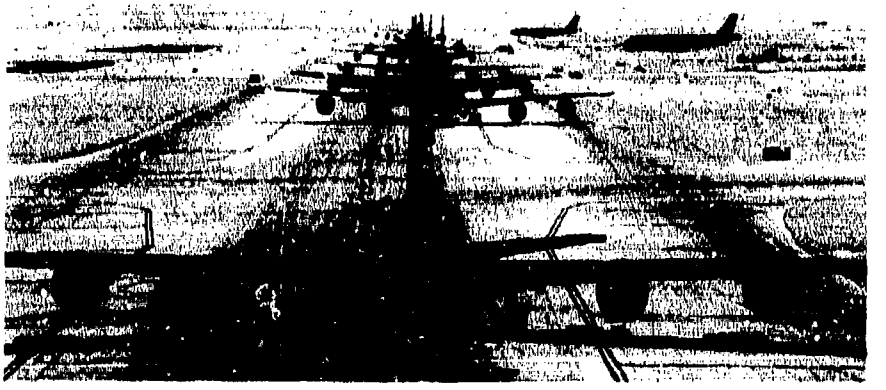
[17](S) Intvw, MSgt Theodore J. Turner, CENTAF historian, with Maj Gen Thomas R. Olsen, CENTAF Deputy Cmdr, Riyadh, 30 Sep 1990, GWAPS CHP 16A.

[18](S) Olsen Intvw.

[19][DELETED]



Less controversial KC-135 tankers deployed to King Khalid Airport.

Airport, deployed instead to King Fahd Airfield under construction near Dhahran. Both Seeb and King Khalid airports received less controversial KC-135 tankers–as did Jeddah.[20]

Not surprisingly, there were considerable difficulties in the initial movement to Saudi Arabia. In the middle of the deployment, Maj. Gen. Lester Brown, acting Ninth Air Force commander after Horner's move to the Middle East, noted:

> The deployment was so rapid that transportation of logistic support items, bare base support equipment and communications gear lagged far behind. The result was that, even though they were on the ground in Saudi Arabia, [the] fighter units [in the initial deployment package] could not really function properly because they did not have the necessary support. For example, one squadron from the 363TFW flew sixteen hours to the beddown site at Al Dhafra–which was a bare base. When the aircrews and planes arrived, they found that there were only thirty SAC people on the base to meet them. . . . The aircrews had to disarm

[20]On the peregrinations of the F-15Es, see (S) hist, 4th TAC Fighter Wing in Southwest Asia, Aug 1990 - Jun 1991. B-52s did eventually end up at Jeddah, as Strategic Air Command had hoped.

> the missiles they had ferried over themselves. Even as late as today [13 August 1990] the 363rd at Al Dhafra has only enough food, water, and munitions to sustain it for twenty-four hours! . . . It will take at least until . . . 18-19 August before the necessary Harvest Eagle and other support equipment and supplies to maintain these units will arrive.[21]

A dozen airfields had to take air refueling tankers, mostly KC-135s. No other aspect of CENTAF's early planning fell so far short of what combat operations required. The planners at Shaw had failed to estimate how dependent air operations would be on air refueling, given the distances in the theater. They had called for sixty-eight tankers; in the end combat operations required over 230. The near doubling of aircraft deployed in December and January accounted for less than half the increase in tanker requirements. Even though the carriers would work in the Persian Gulf during the war, when original assessments had expected them to stay farther away in the Gulf of Oman, Navy strike sorties still depended on air force tankers. Nor had CENTAF planners anticipated how many strikes would have to hit targets deep in Iraq rather than in Kuwait or Saudi Arabia.[22]

In peacetime, tankers belonged to SAC; in spring 1990 that command had tried to persuade CENTAF that its estimate of the number of tankers it would require in war was inadequate. As late as 8 August, the Joint Chiefs of Staff and CENTCOM planned to have only twenty tankers in theater during the deployment's first forty days. Nevertheless, SAC managed to increase the number of tankers deployed in theater to eighty-five in the first forty days. This achievement depended on injecting SAC planners into the efforts in Riyadh and Washington. On 8 August, Brig. Gen. Patrick Caruana with a SAC team arrived in Riyadh aboard the flight of KC-10 tankers that had escorted the first F-15s to Dhahran.[23]

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[21]Intvw, Maj Gen Lester P. Brown, "Desert Shield Deployment: USCENTAF HQ, An Interview Conducted with Maj Gen Lester P. Brown, Acting Ninth Air Force Commander and Col George L. Getchell, Ninth Air Force Chief of Staff," by David L. Rosmer, 9AF/USCENTAF Office of History, 13 Aug 1990.

[22](S) Brig. Horner to Schwarzkopf, "OPLAN 1002 Air Operations," Apr 1990, GWAPS NA 256.

[23](S) Hist, SAC, 1990, pp 334-55.

That same day Headquarters USAF invited SAC to participate in the air campaign planning group in Washington. That command's cooperation paid dividends immediately. The SAC group recommended (their recommendation went directly to Schwarzkopf) that CENTAF needed a minimum of ninety-four tankers, with 114 optimal for forces contemplated in Operations Plan 1002-90. Schwarzkopf replied that so many tankers "almost blew my mind," but he supported the recommendation.[24]

Operational Framework

The process of creating an operational capability in Saudi Arabia was a complex one indeed. First, it demanded a set of realizable and politically realistic objectives. Then, one needed to place the forces in the theater with the base and logistical infrastructures to support sustained operations. And finally, one needed sophisticated operational plans that would place the strengths of one's forces against the weaknesses of the enemy; and plans had to rest on a clear assessment of the enemy and his capabilities. In no fashion were these elements sequential; they occurred concurrently and depended on the personalities, intellectual preparation, training, and education of those who would be responsible for the conduct of the air campaign.

With Horner and his staff in Riyadh bedding down forces and cobbling together a defense against a possible Iraqi thrust into Saudi Arabia, there remained a conceptual gap in thinking through the problems involved in executing an air campaign. Fortunately, the air staff's deputy director of plans for warfighting concepts, Col. John A. Warden III, had begun building a planning cell in his "Checkmate" wargaming facility even before Schwarzkopf requested air staff assistance.[25]

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[24](S) Notes, Lt Col Bernard E. Harvey, Checkmate, 17 Aug 1990, GWAPS CHP 9-4. See also (S) Rpt, Capt Johnson (USN), J-3/JOD, sub: CINCENT Trip, 17 Aug 1990, GWAPS, NA 203; (S) Brfg, Warden to Schwarzkopf, "Instant Thunder," 17 Aug 1990, GWAPS, CHSH 5.

[25]While a student at National War College, Warden had considered using Alexander the Great as a means of studying operational art in war. In the end he settled on writing an extended study of the air campaign, but stayed away from the term "strategic" bombing for obvious reasons. His study was eventually published: John A. Warden, *The Air Campaign, Planning for Combat* (Washington, DC, 1988). Warden made clear to GWAPS interviewers that the *Strategic Bombing Survey* as well as the thinking of Gen Hayward Hansell had heavily influenced his writing of *The Air Campaign* and in his thinking of

On 6 August Warden assembled key personnel to think about how air power could force Iraq to abandon Kuwait. On 8 August Schwarzkopf requested help from the air staff, and since the chief of staff, Gen. Michael Dugan, was out of town, Gen. Loh, Vice Chief of Staff, passed the request to Warden.[26] Because Checkmate had already performed basic ground work for a proposed air campaign against Iraq, Warden was able to brief Loh the next day. Warden's briefing quickly went to the Chairman of the JCS, then to Schwarzkopf, and eventually over to Horner in Saudi Arabia.[27]

The development of Warden's plan need not concern us overly; what is important is the operational concept that Checkmate articulated. The code name, "Instant Thunder," underlined the planning group's rejection of the U.S. approach to air war in Vietnam. That effort had involved a slow, gradual escalation of air attacks on the North Vietnamese; that escalation had allowed the enemy maximum time to adapt. With respect to Iraq, Warden's group advocated a massive and intense application of air power right from the start. Planners sought levels of destruction to the Iraqi military, the political system, and portions of the economy that would either force Saddam to quit, or other Iraqis to remove him; a proposed Presidential briefing, dated 13 August, suggested an intense first night attack to incapacitate Iraq's leadership. Significantly, Warden's briefing only minimally dealt with the problems of the Kuwaiti Theater of Operations (KTO) and Iraqi ground forces.[28]

The air staff plan attempted to identify vulnerabilities in Iraq and its military structure. At Instant Thunder's heart, its operational approach was

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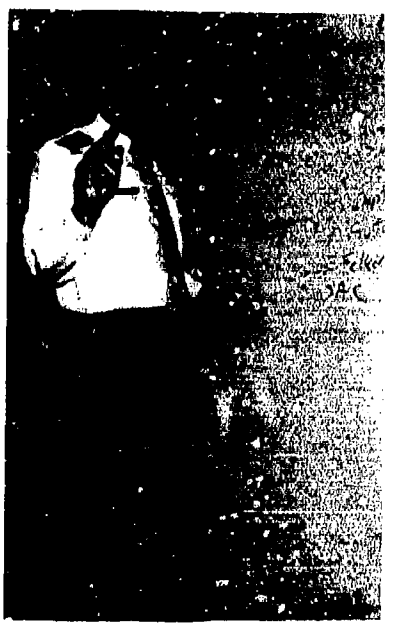
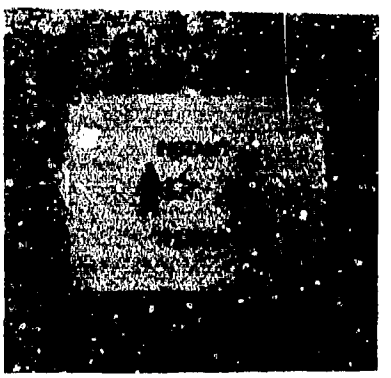
how the air campaign against Iraq should be designed. Intvw, Col John Warden with OWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 21 Feb 1992.

[26]In his memoirs Schwarzkopf indicates that he initiated the request to the air staff for an air campaign plan. Schwarzkopf, *Hero*, p 313.

[27](S) Intvw, TSgt Theodore J. Turner, CENTAF Office of History, "Oral Interview with Lt Col David Deptula," 1 Nov 1990; intvw, Lt Col David Deptula with OWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 20 and 21 Dec 1991; intvw, John Warden with OWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney) 21 Feb 1992.

[28]"'Instant Thunder,' Proposed Strategic Air Campaign," 13 Aug 1990, 2300 hrs, OWAPS CHP 35-6. Gen Powell may have used Checkmate slides to brief the President on 15 August 1990.





Left: Col Warden in "Checkmate" briefing room discussing "Instant Thunder" plan. Above: Code name "Instant Thunder" given to proposed Strategic Air Campaign.

to "conduct powerful and focused air attacks on strategic centers of gravity." The air offensive would involve "round-the-clock operations against leadership, strategic air defense," and electrical targets with the aim of achieving "strategic paralysis and air superiority." The air staff planners estimated that with sufficient air forces, CENTAF could complete such a campaign in five or six days. Early briefings for an air war against Iraq identified eighty-four targets which Checkmate estimated were essential to Saddam's regime.[29] Above all, the air staff plan moved a possible air campaign beyond merely servicing targets to a search for targets sets, the destruction of which would have interrelated or synergistic effects on the Iraqis. The argument was that the destruction of certain carefully selected groups of targets which were interdependent would cause larger problems in both political and military spheres than

[29] *Ibid.* The number of targets in the initial briefing reflected the state of intelligence available concerning Iraq. As more intelligence became available with a refocusing of intelligence assets, the number of strategic targets would grow to over 300 by the beginning of the air war.

the elimination of large numbers of targets that possessed no coherent interrelationships.[30]

At the center of Iraqi power, Warden argued, lay Iraqi leadership. One could attack this target set [DELETED] by cutting off the regime's capacity to communicate with its military and people. At this early point in the process, intelligence had identified only a few targets in this crucial target set; by January Coalition plans would expand this category to more than thirty targets.[31] For attacking Iraq's command and control systems, planners targeted mostly radio and television sites but did not yet possess the intelligence base required for a systematic attack on the telephone network. [DELETED].

On the economic side, Warden and his planners selected electricity and oil as the most likely targets to achieve larger effects. Here historical literature, particularly from World War II, buttressed their thinking.[32] There was a certain irony in this because the *Strategic Bombing Survey* had singled out electricity as a target particularly worth hitting for its impact on long-term industrial production; in Iraq's case the planners were looking for immediate effects. By hitting the electrical network, they hoped to gain political leverage on the Iraqi population as well as to affect communications and other systems depending on electricity. The collapse of the electrical network would also have a considerable impact on the military, since back-up power is rarely reliable. Radar installations and communication centers, dependent on computers, were particularly vulnerable. However, air staff planners hoped to limit long-term damage by attacking transformer stations and by avoiding generators.[33]

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[30]In particular, the personal log for Lt Col David Deptula for 11 August 1990, when the Instant Thunder concept was being worked up by the air staff, has a sketch of a flow plan for attacks on Iraq in support of the air campaign with a final category: "Desired Effect." The diagram became the prototype for the Master Attack Plans utilized during the war. Lt Col David A. Deptula, Personal Log, 9 Aug to 20 Aug 1990, entry for 11 Aug, copy in possession of the author.

[31](S) Instant Thunder Campaign Plan, 17 Aug 1990, Annex C, GWAPS, CHSH 9, p 15.

[32]Intvw, Col John Warden with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 21 Feb 1992.

[33]*Ibid*, p 18; (S) Brfg, Col. Warden to Gen Schwarzkopf, "Iraqi Air Campaign Instant Thunder," 17 Aug 1990, GWAPS, CHSH 7-11.

There were, inevitably, weaknesses in the initial plan that Warden and his staff prepared. Their conception was overly optimistic; it underestimated the number of targets that an air campaign would have to attack; and its estimate on the time necessary for such an air campaign to achieve success failed to take into account the frictions of the war, from bombing inaccuracies to bad weather. Moreover, Warden's conceptions paid little attention to the ground threat, which had considerable effect on the plan's reception by U.S. air leadership in Saudi Arabia. Finally, the plan's assumption that a relatively short air campaign, attacking little of Iraq's political infrastructure, could separate Saddam and his regime from the Iraqi population underestimated the strength of the Ba'thist control.

Nevertheless, whatever the weaknesses in the air staff plans, they exercised an influential, and in the end mostly beneficial influence on the development of the air campaign. Other conceptions for an air campaign against Iraq suggest how valuable Warden's effort was. In early August, Tactical Air Command developed an approach that aimed to begin "with demonstrative attacks against high value targets . . . [and then] escalate as required until all significant targets are destroyed. . . . This strategy allows time and opportunity for Hussein to reevaluate his situation and back out while there is something to save."[34] Air effort would concentrate on targets "that reduce his ability to project power, [i.e.] field armies and infrastructure to support offensive operations."[35]

In effect, this approach represented a replay of the flawed air campaign against North Vietnam, especially its gradual and cumulative escalation of pressure. But some in the Navy were no more imaginative. The initial suggestion by naval commanders on the scene was for an air campaign that would separate the theater into route packages (as had been the case in Vietnam).[36] Other senior admirals suggested a roll back which would chew up the enemy's air defense and other targets in a fashion

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[34]Fax from General Griffith TAC/XP to General Alexander, AF/XOX, 11 Aug 1990, "CENTCOM Air Campaign Plan," GWAPS, CHSH-14. This could not be found in the archives of Tactical Air Command.

[35]*Ibid*, slide 12.

[36]Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992. In fairness, the Navy's operational approach was undoubtedly influenced by the fact that it possessed no stealth aircraft.

quite similar to the Vietnam experience.[37] None of these alternatives suggested the use of air power to achieve rapid operational level effects on Iraq's military and strategic position.

Warden's concept for a "strategic" air campaign received considerable interest from Schwarzkopf. CINCCENT may well have doubted that an air campaign could be decisive, but it did provide an immediate–and probably the only–military option if Iraq initiated a conflict before substantial American ground forces arrived. Consequently, he proved to be an enthusiastic listener when briefed on the conception. And at his urging the team that had briefed CENTCOM journeyed to Saudi Arabia to brief Horner and his staff.

For those who deployed in early August, including Horner, the problems associated with Iraq looked quite different. The most pressing problem was how to beddown and organize the steadily increasing flow of forces. The difficulties involved in the airlift and adjusting to a hostile and forbidding climate were daunting enough. But over the entire theater hung the Iraqi threat. [DELETED].[38] After the war Horner reflected that:

> The idea was that we were to deter an Iraqi invasion of Saudi Arabia, and if an invasion did come, we were prepared to defend. . . .Those were some of the worst nights of my life, because I had good information as to what the Iraqi threat was, and, quite frankly, we could not have issued speeding tickets to the tanks as they would have come rolling down the interstate highway on the east coast. It was an opportunity the Iraqis did not take, but every night we'd get more forces, and we'd sit down and get a game plan of what we'd do if we came under attack.[39]

The threat led Schwarzkopf to push for the deployment of combat forces–both air and ground–at the expense of support forces. While that

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[37]Letter from Capt Stephen U. Ramsdell, to Director, Naval Historical Center, 14 May 1991.

[38]CENTCOM J-5 After Action Report, Combat Analysis Group After Action Report, 21 Mar 1991, GWAPS, NA 259.

[39]Speech By Lt Gen Chuck Horner to Business Executives for National Security, 8 May 1991, GWAPS, Horner Files.

resulted in some difficulties initially, it made sense both in terms of deterrence and combat potential.[40]

Having briefed the major players in Washington and CENTCOM on his proposal for a strategic air campaign against Iraq, Warden arrived in Riyadh to brief Horner. The briefing was not a success.[41] Above all, many in Saudi Arabia thought that Warden's conceptions paid scant attention to the harsh realities of the military balance on the Arabian Peninsula (particularly the ground balance), the logistic difficulties that CENTAF confronted, or the imponderables that an air war might unleash. At the end of the briefing Horner asked Warden a series of pointed questions: Did he know when sufficient supplies would exist in theater to support such a campaign? What would happen if the Iraqi regime did not collapse after a five or six day campaign and CENTAF had used up its logistic base in theater? What could CENTAF do against the Iraqi Army with so little ground forces presently in theater?[42]

Despite his obvious disdain for Warden and his obvious concern with a possible Iraqi offensive, Horner kept Checkmate's draft plan and immediately established his own planning cell to develop it with planners from Checkmate.[43] At the time, Horner did not appear interested in employing air power much beyond battlefield support for the army.[44] But he would steadily move towards a larger conception of air power beyond merely attacking Iraqi ground forces. Several factors combined to push CENTAF toward wider options. First of all, at that point there was not much army to support, if an Iraqi ground offensive did occur; one needed greater leverage on Saddam Hussein than merely destroying tanks. In addition, even army generals like Schwarzkopf and Powell were looking

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[40](S) CENTCOM J-5 After Action Report, p 16.

[41](S) Harvey notes, 20 Aug 1990.

[42]Intvw, Maj Gen Larry Henry with GWAPS personnel (Williamson Murray and Barry Watts), Aug 1992; (S) Harvey Notes, 20 Aug 1990.

[43]Horner sent Warden home, but significantly kept three of the planners to join the special planning cell which eventually became known as the "Black Hole." One of those he kept was Lt Col David Deptula who played a crucial role in transmitting the conceptions that Checkmate had begun into the planning and developing of a strategic air campaign against Iraq.

[44]Intvw, Gen Michael Dugan with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney).

for broader applications of air power than just supporting "the ground commander's scheme of maneuver."

Horner now asked Gen. Glosson to take charge of his planning cell. The cell's official title was the Special Planning Group, but its secrecy soon won it the nickname of the "Black Hole." Glosson was not uncomfortable with the Washington origin of either Warden's plan or his staff, because he had only recently joined Central Command after a Pentagon tour. Indeed he found the Checkmate connection useful and in coming months made increasing use of Warden's staff to exploit the Washington intelligence community.[45] After the war Glosson commented that he carried "as much baggage from the Vietnam War as any other officer in the United States Air Force." Like many fellow officers who had been junior officers during the war, he had devoted much of his postwar career to correcting those deficiencies. Moreover, his time as a student at National War College had influenced him considerably, particularly in thinking about air power and the operational level of war.[46]

Glosson found much of interest in Checkmate's conceptions. But he also believed the plan had crucial weaknesses: too little emphasis on counterair, excessive expectations, and not enough recognition of the staying power of Third World nations. A cryptic comment in his notebook on 23 August suggested: "need air campaign for fifteen rounds not three; six days is dumb."[47]

Over the long-term development of CENTAF's air campaign plan, Glosson kept one of Warden's planners, Lt. Col. David Deptula, and collected a number of officers from combat units now arriving in Saudi Arabia. While such a staff provided him with personal connections to

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[45](S) Intvw, MSgt Theodore J. Turner, CENTAF historian, with Brig Gen Buster C. Glosson, Riyadh, 17-27 Oct 1990, GWAPS CHP 5A.

[46]Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992. Glosson argued in this interview that instead of a Clauswitzian approach to war, much of the Air Force's senior leadership had consistently taken a Jominian view throughout the cold war. Moreover, he argued that Air Force leaders had never understood operational art and had made little consistent effort to think about the higher levels of war. All too often Air Force leaders had become managers instead of warriors.

[47]Glosson Journal, 23 Aug 1990; Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992.

fighting units, it did not provide a group with any special preparation to think about how one might utilize air power to achieve operational-level effects. The situation was considerably different in the case of the Army. In mid-September when confronted with the necessity to plan for a ground campaign into Kuwait and Iraq, the Army was able to pull into Riyadh a group of officers specially trained in operational art, all graduates of the School for Advanced Military Studies at Leavenworth.[48] As a result, the Army was able to build a sophisticated operational planning staff at short notice–one that could immediately think in terms of the operational employment of ground forces.

Horner made clear to Glosson that he wanted "an executable air campaign plan by mid-September."[49] An essential point in the discussions between Horner and his chief planner was the clarification of what the CENTAF Commander had gleaned of the President's objectives during his early August meeting with Bush. As roughly sketched out, these political objectives were to 1) remove the Iraqis from Kuwait; 2) eliminate production and storage of weapons of mass destruction; 3) end Iraq's capacity to threaten its neighbors over the next five to ten years, regardless of whether Saddam remained in power; and 4) insure that the full conventional military capabilities of the United States would be used. There was a limiting factor: the desire to hold American military and Iraqi civilian casualties to a minimum.[50] In early October Glosson journeyed to Washington to brief the national leadership, including the President, on plans for an air campaign; he utilized that opportunity to insure that there was direct agreement between the President's political conceptions and CENTAF's view of its political objectives.[51]

From the initial formulation of political and military objectives in August to the onset of operations in January, there remained great

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[48]CENTCOM J-5 After Action Report and Supporting Documents, GWAPS, NA 259.

[49]What is of considerable interest is the fact that Glosson's Special Planning Group used the "s" word from the first in its draft operations order for CENTAF's air campaign: "This operation will be a strategic air campaign against vital Iraqi centers of gravity . . . " [(S) COMUSCENTAF, Draft Operations Order, 27 Aug 1990, Offensive Campaign–Phase I, p 3].

[50]Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992.

[51]*Ibid.*

consistency in the planning for the air campaign. What did change was the role of the air campaign in American strategy. In August–and much of September–air operations were the sole means of effectively striking the Iraqi military and political infrastructure. As increasing numbers of ground troops arrived, the emphasis shifted towards a combined air-ground strategy–one in which the air campaign would not only attack the heart of Iraqi power, but would prepare the way for an eventual ground offensive. Those ground forces would liberate Kuwait and complete the job of destroying the Iraqi military. Not surprisingly there was some considerable tension between these two approaches, and those tensions carried over into the execution of Desert Storm.

Warden's initial briefings for Instant Thunder had noted that "psychological operations [would be a] critical element in the command; destroy Iraqi TV and broadcast systems–substitute U.S. broadcasts; separate regime from support of military and people."[52] But almost immediately, psychological operations disappeared from discussions of an air campaign against Iraq. [DELETED].[53]

The President's objectives now formed the framework within which Glosson's special planning group worked out its operational concepts for the coming air campaign. CENTCOM's objectives in the plan's last formulation before the onset of Desert Storm were to: 1) destroy Iraq's military capability to wage war; 2) gain and maintain air supremacy; 3) cut Iraqi supply lines to the KTO; 4) destroy Iraq's chemical, biological, and nuclear capabilities; 5) destroy the capabilities of the Republican Guard, Saddam's elite ground force; and 6) liberate Kuwait City with Arab forces.[54]

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[52](S) Warden Brfg, 11 Aug 1990, "Instant Thunder," GWAPS Folder #35.

[53]As we will discuss at the end of this study, psychological operations played a minimal role in the operational air campaign against Iraq, while it was given a centerpiece role in the air campaign against Iraqi ground forces in the Kuwaiti Theater of Operations.

[54](S) HQ USCENTCOM, Combined OPLAN for Offensive Operations to Eject Iraqi Forces from Kuwait, 17 Jan 1991, pp 2-4. For further discussion of this point see Chapter 2 of the GWAPS Effectiveness report.

To achieve these military goals the CENTCOM and CENTAF planners developed a four-phased approach.[55] Phase I would be a "strategic" air campaign to cripple Iraq's political and military leadership. Destruction of Saddam's command and control system was essential to achieving this objective. But the air campaign aimed also to destroy Iraq's ambitious weapons development programs–how ambitious would emerge only after the war–in the nuclear, chemical, and biological areas. Phase II aimed at gaining air supremacy over Kuwait; consequently it remained closely connected in the execution and timing to Phase I; the two phases would have to run concurrently. Phase III would prepare the battlefield by interdicting the Iraqi Army in the KTO along with direct attacks on its forces. Finally, Phase IV would be a ground offensive with air power to "support the ground commander's scheme of maneuver."[56]

CENTCOM's January operations plan for the conduct of the war against Iraq noted that "execution of the phases is not necessarily discrete or sequential; phases may overlap as resources become available or priorities shift."[57] The heaviest emphasis in the early days would lie on destroying Iraq's air defenses and in bombing high value strategic targets. Nevertheless, such attacks would continue to the last days of the war. Similarly, attacks on the Republican Guard and other ground forces would begin on D-Day, but become increasingly intense as the ground war approached.

The senior leadership both in Washington and Riyadh regarded the Republican Guard as a "strategic" target of essential importance to the regime's continued political stability. Moreover, as Powell noted after an early briefing on Instant Thunder, even if the air campaign forced Iraq to disgorge Kuwait, he did not want Saddam to retain his massive army. To

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[55]By 2 September 1990 the conception for Phase I had been largely formulated with the initial planning work; the planning for the two succeeding phases was much less complete. By early October Glosson would brief the first three phases to President Bush. See COMUSCENTAF Draft Operations Order, "Offensive Campaign–Phase I," 2 Sep 1990; and Lt Col David A. Deptula, "Instant Thunder (Offensive Campaign Phase I) Planning Assessment, Talking Notes of Lt Col David Deptula as presented to SECAF and XOXW upon return from first trip to AOR," 24 Sep 1990.

[56]USCINCCENT OPORD 91-001 for Operation Desert Storm, paras. 1D, 3A, and 3B. OPORD contained in a message USCINCCENT to CJCS, 161735Z Jan 1991.

[57](S) HQ USCENTCOM, Combined OPLAN for Offensive Operations to Eject Iraqi forces from Kuwait, 17 Jan, paragraph 3a.

allow Iraq to do so would allow the Iraqis to intimidate their neighbors after U.S. forces had gone home.[58] The Chairman commented on 11 August:

> I won't be happy until I see those tanks destroyed. . . . The campaign I laid out for the President: sweep the air and leave the tanks to pick off piecemeal–if we go this far . . . I want to finish it: destroy Iraq's army on the ground.[59]

Some within the Air Force, Warden being a prime example, believed that air power alone could defeat Saddam Hussein. What, however, their arguments missed was the crucial role that the ground war would play in convincing the world–especially the Arab world–of the complete defeat of Iraq's army. Without pictures on world TV showing Iraqi soldiers surrendering in droves, Saddam could soon have claimed that his army had remained in the field, bloodied but unbeaten, too formidable for the cowardly Americans to attack. Such propaganda would have gone down all too well in parts of the Arab world–in effect a replay of the infamous "stab in the back" legend that the German Army had stood unbeaten on the Western Front in November 1918.

Senior air commanders, especially Horner and Glosson, refused to claim too much for air power; better for the campaign to speak for itself. The problem, of course lay in translating concepts into plans and then inot reality. An important part of this process was the assessment that coalition air commanders had to make of their opponents.[60] In the period before the war, the intelligence community and many so-called experts estimated that Iraq possessed exceptionally capable military forces.[61] Senior air leaders, on the other hand, felt that cultural and political

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[58]Intvw, Col John Warden with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 21 Feb 1992.

[59]Quoted by Memo (S) Subj: "Instant Thunder" Brfg to CJCS, 11 Aug 1990, Lt Col Ben Harvey, GWAPS CHSH #14.

[60]For the net assessment of the actual capabilities of the opposing sides see chapter 2 of this report.

[61]For an unclassified overestimation of Iraqi military capabilities see the study by the US Army War College's Strategic Studies Institute: Stephen C. Pelletiere, Douglas V. Johnson, II, and Lief R. Rosenberger, *Iraqi Military Power and U.S. Security in the Middle East* (Carlisle, PA, 1990).

Iraqi tank destroyed during air campaign.

impediments existed within the Iraqi military that would degrade its capacity to use the complex technological systems under its control.[62]

The air campaign against Iraq largely confirmed their net assessment of Iraqi military weaknesses and corresponding Coalition strengths. At the time, however, it represented a substantial leap of faith. Had such assumptions proved faulty, they might have resulted in heavy losses for the Coalition. The calculation of substantial superiority of Coalition air

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[62]Senior air commanders from the Coalition's Arab air forces confirmed this assessment. In fact most estimated that the Iraqis were considerably inferior to the Saudi and other Gulf air forces; one source estimated that there were only twenty Iraqi pilots good enough to match the best pilots in the Gulf air forces in air-to-air combat and a further twenty capable of matching their counterparts in the air-to-ground arena. Consequently, out of an air force of nearly 500 pilots, Arab sources calculated that the Iraqis possessed barely fifty first-rate pilots. Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992.

capabilities over those of the Iraqis allowed air planners to take substantial risks in developing the air campaign. They could think in terms of degrading rather than destroying Iraqi systems; moreover, their assessment allowed planners to spread scarce resources–especially in terms of precision bombing aircraft–across a broad spectrum of targets.

Tactical Framework

The urgency of the planning task caused Glosson to ask more from CENTAF's intelligence staff than they could provide. Checkmate planners had used target photography in Washington, not yet available in Riyadh; intelligence officers had worked with Checkmate to select aiming points on target photographs. [DELETED]. But coordinates were of little use to planners or pilots unless accompanied by target photographs. The failure of the intelligence community to make existing imagery promptly available to the planners who desperately needed it seemed inexplicable to Glosson. So began his rocky relationship with a community vital to his work.[63]

Glosson established his own channels to intelligence analysts in Washington through Checkmate and later through Rear Adm. J. M. McConnell on the Joint Staff. They helped Glosson's Special Planning Group–the Black Hole–come to grips with growing target lists. [DELETED]. Checkmate had begun with photography on eighty-four targets that looked promising, but over the next five months the Black Hole became acquainted with ten times that many targets, and still important targets would remain that intelligence failed to identify until after the war–if then. In many cases spaceborne and airborne reconnaissance assets simply could not substitute for ground based assets.[64]

Precise intelligence was all the more important to Black Hole planners because they relied heavily on precision bombing. They needed to know exactly where the Iraqi leadership conducted business and how communications ran between Baghdad and army divisions, air bases, and missile sites. If intelligence could identify key nodes in the Iraqi com-

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[63](S/NF) Memo, Col James R. Blackburn Jr, Dir of Targets, HQ USAF, subj: USAF/INT Targets/MC&G Support to Desert Shield, 17 Oct 1990, GWAPS NA 269.

[64]See GWAPS Planning report.

mand and control network, precision-guided bombs, some of which could penetrate bunkers constructed of reinforced concrete, could disable the entire network.

Unfortunately, one of CENTAF's real weaknesses lay in its intelligence staff. It was not that intelligence was not available, or that there were not suitable, highly-trained officers in the field. But substantial problems emerged in getting intelligence to the operators through organizational structures in a timely fashion. For that reason, a number of the senior commanders in the Gulf War would criticize intelligence when the war was over.[65] But there is, of course, another side to the story: the disinterest that the operational community in the Air Force has displayed towards its intelligence branch throughout the past several decades. As a result, a considerable gap existed between real-time needs of operators and planners, and the desire of the intelligence community to maintain peacetime procedures and security classifications. In the end such difficulties did not prove crucial to the outcome of the war, but only because planners and air commanders established work-arounds with the help of those in intelligence services willing to work outside of normal channels. But in an environment where American forces were less dominant, this gap might have proven costly.

The Black Hole relied on the F-117 "stealth" fighter as its principal platform to attack targets in the Baghdad area. Analysis predicted that attacks by F-111s and navy A-6s on targets in Baghdad would be extremely dangerous so the F-117 became the weapon of choice. Designed to give enemy radars a minimal picture, the F-117 promised to deliver laser-guided bombs in Baghdad without significant losses. Although F-117s had been operational since 1983, their only combat test had come in December 1989 in Panama. The F-117 had never had to

[65]Horner commented in a speech in spring 1992: "We ran into a problem that our intelligence systems were primarily designed for peacetime. You think about it, it makes sense. You have peacetime for ten or fifteen years, and you have war for, in this case, six weeks, and then you hope to enjoy a long period of peacetime. So as a result you tend to develop intelligence capabilities that look into a country, count its garrison. . . . And you tend to atrophy your capability to identify where his forces are deployed in the field." Lt Gen Chuck Horner, "Address to Business Executives for National Security," Washington, DC.

deal with formidable air defenses like those protecting Baghdad.[66] But Glosson had flown against the F-117 when he had taken his F-15 wing to Red Flag, and his experience on the Nevada range had at least convinced him that F-117s could get inside enemy air defenses.[67]

The Air Force had kept its fifty-six F-117s at Tonapah, Nevada, an airfield whose existence remained secret–along with the F-117–until 1988. Before August 1990, Horner could not count on getting F-117s in the Middle East. Nevertheless, he hoped for some stealth aircraft. Eighteen F-117s arrived [DELETED] on 21 August. The Pentagon targeteers put as many as eight F-117 sorties on a single target for Instant Thunder, but Glosson and Deptula eventually hit on attacking as many targets as possible by sending each F-117 sortie against two targets with a 2000-pound laser-guided bomb (LGB) for each.[68] The ability to strike large numbers of targets with F-117s in a short time expanded again when President Bush doubled U.S. forces in November. The number of F-117s climbed.[69]

For precision bombing in less formidable areas, the Black Hole planned on using F-111Fs and eventually F-15Es. The latter, however, would only be useful for precision bombing after receiving their laser targeting pods, part of the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system. When the first F-15E squadron arrived in August, it had only LANTIRN navigation pods–no targeting pods. They would eventually reach the theater in time to be used during the air campaign. The F-111Fs also posed a problem, but one more quickly solved. CENTAF had not expected to get F-111Fs; instead Operations Plan 1002-90 called for F-111Ds, which lacked precision-bombing capability. In early August the Secretary of the Air Force and Checkmate urged a

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[66]*Ibid*; (S) study, Ronald H. Cole, *Operation Just Cause* (Washington: JCS Historical Div, 1990).

[67]Intvw, Maj Gen Buster Glosson with CWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992. [DELETED]. Intvw, Maj Gen Larry Henry with CWAPS personnel (Williamson Murray and Barry Watts), Aug 1992.

[68]See Richard P. Hallion, *Storm Over Iraq: Air Power and the Gulf War*, (Washington, DC, 1992), p 153.

[69](S) Horner called for F-117s [DELETED] in his April 1990 briefing to Schwarzkopf [(S) Brfg, CWAPS NA 256]. [DELETED]. See (S) intvw, Maj Gen Thomas R. Olsen (Ret) with CWAPS personnel, 9 Mar 1992.

switch to F-111Fs to increase CENTAF's precision-bombing capability.[70] Consequently, when eighteen F-111s arrived at Taif on 25 August, they were F models from European Command rather than D models from Tactical Air Command.[71]

Since the planners in the Black Hole eventually decided not to risk conventional (non-stealthy) aircraft on missions against Baghdad where many crucial targets lay, missiles would hit targets in the capital area during daylight hours. [DELETED]. The Air Force had also developed a conventional version of its Air Launched Cruise Missile (ALCM). Strategic Air Command was eager to see conventional Air Launched Cruise Missiles tested in combat if it could launch them from B-52s that flew out of the United States and which did not touch down in the Middle East. This would be the longest air combat mission on record.[72]

The Navy possessed the sea-launched Tomahawk cruise missiles. [DELETED].[73]

The Navy and Marine corps also contributed planners to the original Checkmate effort and then to the Black Hole. At first Navy and Marine planners hoped to use their A-6 precision bombers against targets in the Baghdad area, but computer modeling of the threat persuaded them to leave that job to F-117s and Tomahawks. By bringing half the six carriers, deployed by mid-January, in the Persian Gulf (with the other half farther away from Kuwait in the Red Sea) and attacking targets mostly in Kuwait and southern Iraq, the Navy sought to reduce dependence on Air Force tankers. The Marines preferred to keep their aircraft employed in Kuwait in behalf of their ground forces. They got their air as close to the battlefield as they could, with AV-8s north of Dhahran at Al Jubayl and FA-18s (with their A-6s) south of Dhahran at Bahrain.

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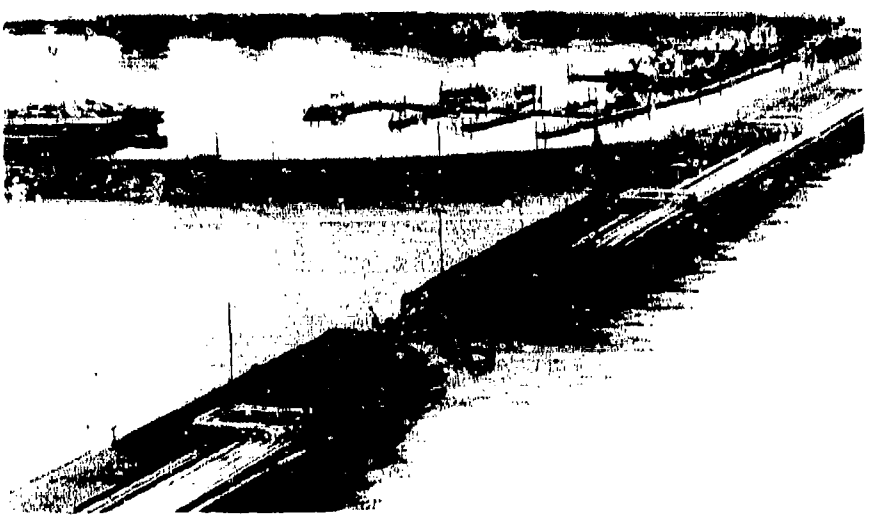
[70]Crucial to this deployment option was the disappearance of the Soviet threat in Europe which allowed the F-111Fs to deploy to the Middle East.

[71]Issue paper, Maj "Sky King," Checkmate, subj: F-111F Deployment, 12 Aug 1990, GWAPS CHSH 59-3.

[72][DELETED].

[73]On the Tomahawks, see Frank Schwamb, et al, *Desert Storm Reconstruction Report, Vol II,: Strike Warfare* (Washington: Center for Naval Analyses, 1991).

Beyond phases and strategic objectives, the air campaign needed target sets that aimed at getting maximum synergies and interrelated damage from air strikes. Then, planners had to keep two limiting factors in mind: air attacks must inflict *minimum* casualties on the Iraqi population (as well as limited damage on the civil infrastructure of the country). As Glosson noted after the war, "the American people would not have stood for another Dresden."[74] Secondly, attacking air forces could not suffer heavy losses, again due to the pressures exerted by public opinion.



A bridge destroyed by multi-national forces.
UN Photo 158204/J. Isaac

Early on, Warden and his staff had created ten target sets or categories. This was a crucial conceptualization, especially when one considers that the eighty-four targets on Warden's list on 21 August had grown to 218 by 11 October, 237 by 20 December, and 481 by 15 January.[75] These target sets were: Leadership; Command, Control, and Com-

[74]Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992.

[75]See Watts and Keaney, GWAPS Effectiveness report, Target Sets.

munications; Strategic Air Defenses; Airfields; Nuclear, Biological, and Chemical Research and Production; Naval Forces and Port Facilities; Military Storage and Production; Railroads and Bridges;[76] Electrical Power; and Oil Refining and Distribution Facilities. Schwarzkopf added the Republican Guard as a category and Scuds soon emerged as a separate target set. After the beginning of Desert Storm, two more categories appeared: fixed surface-to-air missile sites in the KTO and breaching sites for the ground offensive.

Organization

A crucial difference in the conduct of the air campaign against Iraq and Rolling Thunder against North Vietnam lay in the fact that now there was *one* individual responsible for the conduct of the campaign. In Vietnam, no less than six competing command authorities had muddled the execution of operations. Schwarzkopf now assigned the conduct of air operations against Iraq to one commander: Gen. Horner, as the Joint Forces Air Component Commander (or JFACC). The concept of a JFACC had originated in the mid-1980s after serious debates among the Services. That debate reflected the pressures from Congress for "jointness," as well as the self-imposed difficulties that U.S. forces had encountered in the Grenada operation. Several members of the air staff, supported by the Air Force Chief of Staff, Gen. Charles Gabriel, pushed heavily for the creation of a JFACC position to provide a clearer focus for any future air campaign. Integral to the concept was a belief that the JFACC would not have to be an Air Force general but would reflect the composition of the units conducting the campaign–a campaign that relied heavily on carrier aviation would most naturally have an admiral as JFACC.[77]

Early on, Schwarzkopf made clear that Horner would be the JFACC; as Schwarzkopf indicated to Glosson: "If you aren't part of the air cam-

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[76]The original category was only railroads. Highway bridges were added when it became apparent that they represented a crucial portion of the transportation network.

[77]I am indebted to Col Robert Gaskin, USAF (ret) for recounting the interservice squabbles that eventually resulted in the creation of the JFACC position. Col Gaskin was the action officer for XOXID in debates which lasted a number of months and in which this author sat on several occasions.

paign under Horner, you don't fly."[78] In Horner's terms, the various Service air components and Coalition air forces were under his "control" rather than "command;" but the choice of wording reflected a desire not to exacerbate interservice or Coalition tensions. Nevertheless, whatever Horner's sensibilities or the complexities of interservice politics, his draft operations order of 27 August 1990 made clear that the "JFACC will conduct, in the near term, a theater air campaign to seize the initiative by attacking, isolating, and incapacitating the Iraqi military leadership and destroying Iraq's ability to conduct military operations."[79]

The creation of a Special Planning Group answered two crucial problems. First, most CENTAF planners were embroiled in the beddown of arriving units; they also had to put together the daily Air Tasking Order (ATO) that prepared Coalition air forces to meet any Iraqi offensive. Thus, Horner needed a Special Planning Group to plan a complex "strategic" air campaign. Equally important was the need for security, not only against Iraqi espionage, but also against premature disclosure to allies; the Coalition had not yet discussed any offensive action against Iraq, and there were many in the U.N. who had proven dubious even of the idea of an embargo of Iraq.

Consequently, development of an air campaign demanded stringent security precautions.[80] It was not that the U.S. needed to hide its planning from the Saudis or other Coalition members; rather the secrecy surrounding the Special Planning Group reflected the requirement to prepare a coherent plan before one briefed the Saudis. Due to diplomatic and political sensibilities, any plan would have to be briefed first to King Fahd; there could be serious diplomatic repercussions, if the Saudis discovered plans for offensive operations before they reached concrete form.[81] Finally, one needs to note the political sensibilities in the United States, where substantial portions of the public and Congress remained dubious about American participation in the crisis.

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[78]Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 9 Apr 1992.

[79]COMUSCENTAF draft operations order, 27 Aug 1990, Annex C, p 1.

[80]Notes from Ninth Air Force "Warrior" Brfg by Lt Cols Sam Baptiste and Jeff Feinstein to GWAPS, 4 Dec 1991, notes taken by Barry Watts.

[81]"Extract of Major Comments and Questions, Notes from Horner Brief," Col John Warden, 20 Aug 1990, GWAPS, CHP 35-10.

In December, Horner formalized the de facto arrangements between his two planning cells. Both the original CENTAF planners and the Special Planning Group now officially came under Glosson. The latter's title was Director of Campaign Plans–the organizations underneath him were: 1) Guidance, Apportionment, & Targeting and 2) the Air Tasking Order shop. In addition, Horner also appointed Glosson as the commander of 14th Air Division, containing fighter units that would conduct much of the air campaign. There appear to have been two reasons for Horner's decision. First, it brought planning and execution functions of his staff together. Secondly, it formalized the close relationship between himself and Glosson, who otherwise would have had to report to Horner through the Deputy Chief of Staff for Operations.

Horner's principal device for unifying the air efforts not only of the U.S. Services but also of the Coalition as a whole was the daily Air Tasking Order (ATO). Through the months of Desert Shield, the diverse air forces of the Coalition accustomed themselves to the necessity of getting all sorties into CENTAF's air tasking order. Meanwhile CENTAF prepared air tasking orders for the first two days of the Desert Storm air campaign. Horner did not want orders prepared in advance of the campaign for more than the first two days, because after that initial period unexpected changes would require flexibility.[82] In fact, the planners did prepare skeleton outlines for further days in the campaign.

Since the war, there has been considerable controversy over the JFACC and the air tasking order. Admittedly, and not surprisingly, there were problem areas. Nevertheless, without a JFACC or an ATO there was little possibility of running a coherent air campaign: the possibilities of blue-on-blue fratricide would have multiplied; and the Iraqis would have found it relatively easy to slip aircraft into Coalition airspace because of competing authorities.[83] The only alternative to the JFACC-ATO approach would have been a modified version of the route package approach of the Vietnam War; each Service would have controlled its own geographic

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[82]Partial sets of ATOs for Desert Storm are in GWAPS CATO and GWAPS HQ USAF Ops Ctr CSS 6. See also AFHRA 882196-214.

[83]In one case the Iraqis almost managed to slip two F-1s out into the Gulf due to competing airspace control between AWACS, Marine ground control and Navy control. In the end, the system reacted and a Coalition F-15 shot down the Mirages.

area independent of any larger control. The result would have been a less coherent, more factionalized and fractionalized air campaign.

What made the articulation of the air campaign against Iraq substantially different from earlier efforts lay in both its process and its conceptualization. In the earliest days of Instant Thunder, Colonel Deptula had hit on the idea of using a "Master Attack Plan" as an intermediate step between the target list and the ATO. The Master Attack Plan was an effort to coalesce numerous inputs into a coherent conception before one began the process of building an ATO of thousands of sorties. By giving only the basic information about combat sorties, the Master Attack Plan required relatively few pages instead of the hundreds consumed by the ATO. With a Master Attack Plan one could work on the overall conception of the campaign–an impossibility with ATOs, given the size of those documents. Consequently, Deptula's Master Attack Plan became the principal vehicle for designing the structure of the air campaign.[84] By beginning the ATO process with a Master Attack Plan, the Black Hole's planners were now able to build a coherent picture of what they were attempting to accomplish with the air campaign and to track that campaign on a day-to-day basis.

Final Preparations

As more intelligence on Iraq became available, the size of the task on which Coalition air forces would embark slowly emerged. Especially troubling was the growing fear that the most dangerous weapon in Iraq's arsenal might prove to be anthrax, a fatal disease sometimes transmitted by cattle or sheep to farmers.[85] Although biological weapons might be more dangerous, CENTCOM predicted that Iraq was more likely to use chemical weapons. If Iraq had succeeded in producing chemical warheads for its missiles, a chemical attack on Riyadh or Israel was possible. Even conventional missile attacks on Israel might provoke an Israeli retaliation that in turn would threaten Arab participation in the Coalition. CENTAF planned to bomb fixed launch sites at the air campaign's outset, but Iraq possessed mobile launchers. U.S. Space Command assured CENTCOM that its satellites could see Scud launches in time

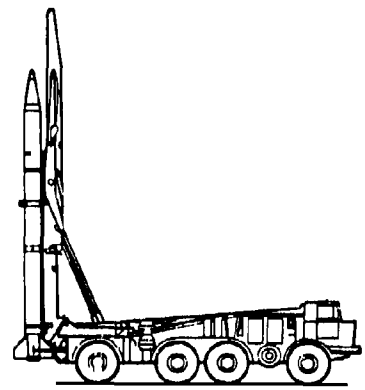
[84]Succeeding versions of master attack plans for the first three days are in GWAPS BH 4-1 and CHC 16.

[85]See GWAPS Planning report.

to provide sufficient warning for those in the target area to take shelter and don gas masks. Whether Army Patriot surface-to-air missiles could shoot the Scuds down remained to be seen.[86]

Army and Marine ground forces had reason for special concerns about Iraqi artillery because of its superior range and the heavy emphasis that the Iraqis had placed on it in their defensive doctrine.[87] Schwarzkopf, however, placed more stress on air strikes against Iraqi armor, because he and Powell wanted to destroy Iraq's potential for future offensive operations. In any case, Schwarzkopf insisted that air power destroy half the Iraqi ground forces before beginning Phase IV, the ground offensive. Coalition air power was to pound Iraqi ground forces so heavily that they could not exact many Coalition casualties during a ground campaign. This was an unprecedented demand.[88]

CENTAF categorized the job of destroying the Iraqi Army in its holes as Phase III of the air campaign. This did not fully square with Schwarzkopf, who divided the job between Phases I and III. For Phase I, the strategic air phase, Schwarzkopf ordered CENTAF to begin bombing the Republican Guard in southern Iraq. After the Guards had led the invasion of Kuwait, Saddam had pulled them back into a second echelon



[86]See GWAPS Space report.

[87]The Iraqis had been working very closely with the South Africans and the Canadian artillery expert, Gerald Bull, during the last stages of the war with Iran. As a result, they possessed weapons with range superior to many in the ground forces of the Coalition.

[88](S) Rpt, Combat Analysis Gp, 21 May 1991, in Vol VI of CENTCOM J-5 After Action Rpt, GWAPS NA 259.

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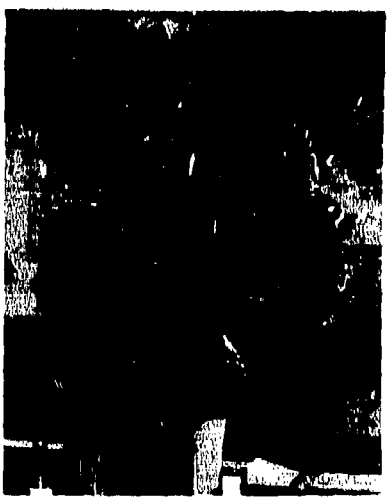
and placed less capable forces on the front lines in Kuwait. Thus, the Republican Guard was in position to launch a major counterattack once the direction of a Coalition offensive became clear. They could also stop front line forces from deserting. Since the Republican Guard was also an essential political prop for the regime, Schwarzkopf argued that they were a strategic target; consequently, he wanted them to be attacked as soon as possible.[89]



Lt Col Deptula briefing Gen Schwarzkopf on the "final" attack plan.

Although accepting Schwarzkopf's desire to see the Republican Guard bombed early, Horner and Glosson held the line on the first night of the campaign–there would be no diversion of air power to bombing ground forces on that night. In CENTAF's view the first three phases of the campaign plan had merged. Schwarzkopf's notion that the Coalition needed a Phase II for suppression of enemy air defenses in Kuwait and southern Iraq had never made sense to Horner and his planners, who intended to attack the Iraqi air defense system at its heart right at the start. The decision to attack the Republican Guard from the first day on, however, still left a pattern by which targets in Baghdad and northern Iraq would absorb most of the sorties for the first week; the bulk of the effort would then shift to Iraqi ground forces.[90]

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[89]Schwarzkopf, *Hero*, especially pp 319-20.

[90](S) Intvw, GWAPS with Maj Gen Glosson, 9 Apr 1992; (S) Intvw, Center for Air Force History with Glosson, 12 Dec 1991.

Since the air assault on Iraqi ground forces would mostly come after the meticulously planned first two days, Phase III received relatively little attention in the Black Hole in the early planning stages. Checkmate ran computer spreadsheets which did suggest air's ability to destroy half Iraq's deployed force (including tanks and artillery) in less than a month. Nevertheless, throughout the prewar period the problem of taking apart the Iraqi Army in the KTO never received the attention or concentrated analysis that the air campaign against Iraq received during the same period.

The Coalition buildup in aircraft and munitions did keep up with intelligence estimates of the Iraqi buildup in the KTO to more than thirty divisions by the end of December. Indeed more than 300,000 tons of bombs reached the theater before the end of the war; Coalition air forces, however, would expend less than a third of that enormous quantity. The rest filled bomb dumps throughout the theater and especially the new depot at Al Kharj southeast of Riyadh. In August and September, CENTAF had been short of precision weapons because most of the bombs stored in the theater were "dumb bombs"--many dating from the Vietnam War. By November, however, CENTAF's precision munitions inventory had expanded considerably and was improving.[91]

A Coalition offensive had become likely by early November; President Bush announced his decision to double the size of the American deployment and bring VII Corps from Europe. This decision followed a CENTCOM Desert Storm briefing at the White House on 11 October. While the air portion of the briefing was persuasive, the Phase IV plan to send Coalition ground forces straight into prepared Iraqi fortifications in Kuwait raised the specter of heavy casualties. Schwarzkopf later explained that he could not divide his ground forces for a flanking movement unless he got VII Corps. Bush then gave CENTCOM VII Corps and virtually doubled the air deployment as well. Although CENTAF believed it possessed sufficient strength to wage an effective air campaign, the additional aircraft, and especially the increased numbers of precision bombers (F-117s, F-111Fs, and F-15Es), provided an abundance which made planning easier.[92]

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[91]The series of Checkmate briefings reporting its findings on Phase III are in GWAPS CHSH 6 and 8.

[92]Schwarzkopf, *Hero*, pp 356-67.

Like VII Corps, many of the new Air Force units deploying to the Middle East came from Europe. Of the nearly 300 Air Force fighters that arrived in the Arabian Peninsula in the last two months before Desert Storm, more than a third were from USAFE. Thirty-two more F-111Fs from Lakenheath AFB, England, joined the thirty-six already at Taif. A dozen more F-4G Wild Weasels came from Spangdahlem Air Base, Germany, to Shaikh Isa on Bahrain. Twenty-four air-to-air F-15Cs arrived at Al Kharj from Bitburg AFB, Germany, and twenty-four F-16s flew from Hahn AFB, Germany to Al Dhafra in the United Arab Emirates. Another sixty-six F-16s arrived from the United States to make a grand total of 210 F-16s in the theater--by far the most numerous strike aircraft, with 132 A-10s a distant second.[93]

In addition to direct contributions to CENTCOM's force structure, European Command prepared for air and special operations missions into Iraq from Incirlik, Turkey. Not until the actual opening of the air campaign in January did Turkey grant permission for air operations, and special operations would remain taboo. Since European Command had sent all its F-111F precision bombers to CENTCOM, Task Force "Proven Force" had to make do with dumb bombs dropped by eighteen F-111Es and thirty-six F-16s. As early as September, the Black Hole had included provisional targets for Proven Force in the Master Attack Plans for the first two days. Beyond that, no firm arrangements were made even when the Proven Force commander, Maj. Gen. James L. Jamerson, visited Horner in early January. Horner could not count on Turkey's approval, and he had plenty of air power even without Proven Force.[94]

While CENTAF's forces grew, they were not idle. Not until the end of October could American aircraft use live ordnance on Saudi ranges, but short of that, the squadrons had engaged in as realistic training as possible. This was not without cost, and a series of accidents culminated in early October when an RF-4C and an F-15E flew into the ground. All four crewmen died. Horner then raised the minimum training altitude for fighter aircraft to 1,000 feet. Only the B-52s could continue to practice

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[93]For a complete list of aircraft deploying to the theater November 1990 - February 1991, see OWAPS Statistics report.

[94](S) Hist, Joint Task Force Proven Force, 13 Dec 1991; (S) Intvw, CMSgt Jerome Schroeder, Proven Force historian, with Maj Gen James Jamerson, Ramstein Air Base, Germany, 27 Mar 1991.

missions at 500 feet. Although safety considerations inspired the new rules, they pointed toward an air campaign that would largely abandon low altitude in favor of altitudes above 10,000 feet. Since the air plan aimed to destroy Iraq's air defense system and the ability of Iraqi aircraft and surface-to-air missiles to control medium altitudes in the first two days, Coalition aircraft would be able to fly above the Iraqi antiaircraft artillery with relative impunity. But that factor would carry with it important consequences on the accuracy of aircraft not carrying precision-guided munitions in the Coalition inventories.[95]

Even if CENTAF could deconstruct the Iraqi air defense system, thousands of Coalition aircraft would still be in danger of flying into each other. Requiring all sorties to be included in a single air tasking order helped, but Horner attempted to further reduce the risk by conducting increasingly larger exercises. Beginning with hour-long exercises of a dozen aircraft in September, the training program culminated in November with a week-long exercise involving more than 2,000 sorties–a third of them on a single day. Like much of the rest of the exercise program, Imminent Thunder also attempted to deceive Iraqi intelligence. Its well-publicized name echoed Instant Thunder. Unlike Instant Thunder, most of Imminent Thunder's sorties were close air support. On board Navy ships in the Persian Gulf, the press watched a Marine amphibious operation near Mishab, twenty miles south of Khafji and forty miles south of Kuwait. Although rough water caused the Marines to cancel the hovercraft landing, even casual readers of the western press knew that the Marines were practicing amphibious landings. Iraqi focus on the Kuwaiti coast gave Schwarzkopf's flanking movement in the opposite direction a better chance of surprise.[96]

CENTAF Imminent Thunder exercised the so-called "D-Day Plan" which Horner's planners had been developing since August. At the beginning, they had intended to use the D-Day Plan to respond to an Iraqi invasion of Saudi Arabia. The bulk of Coalition sorties would attack Iraqi forces on the move into Saudi Arabia and Kuwait together with their supply lines. By September, however, Iraqi forces seemed unlikely to move south in view of the U.S. buildup; moreover, it was clear that the

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[95](S) Intvw Maj Gen Thomas R. Olsen (Ret) with GWAPS personnel, 9 Mar 1992.

[96](S) Msg, CINCCENT to JCS, subj: Exer Imminent Thunder, 041800Z Dec 1990, AFHRA 882245.

Iraqis were putting a major effort into developing defensive positions in the face of growing Coalition forces. The Bush administration's second deployment made plain the likelihood of a Coalition offensive. At the end of November the United Nations Security Council called upon member nations to use force against Iraq if it did not withdraw from Kuwait before midnight 15 January. Iraq's only response was to release the foreign hostages it had taken in Kuwait during August. This relieved Horner of concern about the American and British hostages that Iraq had placed at sites that it wished to discourage the Coalition from bombing.[97]

Horner knew that the most likely air plan to be executed was the one developed by the Black Hole. Despite that plan's secrecy, there had been considerable speculation in the press about an offensive air campaign. In September, Secretary of Defense Cheney had fired the Chief of Staff of the Air Force, Gen. Michael J. Dugan, for talking to reporters about the possibility of defeating Iraq with an air campaign. Nevertheless, few even among Horner's staff knew the details of the campaign plan. Except for a handful of British and Saudi planners in the Black Hole, Coalition air forces remained in the dark about their targets until forty-eight hours or less before D-Day.[98]

By mid-January 1990, Horner could call upon the approximately 2,400 aircraft, three-fourths of them American and nearly 50 percent of them from the USAF. More than half of the Coalition fleet of aircraft could attack, while the rest could help them get to their targets safely or move troops and supplies. Six Navy carriers (three in the Persian Gulf and three in the Red Sea) carried more than 400 aircraft, while the Marines had more than 200 on shore. Two Navy battleships and sixteen cruisers, destroyers, and subMarines carried over 400 Tomahawk cruise missiles. Allied fighter aircraft included British, Saudi, and Italian Tornados; Saudi F-15Cs; Mirages from France, Kuwait, Qatar, and the United Arab Emirates; British and French Jaguars; Bahraini F-16s; and Canadian CR-18s. Horner had spent considerable time with the air leaders of the allies and the other U.S. Services, and had included their forces in exercises. By mid-January all were familiar with the kind of air war that would come.

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[97]UN Security Council Resolution 678, 29 Nov 1990.

[98](S) Horner Intvw, 4 Mar 1992.

Only 27 percent of the Air Force combat aircraft deployed in support of Desert Shield and Desert Storm. Yet, that overall percentage was deceiving. Fully 75 percent of the Wild Weasels, most of the stealth aircraft, and virtually all aircraft capable of flying precision-guided munitions were in the Middle East by January. In addition, 46 percent of USAF tanker assets supported the air campaign directly, while 80 percent of the strategic airlift went to support of the forces in the Middle East. Moreover, 63 percent of the laser-guided bombs, 43 percent of the CBUs (cluster bomb units), and 52 percent of the HARMs in the inventory went out to the combat theater.[99] All of this suggests that without the ending of the Cold War, it is doubtful whether the U.S. could have mounted such an air campaign in the Middle East.

The Final Plan

By the end of December, most of the forces for the air campaign were in place;[100] by then staffs were working out the final iteration of plans to destroy the Iraqi military. The final plan looked to achieve synergistic effects by attacking a wide variety of targets. Given the overcentralized nature of Iraq's society and political life, and the weaknesses inherent in its military system, Horner's planners hoped to break apart the controlling system in a political as well as a military sense. By degrading the electrical power network, one would exacerbate the difficulties caused by attacks on the command and control sector. And by attacking the integrated air defense system both directly and by raids on the regime's overall command and control system, one could separate the controlling mechanisms from the "shooters" on the airfields and in the missile batteries.

In turn, attacks on those facilities would keep attrition of Coalition air assets within tolerable limits for sustained operations. A sustained period without losses would then allow Coalition air forces to destroy targets, such as nuclear, chemical, and biological research facilities–of no immediate threat–at leisure. Attacks on oil refineries and distribution facilities would pressure Iraq's military and civilian society, while the attacks on transportation (railroads and bridges) would isolate its army

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[99]Maj Dan Draper, LGXX (FA)/31017/25/25 Apr 1991, "Comparison of Logistic Tail Vice Aircraft Deployed to South West Asia."

[100]Among the exceptions were three of the Navy's carriers which were still on their way to the theater. One, in fact, would not arrive until after the war had begun.

and allow its destruction. Finally, the Republican Guard represented more than just an element of Iraqi ground forces; it represented an essential element in the stability of the regime, because they served to protect Saddam against his own armed forces. The air assault on Iraqi ground forces would begin against the Republican Guard on the first day and build until nearly all available sorties were attacking Iraqi divisions throughout the Kuwait Theater of Operations. When bombing had reduced the effectiveness of those units by at least 50 percent, Coalition ground forces would eject the remnant from Kuwait.

Gaining air superiority was essential to further military operations.[101] There were two fashions with which one could address Iraqi air defenses. The traditional approach would have involved a roll back campaign–one in which Coalition air power would steadily move its operations northwards and destroy Iraqi defenses on a gradual basis. The initial CENTAF draft operations order of 27 August reflected such an approach. As it noted: "Target priorities will be designed to roll back the IADS (integrated air defense system) and atrite [sic] enemy forces. Campaign will be expanded to include interdiction of C3 nodes, military support facilities and key choke points in northern Kuwait as forces are made available."[102] But the Master Attack Plan evolved independently of the initial operations order (and in fact the operation would soon be updated from the iterations of the Master Attack Plan). From the first, the authors of the Master Attack Plans envisioned attacking the heart of the enemy's integrated air defense system with F-117s at the beginning of the war.[103]

CENTAF's August operations order had noted: "Iraq's integrated air defense system [code-named KARI] . . . maintains track on every civilian and military aircraft over Iraqi airspace and consolidates the information into an overall air picture at the Air Defense Operations Center (ADOC) in Baghdad."[104] The implications of such a centralized system led planners to consider an attack to paralyze KARI at its center and degrade the capacity of the intercept operations centers and section operations

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[101]This is a point often ignored by US Army thinkers and largely reflects the fact that since the first months of the North African campaign in 1943, one of the crucial contributions that air power has made to US military operations is that air superiority has allowed US ground forces to operate in an environment free of an enemy air threat.

[102]COMUSCENTAF, draft operations order, 27 Aug 1990, Annex C, p 2.

[103]See "Instant Thunder" brief, 17 Aug 90/ 2100, "Campaign Flow."

[104]COMUSCENTAF Operations Order, 27 Aug 1990, Offensive Campaign–Phase I, Annex B, p 6.

centers to coordinate defensive responses. The conceptualization of the first night's attack led to the belief that direct attacks could paralyze the Iraqi air defense system, while conventional air packages, protected by SEAD aircraft, could suppress the separate pieces of the enemy's air defenses.[105]

But how to attack KARI's controlling center without heavy losses in fighting through the defenses deployed around Baghdad–defenses that after the war Horner described as among the strongest in the world?[106] The answer was to rely heavily on stealth to attack the command structure of the enemy's air defenses. Yet the planners also were to provide the Iraqis with a large SEAD package that appeared to give them what they expected: a massive attack on Baghdad itself.[107]

By early January, the Black Hole had evolved a complex, carefully orchestrated plan for the first days of Desert Storm–a plan that aimed at operational level effects on the Iraqi air and ground defenses and at the destruction of Iraq's long-range capabilities that represented such a threat

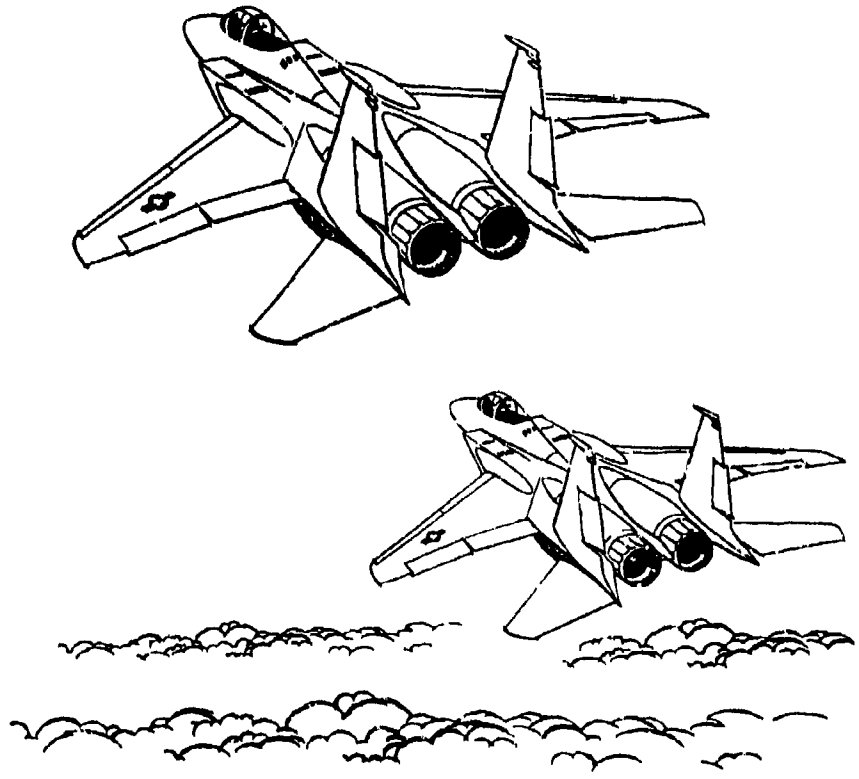
Black Hole staff.

[105]Conversation with Lt Col David Deptula, 24 Jun 1992; and "Instant Thunder" brfg, 16 Aug 1990/2100, "Campaign Flow."

[106]Lt Gen Horner, Address to Businessmen for National Security, May 1991.

[107]See Chapter 3 of this report for a fuller examination of how this was done.

to the stability of the region: namely its nuclear, biological, and chemical programs. Of course there were weaknesses in the planning effort. But those weaknesses reflected deeper organizational and cultural patterns that had been established in the Air Force even before its birth.[108] Yet in many ways the final plan represented an intellectual triumph over much of the cultural baggage that had distorted the air war against North Vietnam. In the end, the Black Hole made a considerable effort to move beyond self-imposed limitations and to maximize the potential of aircraft and weapons technology.



[108]See in particular Barry Watts, *The Foundations of USAF Doctrine* (Maxwell AFB, 1985).

2

Net Assessment of the Opposing Sides

No single, numerical comparison can convey the balance between the opposing sides in the Gulf War. The crucial factors determining the outcome mainly concerned issues such as military preparation, peace-time training, doctrinal conceptions, and the complex interrelationships among training, technological capabilities, and the educational sophistication of those who did the fighting.

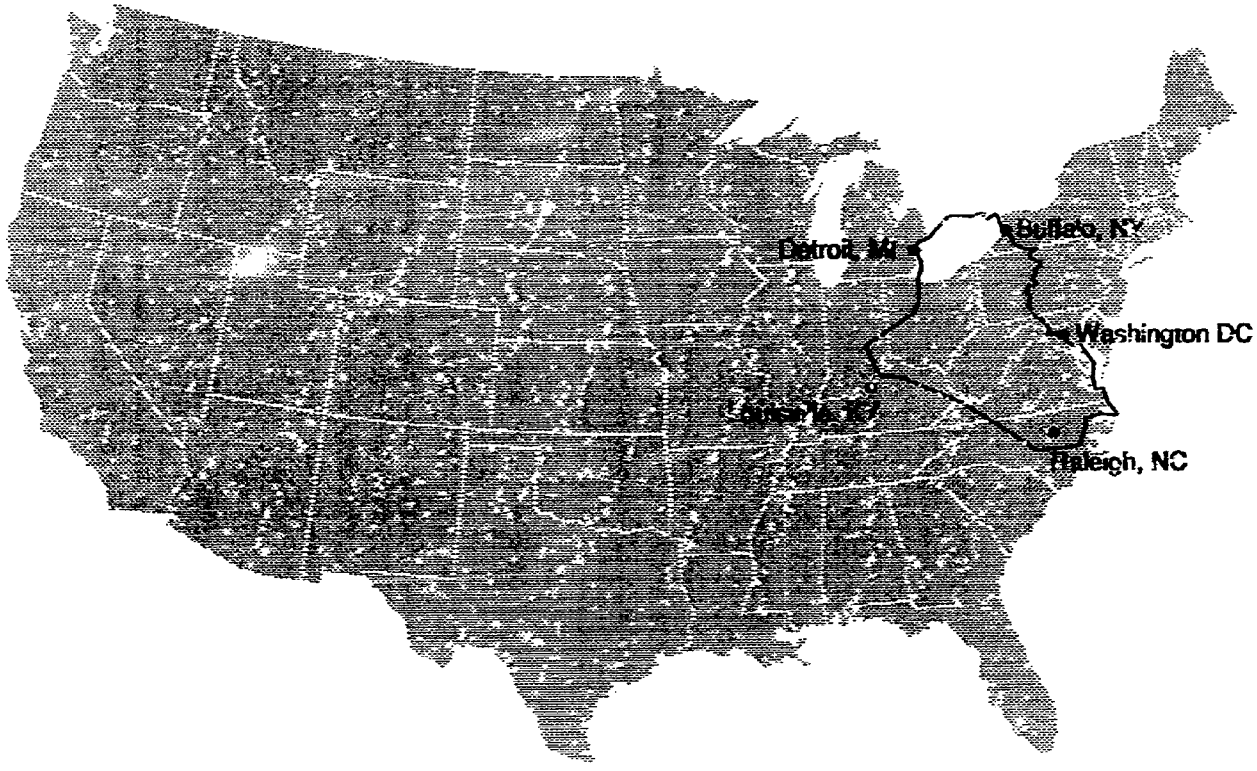
Moreover, the military ethos and political framework within which opposing military forces had developed played a major role in the outcome. This chapter will assess these factors as they applied to the opposing sides, first by looking at the Iraqis and then in turn at the Coalition. What it will attempt to convey is a sense of how these strengths and weakness matched up; finally, it will estimate how the two sides assessed the strengths and weaknesses of their opponents and sought to manipulate the situation to their strategic and operational advantage.

The Nature of the Theater

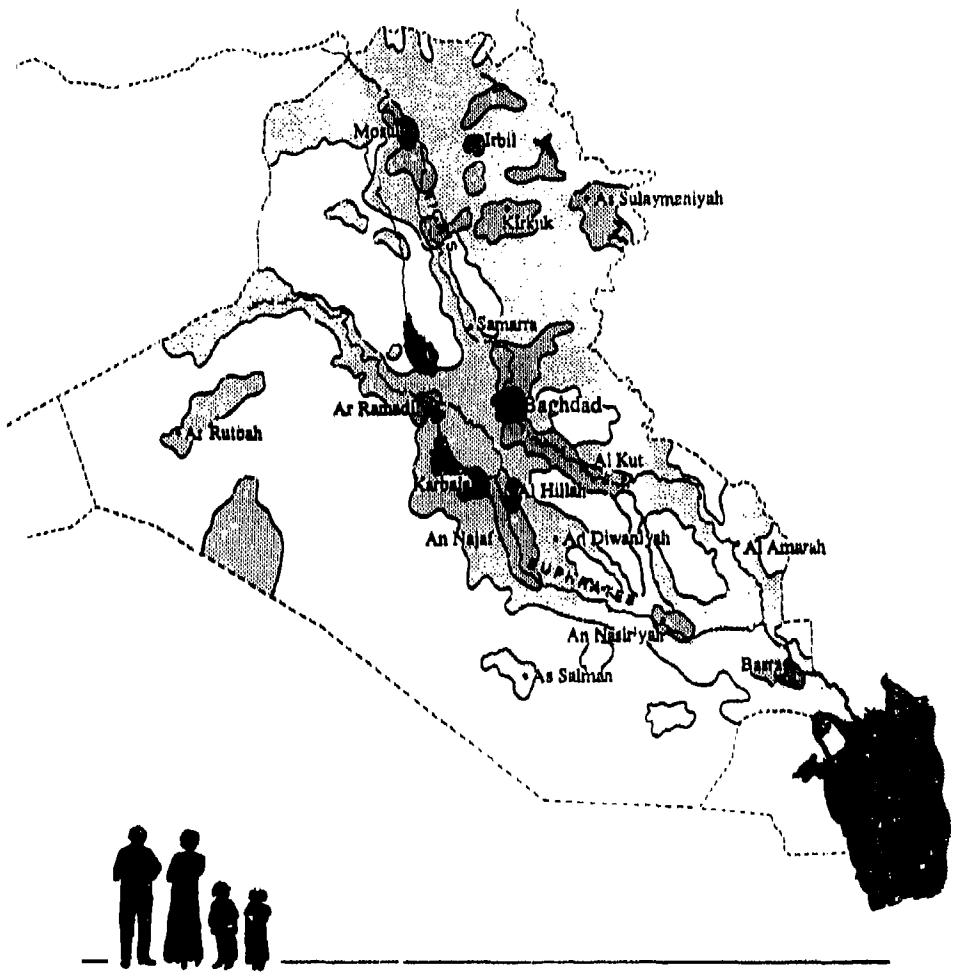
Iraq is the valley created by confluence of two great rivers, the Tigris and Euphrates, between whose banks the great civilizations of early man developed. In comparative terms laid out on a map of the eastern United States, Iraq would reach from Raleigh to southern Canada and from Washington, D.C. to eastern Indiana [see Map 1]. The great majority of its population of 17.6 million exists within the geographic confines of the Mesopotamian Valley.[1] Its people consist almost entirely of city and town dwellers, or farmers; only a few Bedouins inhabit the great deserts lying west and south of the rivers. While Iraqi culture has, of course, drawn heavily from the desert traditions of the original Arab tribes and conquerors, current Iraqis have little contact with their desert roots [see Maps 2, 3, and 4].

[1]Congressional Quarterly, *The Middle East*, Seventh Edition (Washington, 1990).

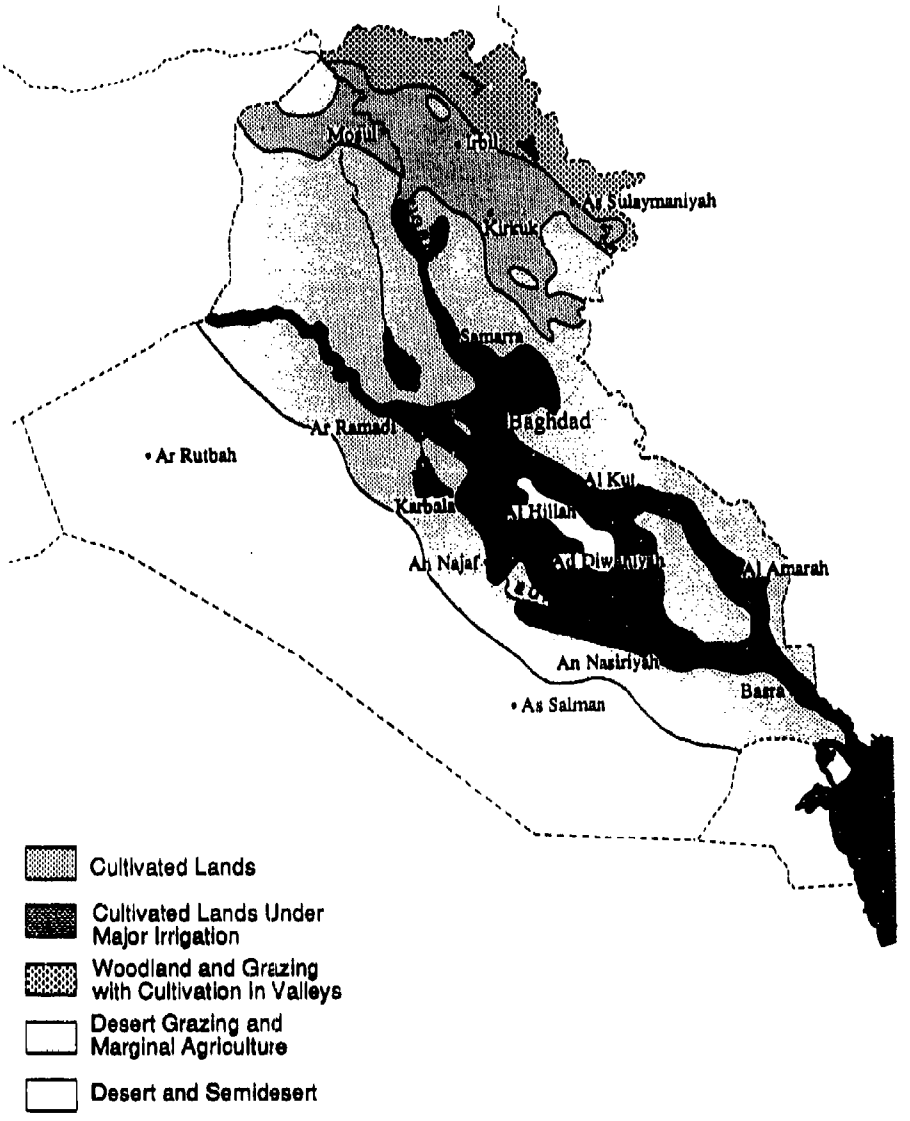
Map 1
Iraq - U.S. Size Comparison



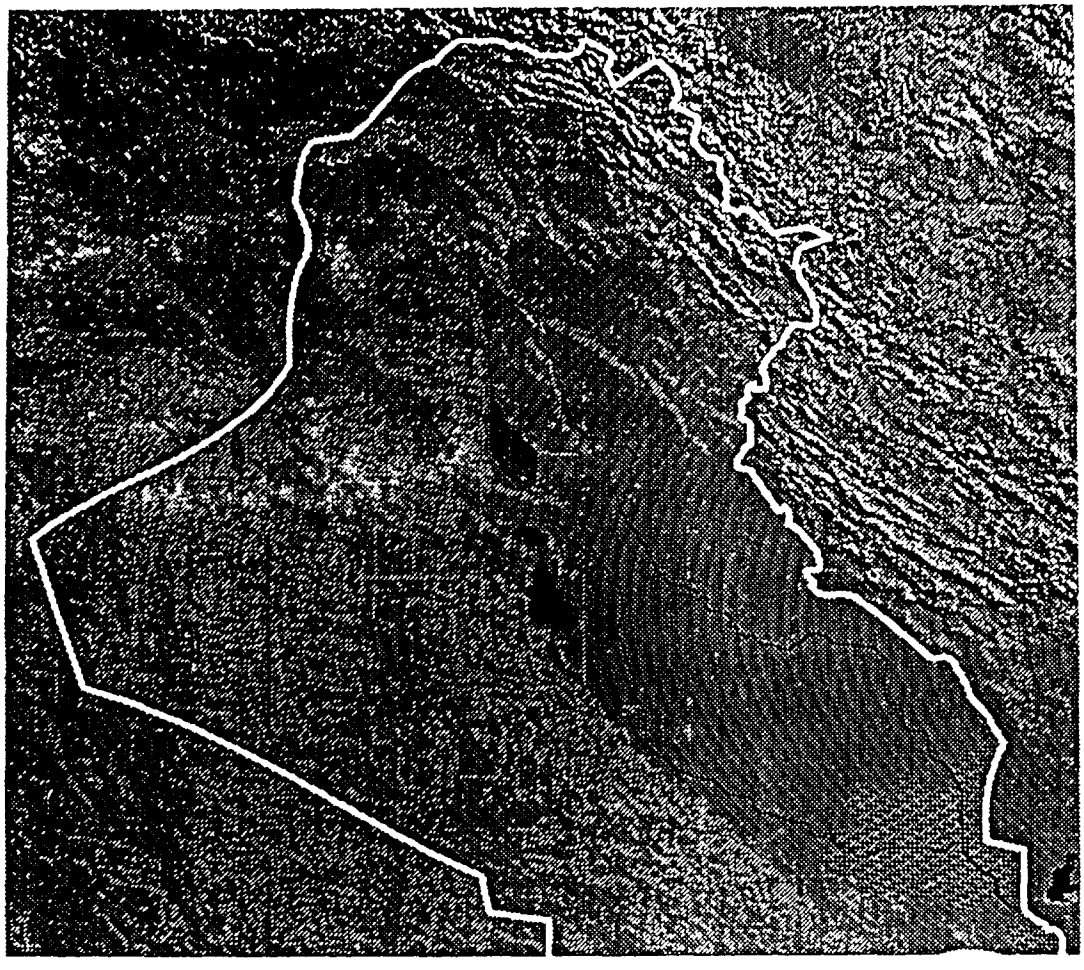
Map 2
Iraq Population Contours



Map 3
Iraq Land Utilization



Map 4
Iraq Terrain



Nor for that matter has the Iraqi military, particularly the army, fought in those deserts. Instead the nation's great experience in war, its conflict with Iran, came in the terrain to the east of the rivers. From the border with Turkey in the north, a series of high mountains descends into rugged hills over a distance of three hundred miles. In this area, with sharply pointed terrain features, the Iraqis fought numerous battles with Iranians and Kurdish guerrillas. Map reading was relatively easy in a landscape of peaks and valleys. To the south, the Iran-Iraq frontier encroaches on the Mesopotamian valley with its relatively dense population; it then curves southward into a region of swamps and complex irrigation canals. In this area, the heaviest fighting of the Iran-Iraq conflict played itself out. Here, too, navigation represented few significant

difficulties; moreover, terrain proved most suitable to the defensive tactics the Iraqis used to blunt Iranian attacks.

Significantly, the Iraqis had little experience in the deserts to the west and south. What little knowledge of the western deserts existed remained confined among truck drivers and construction crews working the pipelines and roads to Jordan and Syria. But even those Iraqis who drove through the desert felt that the great trackless spaces represented an area that was mysterious and hostile.[2]

And they were right. The desert spaces lying west and south of the Mesopotamian valley are thoroughly inhospitable to human beings. Scorching heat in summer, sudden deluges and terrible sand storms in winter, and virtually no water at most times of year would make this area a difficult challenge to military organizations even in peacetime. Beside the lack of water, navigating in a trackless wilderness with few points of reference–or in some areas constantly changing ones–represents as great a challenge as navigation at sea.

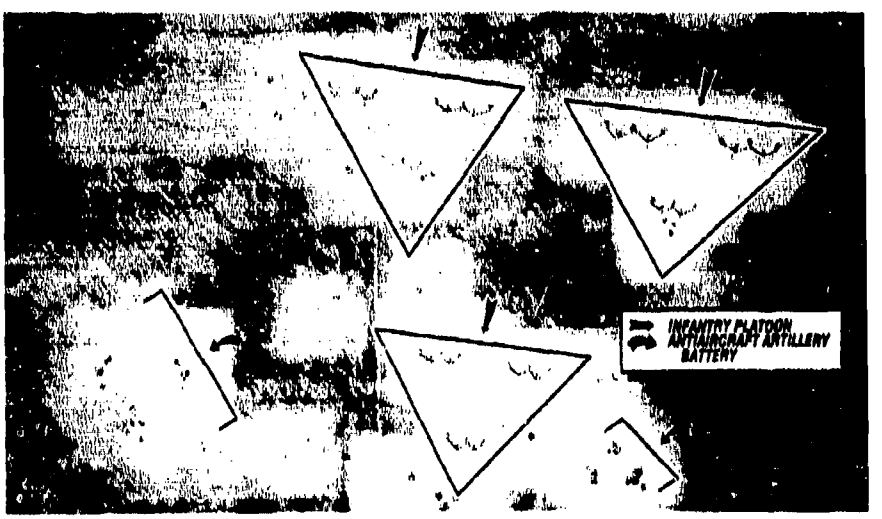
The first military force to grapple with operations in the desert, particularly the deep desert, was the British army in the Second World War. In a series of experiments stretching back to the 1920s and then pushed with great enthusiasm in the 1940-1941 period, the British learned to operate significant combat forces in a desert environment.[3] That process, however, took more than a decade of hard work and specialized training. But the Iraqi military in 1991 had little experience in desert conditions. Once the confrontation with the Coalition began, the Iraqis had little time to solve the problems involved in operating in such a region. As a result, both in their deployment and estimation of Coalition capabilities, the Iraqis assumed that Coalition forces would not and could

[2]The Egyptian commentator Mohammed Heikal confirms this judgement: "The reason for Iraq's failure to protect its flank was later explained by a captured officer. The Iraqis assumed, he said, that the Coalition would not attempt to operate in the featureless desert, because of the risks of losing their way." Mohammed Heikal, *Illusions of Triumph, An Arab View of the Gulf War* (London, 1992), p 311. See also his analysis on p 269.

[3]For the best description of this effort see John W. Gordon, *The Other Desert War: British Special Forces in North Africa, 1940-1943* (New York, 1987).

not utilize the trackless spaces west of Kuwait. But the Global Positioning System combined with high levels of logistics and personnel training allowed Coalition forces to adapt to the desert in a fashion the Iraqis never expected.[4] Consequently, the deserts of western and southern Iraq represented a plus to Coalition forces, an advantage, however, that was not entirely clear before the ground campaign.

For allied airmen, the desert theater also presented significant advantages. The terrain laid the Iraqi Army open to the prying eyes of all forms of overhead reconnaissance. While the desert allowed the Iraqis to spread their forces out, the army divisions that poured into the KTO became an open book to the prying eyes of Coalition intelligence. Admittedly, the sameness of terrain and lack of clear points of reference were significant problems to allied aircraft in identifying which enemy positions were which, and after the ground war began in identifying the positions of Coalition forces.



The terrain laid the Iraqi Army open to the prying eyes of all reconnaissance.

[4]And in a fashion that few of the so-called "experts" in the civilian world expected.

Middle Eastern weather provides distinct climatic periods: summer with extraordinarily dry and hot conditions, and winter, lasting from November to April. Rainfall during the latter season averages only four inches a year around Kuwait; heavier rains fall the further north one moves. Nevertheless, throughout the winter, strong and violent storms move through the area, bringing heavy rains and blowing sand storms in their wake. Unfortunately, Desert Storm's onset coincided with a period of particularly bad weather in the Gulf.[5] However, in any year the pattern of winter weather is not conducive to smooth, unimpeded military operations. If the bad weather that occurred in January and February was exceptional, it should not have been unexpected.

In the end, neither weather nor terrain represented significant advantages to the Iraqis, despite the fact that the war took place on their land. Ironically, their lack of knowledge of the desert turned to the advantage of the Coalition. From the point of view of employing air power and ground-based, technologically sophisticated systems, the desert with its flat and featureless terrain represented a significant advantage for Coalition military forces.

The Iraqis

Saddam Hussein invaded Kuwait and persisted in the face of worldwide opposition, a U.N. embargo, and the projection of immense military power into the Gulf as a result of ideological and political factors. Foremost among these were the nature of Iraqi tyranny, its ideologic world view, and its strategic goals. Iraq's military forces reflected its society, and the political and ideological framework of those forces played a crucial role in determining the outcome of the Gulf War.

The current regime in Baghdad draws heavily from an ideology developed in Syria in the 1930s.[6] This Ba'thist ideology combined diverse threads of Fascism and Marxism with an intense Arab hostility to European colonialism. Above all, it aimed at rejuvenating the Arab world by rejecting Western political conceptions and replacing them with

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[5]Heikal, *Illusions of Triumph, An Arab View of the Gulf War*, p 307.

[6]The discussion in this chapter on the nature of the Iraqi political regime draws heavily from the penetrating book by the Iraqi exile Samir al-Khalil, *The Republic of Fear, The Politics of Modern Iraq* (Berkeley, CA, 1989).

"Arabic" values. By utilizing the West's science and technology, the Arabs, Ba'thist theory argued, could return to their rightful position as *the* dominant world civilization.

In Iraq, the Ba'thist seized power briefly in 1963, but then fell from power. However, in 1968 they regained power; this time they set about making a stable and obedient polity out of a nation whose history had revolved around the success or failure of military coups. The new regime embarked on a ferocious purge of all centers of power in Iraq. Saddam Hussein, already assistant secretary general of the party, assumed control of internal security for the regime. Under his driving leadership, a pervasive sense of fear spread throughout the country. By 1979, firmly in control of state security, he moved against his fellow Ba'thists. In June, he replaced the president, while holding the families of his colleagues in the Revolutionary Command Council hostage. At the same time, he thoroughly purged the party's lower ranks. Then he moved against the leadership.[7]

When the dust settled, Saddam had created an extraordinary police state, one firmly grounded in Ba'th ideology and its paranoiac world view. His combination of ideology with an effective secret police reaching into all levels of society gave his regime enormous staying powers. On the other hand, it knew little of the external world and its ideological preconceptions insured that it would understand less.

The Iran-Iraq War

Having eliminated internal opposition, Saddam moved against Iran. Khomeini's revolution had thrown that nation into turmoil, while purges of the Iranian military placed the Islamic Republic's ability to defend itself in doubt. Since Iranian oil reserves lay close to Iraq in an area

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[7]According to Khalil, Saddam carried out the purge of the party's top leadership in public: "The production that Saddam managed had all the hallmarks of his personal style. The first to 'confess' was Revolutionary Command Council member 'Abd al-Husain Rashid whose family was held hostage. The confession was filmed and then, as one version of the story has it, shown to an all-party audience of several hundred leaders from the entire country. A grief-stricken Saddam addressed the meeting with tears running down his cheeks. He filled in the gaps in Rashid's testimony and dramatically fingered his former colleagues. Guards dragged people out of the proceedings and then Saddam called upon the country's top ministers and party leaders to themselves form the actual firing squads." *Ibid*, p 72.

inhabited largely by Arabs (although of Shi'te faith), Saddam concluded that he could easily expand Iraq's economic base, while seriously damaging his hated rival, Khomeini, by invading Iran.

Ba'thist ideology provided Saddam with an extraordinary set of goals. As he suggested in January 1980, "We want our country to achieve its proper weight based on our estimation that Iraq is as great as China, as great as the Soviet Union, and as great as the United States."[8] In this context. Saddam meant not just Iraq, but an Arab world dominated by Iraq's Ba'thist Party–one that with its oil reserves and attendant economic power could compete with the super powers.

The fact that Saddam possessed no experience beyond the world of Iraqi politics complicated the task. Moreover, he possessed no military experience, nor any background in military or strategic issues. His political instincts warned him to insure the political reliability of Iraq's military; much like Stalin, he equated professional competence with political independence. Consequently, his regime liquidated many of its best military commanders as threats to the nation's political stability. Moreover, there was little place in Saddam's Iraq for bearers of bad news or those who disagreed with the regime's policies.[9] Few who spoke their minds or who disagreed with the leader survived in positions of power.

Nevertheless, one should not take the regime and its military as fools. Within a limited arena, the Iraqis could mobilize popular support and economic resources–thanks to oil revenues–to confront opponents who operated within similar frameworks. The Iraqis possessed the political tools of control to force Iraq's population to obey; moreover, against military organizations with similar backgrounds, Iraqi commanders eventually proved sufficiently competent to force Iran to make peace on the basis of *status quo ante bellum*.

However, Saddam's decision to attack Iran initially resulted in a catastrophic war. After some initial successes, the Iraqis soon tumbled back onto their own territory in humiliation. Defeat came first in the air. Saddam had begun the war with major strikes to knock out the Iranian

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[8]Speech of Saddam Hussein, 2 Jan 1980.

[9]Some reports stated that Saddam had shot a number of senior officers on the night of the invasion of Kuwait for disagreeing with his decision.

Air Force. The attack achieved little. Iraqi "bombs either missed the targets or misfired, partly because the crews did not possess the degree of expertise needed and partly because their Soviet warplanes, fitted with mediocre avionics, lacked accurate targeting equipment."[10]

Some Iraqi squadrons refused even to fight, while those that did, accomplished little in the air-to-air or air-to-ground arenas.[11] The Iranians, still possessing sophisticated U.S. aircraft and U.S.-trained pilots, and at least a modicum of the expertise that the Shah had purchased, gained the upper hand in the air war. Threatened with the loss of his air force, Saddam dispersed Iraqi aircraft to neutral territory in Jordan, Kuwait, Saudi Arabia, and Oman.[12] On the ground, the Iranians proved equally intractable and fierce. Moreover, Khomeini articulated his country's aim as being nothing less than the complete overthrow of Saddam's regime. The result was a series of defeats that came close to breaking Iraq.

But Saddam rallied his military to hold against fanatic Iranian assaults. Luckily for the Iraqis, the Iranians had their own troubles. In a fit of religious zeal, they completed the destruction of the Shah's military as the war continued. Without effective military leadership from senior levels down to non-commissioned officers,the revolutionary youth of Iran died in huge numbers before superior Iraqi firepower. The Iran-Iraq war settled into a war of attrition, in which the two sides faced each other across complex trench systems. The Iraqis relied on superior firepower to defeat the many Iranian offensives; the Iranians counted on superior numbers and religious fanaticism to break the Iraqis. As the war continued, the Iranians battered their way into southern Iraq, although they never achieved a decisive breakthrough. The result was a frightful blood bath for both sides.[13]

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[10]Dilip Hiro, *The Longest War, The Iran-Iraq Military Conflict* (New York, 1991), p 40. The complete failure of this Iraqi attack on the Iranian Air Force probably contributed to an Iraqi belief in January 1991 that their air force could also survive a first strike by Allied air forces, should the Gulf confrontation turn into war.

[11]*Ibid*, p 41-2.

[12]*Ibid*, pp 41-2. See also Kenneth R. Timmerman, *The Death Lobby: How the West Armed Iraq* (Boston, 1991), pp 19-20.

[13]For discussions of the Iran-Iraq War, see Hiro, *The Longest War, the Iran-Iraq Military Conflict* (New York, 1991); Khalil, *The Republic of Fear, The Politics of Modern Iraq* (Berkeley, CA, 1989); Anthony Cordesman, *The Iran-Iraq War and Western Securi-*

Only desperate measures kept Iraq in the war. Saddam mobilized the population for war; to maintain morale, he allowed a peacetime economy to function. This approach of guns *and* butter provided domestic stability, but at the expense of Iraq's currency reserves and only with extensive borrowing from Arab neighbors. Confronting defeat, Saddam turned to an economic strategy and one of terror.[14] Iraqi aircraft attacked Iran's petroleum export facilities as well as tankers carrying Iranian oil. But these attacks failed to dissuade Iran from its political goal of toppling Saddam's regime. Both nations then resorted to firing Scud missiles at each other's cities. Heavy casualties resulted on both sides, but the repressive apparati of revolutionary police states stomped out waverings in popular support.

Finally, in 1988 a series of Iraqi victories led to the collapse of Iranian morale. In the spring, the Iraqis, going over to the offensive, regained much of the territory lost earlier in the conflict.[15] The Iraqis planned these attacks carefully, and set-piece battles against a debilitated opponent broke the Iranians. In each attack the Iraqis gained surprise; helped by U.S. intelligence, they possessed a thorough picture of Iranian dispositions, while the enemy operated in the dark.[16] Saddam's high command preplanned everything to the last detail, while Iranian weaknesses allowed the Iraqis to win without displaying much flexibility. They operated only within a highly structured framework.[17]

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ty, 1984-1987 (London, 1987).

[14]Jaffee Center for Strategic Studies, *The Middle East Balance, 1987-1988* (Boulder, CO, 1988), Chapter 5.

[15]For an excellent discussion of the ending of the conflict see: Hiro, *The Longest War, The Iran-Iraq Military Conflict*, pp 199-212.

[16]Anthony Cordesman, *The Iran-Iraq War and Western Security, 1984-1987; Strategic Implications and Western Security*, (London, 1987), pp 36-39. This intelligence information gave the Iraqis a healthy respect for the intelligence capabilities of the Americans.

[17]There were a number of "experts" both within and outside of the US government who discussed the Iraqi military in the most glowing terms before the Gulf War. Those assessments in turn drove the estimates that Coalition ground forces would suffer horrible casualties if it came to a direct military confrontation. What such analysis missed was the fact that Iraqi battlefield performance was strictly conditional. Within the context of a Middle Eastern war against an opponent with roughly equivalent levels of training and technology, the Iraqis were capable of performing effectively. But against an opponent whose capabilities, both in terms of technology and personnel, were on a more advanced

The war's cost was appalling. Estimates on the number of dead vary; conservative sources suggest a combined total of 367,000, of whom 262,000 were Iranian and 105,000 Iraqis. Military and civilian wounded approached three-quarters of a million.[18] Despite the war's costs, Saddam emerged in a stronger position than at the conflict's onset. The Ba'thist regime in Baghdad had proved extraordinarily stable; undoubtedly, its ruthlessness enabled it to survive. It had mobilized its people and forced them to make extraordinary sacrifices; its security apparati reached into every level of Iraqi society; no matter how unpopular the conflict, no political disturbances occurred. Nevertheless, the performance of Iraqi military forces left much to be desired.

On the other side of the ledger, supporting the regime's demand that Iraqis persevere in the costly conflict to the end, lay extensive efforts to bribe the populace. Iraq pursued costly building projects; imports from outside kept shelves stocked with food stuffs and consumer goods; the peacetime economy continued in full swing. To do this, the regime imported millions of workers from Egypt and elsewhere in the Arab world. However, oil revenues could not meet the expenses of the war, much less the demands of servicing a peacetime economy. Only massive borrowing in the Arab world could keep the peacetime economy afloat and support the massive military effort required by the war. When the conflict was over Iraq was virtually bankrupt; its oil revenue could barely cover the interest on the national debt.

The regime's guns and butter approach had an interesting side effect that would impact on the military confrontation with the Coalition. When it became clear that the war with Iran was going to last a long period of time, the Iraqi military instituted a series of reforms to make military service as attractive as possible. Besides higher pay, considerable survivor benefits, and disability payments to the wounded, the regime provided for extensive periods of leave for soldiers in the combat theaters. Such policies would be in place when the Gulf crisis occurred,

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level, the Iraqi military proved incapable of functioning effectively. For one of the most optimistic estimates of Iraqi military competence see: Stephen C. Pelletiere, Douglas V. Johnson II, Leif R. Rosenberger, *Iraqi Power and U.S. Security in the Middle East* (Carlisle, PA, 1990).

[18]Hiro, *The Longest War, The Iran-Iraq Military Conflict*, p 250.

and consequently, throughout the lead up to the war, as much as 20 percent of the Iraqi Army may have been on leave at any given time.[19]

The people of Iraq greeted peace with enormous enthusiasm. But behind that enthusiasm lay much war weariness. The army's attitudes reflected national feelings. The long struggle with Iran certainly did not create a battle-hardened military force, eager to embark on other struggles.[20] [DELETED]

[DELETED][21]

In retrospect, the Iran-Iraq war did nothing to lessen Saddam's ambitions. Despite the fact that his country was almost bankrupt with a staggering debt, Iraq continued extensive armaments programs as well as the construction of monuments to glorify the war.[22] The Iraqi military obtained the most sophisticated weapons systems possible from Soviet and western suppliers; at the same time, it pushed efforts to produce special weapons, including nuclear devices. When these ambitious programs combined with a steady drop in oil prices, Iraq verged on bankruptcy. In 1989 it failed to pay the interest on its foreign debt; so serious did the financial situation become that some major arms suppliers suspended arms sale.[23]

Not surprisingly, Saddam leapt at the opportunity to settle with Kuwait in 1990; at one fell swoop he could eliminate a significant portion of his debt, while adding the oil resources of the Emirate to those of Iraq. America's reaction came as a surprise; but here Saddam's substantial misestimations of U.S. power and resolve worked against the Iraqis.

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[19]See Chapter 6 of this report for examination of Iraqi leave policies and the impact they had on the army's readiness to meet Coalition forces in "the mother of all battles."

[20][DELETED]

[21]Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "The Gulf War: An Iraqi General Officer's Perspective," 11 Mar 1991, JDC Rpt #0052, p 3.

[22]See in particular Samir al-Khalil, *The Monument* (Berkeley, CA, 1992).

[23]Elaine Sciolino, *The Outlaw State: Saddam Hussein's Quest for Power and the Gulf Crisis* (Boston, 1991), pp 140, 188.

Above all, Saddam calculated that air power was an insignificant factor. As he suggested to CBS newsman Dan Rather in August 1990: "The United States depends on the air force. The air force has never decided a war."[24] Since air power could not play a crucial role, Saddam calculated that ground war would prove the final determinant of any military confrontation with the United States. Here the Iraqis believed they could inflict such heavy casualties that the Coalition would disintegrate and American will power would collapse. As Saddam suggested to the U.S. Ambassador in July 1990: "Yours is a society which cannot accept 10,000 dead in one battle."[25]

One senses from Saddam's speeches as well as his actions a pervasive belief that the United States dared not resort to war.[26] Consequently, many Iraqis, including the military, did not take the threat of Coalition military action as seriously as they should have.[27] Military preparations aimed to deter the Coalition from attacking rather than to place Iraqi forces in the best military position.[28] Yet on paper those Iraqi military forces and their newly acquired capabilities represented a formidable challenge if the Coalition were to resort to war.

The Iraqi Military[29]

Saddam's gamble rested on how well his military would perform. There were some experts in the West who felt that the Iraqi military

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[24]CBS Interview (Dan Rather) with Saddam Hussein, 29 Aug 1990, transcript in FBIS-N25-90-170.

[25]Quoted by Jim Hoagland, *Washington Post*, 13 Sep 1990, p A33.

[26] Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "The Gulf War: An Iraqi General Officer's Perspective," 11 Mar 1991, JDC Rpt #0052; and (S/REL UK) "Analyses of Source Debriefings," JDC Rpt #065.

[27](S/REL UK) Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, 11 Mar 1991, "Analysis of Source Debriefings," JDC Rpt #065, p 7.

[28]The stationing of much of their military forces in Kuwait and in southeastern Iraq made more sense from a political and diplomatic perspective, than from a military perspective.

[29]I am indebted to Dr. Caroline Ziemke for her help in the preparation of this section on the Iraqi military, both army and air force.

represented a highly competent military force.[30] One of the U.S.Army's major intelligence organs noted in September 1990 that the Iraqi Army

> . . . can conduct multi corps operations over 100 km or more and is capable of coordinating air and artillery, timing of movements and operations, coordinating complicated logistics requirements, and getting supplies, equipment, and troops to the right place at the designated time. The Iraqi army is distinguished by its flexibility, unity of command, and level of mobility. The army is highly qualified in planning, C-2, logistics and maintenance, but limitations placed upon commanders' initiative, especially in exploiting success, reduce these advantages.[31]

Nevertheless, Desert Storm indicated that the Iraqi military forces did not function at such high levels of effectiveness against Coalition forces. Within the Iraqi Army and Air Force, there existed considerable weaknesses and deficiencies; in the Iran-Iraq war, the Iraqis either worked around those weaknesses or placed their own strengths against the weaknesses of their opponent. The issue is not that the Iraqi military were grossly incompetent. In fact, throughout the Gulf War, they exhibited considerable powers to work around the damage imposed by Coalition air attacks.[32] But the point is that along with their strengths the Iraqis possessed serious weaknesses.

The greatest weakness of Iraq's military posture lay in the regime itself. Saddam possessed little understanding of the external world beyond Iraq.[33] Ba'thist ideology distorted the few glimmerings of other nations that penetrated inside Saddam's tight-knit circle. Moreover, the dictator himself was largely ignorant of military factors–an ignorance that

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[30]The study by Pelletiere, Johnson, and Rosenberger, *Iraqi Power and U.S. Security in the Middle East* is a case in point. For a brief sampling of such attitudes one might consult the testimony given before the House and Senate Armed Services Committees in the period immediately before the outbreak of the war; in particular see the testimony by Gen David Jones and Adm William Crowe, both former Chairmen of the Joint Chiefs of Staff.

[31]US Army Intelligence and Threat Analysis Center, "How They Fight–Desert Shield Order of Battle Handbook," Sep 1990, p 43.

[32]The Iraqi ability to hide their Scuds is a case in point, as was their capacity to maintain some form of communications to front line units throughout the war. For further discussion of the Scud campaign see Chapter 4.

[33]Nor for that matter did much of the Iraqi Army. [DELETED]

the experiences of the Iran-Iraq War had not corrected. Finally, his tyranny had so cowed military and civilian advisers alike that few, if any, dared mention unpleasant truths.

The Iraqi Army

The history of Iraq's army is intertwined with the nation's political history. It has represented the only coherent symbol of the Iraqi nation. As such, it was not loath to interfere in politics; between 1936 and 1956, it launched no less than five major coups, including an attempt in 1941 to join the Axis. Nevertheless, the army displayed little competence on the battlefield in that period. In the 1941 coup, a couple of under-strength British brigades from an army in desperate shape in the Middle East sufficed to rout the entire Iraqi Army.[34]

The Iraqi Army's participation in politics came at a high cost. Bloody purges followed each coup. The success of the 1956 coup only embroiled the army deeper in politics. Military men dominated cabinet and policy-making positions.[35] None of this contributed to the professionalization of the officer corps or to bettering military effectiveness. The disastrous performance of Iraqi forces in 1967 and 1973 against Israel further underlined the ineffectiveness of a politicized military.

The Ba'th Party's control of Iraq after 1968 further exacerbated the military's weaknesses. The army's central role in maintaining internal order continued under the Ba'thists, but its political independence did not. Iraq's new leaders did not miss the lessons of previous decades. A series of bloody purges removed all influential officers who lacked close ties to the party; political loyalty became the sole criteria for promotion.[36] By 1971 Saddam, as the director of state security, was confident that "with our party methods, there is no chance for someone who disagrees with us

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[34]The British had just lost Greece, were in the process of losing Crete and had suffered a major defeat at the hands of Rommel (the first of many). In these desperate circumstances the British put together a rag-tag force and regained their position controlling Iraq and its strategic oil fields.

[35]Khalil, *The Republic of Fear*, pp 21-22.

[36][DELETED]

to jump on a couple of tanks and overthrow the government."[37] The party and its security organs maintained a vigilant watch over everything in the military.[38]

With Saddam's seizure of power in 1979, the emphasis became loyalty to the tyrant as well as party. In terms of the dictator's priorities, political control of the army became a basic principle on which the survival of the regime rested. With the army's previous history of launching coups, Saddam could not afford a cocoon of "professionalism." The first years of the war against Iran underlined the costs of a system that equated political loyalty with military competence.[39] The war's desperate situation eventually forced Saddam to make changes, and the Iraqi Army showed some improvement during the conflict. But improvements came within a framework that satisfied political criteria. Initiative, flexibility, rapid decision-making never became a hallmark for Iraqi operations. Iraq won the war against Iran because their opponent was less professional and even more determined to impose ideological [religious] purity.[40]

In the two years between the war with Iran and the Gulf conflict, the Iraqi Army went through an extensive expansion. The regime made major efforts to upgrade equipment as well as to expand the quantitative basis; it purchased large numbers of T-72s from the Soviet Union along with less sophisticated weapons and tanks from China. The Republican Guard, already a major force by the end of the war with Iran, continued its expansion as well. In the end, however, this continued expansion of Iraq's military forces may only have succeeded in diluting the quality of the army; certainly the events of 1991 suggest a hollow military indeed.

The overall picture of the Iraqi Army, then, was spotty. It had shown considerable powers of sacrifice in the Iran-Iraq war. Saddam's tyranny reinforced that spirit. The army possessed extraordinary engineering skills; as it had shown on numerous occasions during the Iran-Iraq War,

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[37]Ronald E. Bergquist, *The Role of Air Power in the Iran-Iraq War* (Maxwell AFB, AL, 1988), p 22.

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[40][DELETED] (/REL UK) Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "Analysis of source Debriefings," JDC Rpt #065, p 3.

its ability to construct extensive field fortifications was unsurpassed. It also possessed extensive skills in camouflaging its positions and in building extensive dummy positions to mislead its opponents. On the other hand, the army remained politicized; it had little tolerance for initiative, nor much capacity to adapt; its soldiers possessed few of the educational or cultural aptitudes required by modern armed forces.[41] And its general officers had few of the leadership or intellectual capabilities of leaders on the other side of the hill.

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The Iraqi Air Force

In most respects the Iraqi air force mirrored the weaknesses of the ground forces. [For the location of major Iraqi airfields see Map 5.] Throughout its history, the Air Force has remained subservient to the Army. Iraq has consistently identified itself as a continental power, while the Army's role as an internal guardian of order has given it the dominant position among Iraq's military institutions.

Two events in the 1980s, however, caused the Iraqis to reconsider the external threat. The 1981 Israeli attack on the Osirik nuclear reactor had set back Iraqi nuclear ambitions considerably; that raid also underlined Iraq's vulnerability to air attack.[43] Moreover, the relative impunity with which Iranian aircraft attacked Baghdad in the early days of the Iran-Iraq war represented a further warning. The result was that Iraq devoted considerable resources to build up its air defenses and to purchase up-to-date fighter aircraft. Nevertheless, even with this effort to build up the air force and air defenses, the primary focus in the Iraqi Air Force rem-

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[41][DELETED] Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "Analysis of Source Debriefings," JDC Rpt #065, 15 Mar 1991.

[42]*Ibid*, p 7.

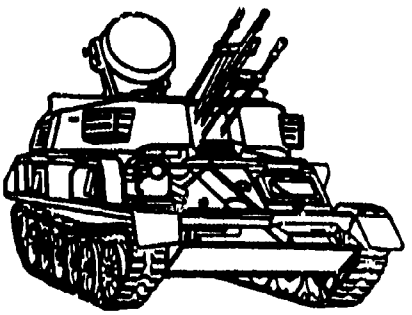
[43]For more detailed examination of Iraq's efforts to acquire nuclear weapons see: Michael Eisenstadt, "'The Sword of the Arabs: Iraq's Strategic Weapons," Policy Paper No. 21 (Washington Institute for Near East Policy, 1990); and Jed C. Snyder, "The Road to Osirak: Baghdad's Quest for the Bomb," *Middle East Journal*, Autumn 1983.

Table 1
Iraqi Air Force Distribution of Fighter Units

[DELETED]

ained on the air-to-ground mission rather than on the air-to-air task of gaining air superiority.[44]

That Iraq would see the army as the decisive combat arm is not surprising. What seems less explicable is that the Air Force, charged with providing air defense and air support for ground forces, has proven so ineffective in both roles, not only in the war against Iran but in the Gulf War as well. While technically impressive, the Iraqi air defense system demonstrated weaknesses even during the Iran-Iraq War. Early in the Iran-Iraq War, the Iranian air force flew at will over Iraqi cities;



[44]This reflected the fact that by the end of the Iran-Iraq War the Iranian air force had almost entirely collapsed due to the loss of its US-trained pilots and aircraft. Consequently, the Iraqi air force no longer confronted the problem of gaining air superiority over the battlefield, while the crucial mission remained the support of Iraqi ground troops locked in their desperate struggle with the Iranians. (S/WN/NC/NF) SPEAR, Naval Intelligence Command, "Iraqi Threat to U.S. Forces," Dec 1990, p 3-63.

Map 5
Iraqi Air Bases

the Iraqis made little effort to intercept intruders, because their defenses were incapable of distinguishing between friend and foe. In short, the primary role of Iraqi air power in the early 1980s was as a deterrent. Consequently, there was little willingness to risk aircraft losses or to fly dangerous missions. Far from criticizing his Air Force for its lack of offensive initiative in 1981, Saddam saw its inactivity as a reasonable strategic proposition: "We will not use our air force. We will keep it.

Two years hence our air force will still be in a position to pound Bani-Sadr [then prime minister of Iran] and his collaborators."[45]

Like the army, the air force did improve during the war. Its strikes against Iranian tankers and Kharj Island–the crucial terminal for Iranian oil exports--showed considerable sophistication. However, at least in attacks on Iranian tankers, Iraqi aircraft operated in a risk-free environment.[46] Nevertheless, one Iraqi pilot made the enormous mistake of attacking the USS *Stark*, which created a serious international incident.

However, the attacks on the Kharj terminal were complex air operations in a hostile arena. In addition, in November 1986, Iraqi F-1s used "buddy" refueling techniques to strike the Larak Island oil facilities–a distance of nearly 1,200 miles from their bases.[47] Still, the Iraqis launched such raids only after long preparation and planning; also, these raids exploited Kuwaiti bases for recovery, and only utilized a small portion of Iraq's air assets–the best pilots and aircraft. More significantly, the Iraqis failed to maintain such efforts for prolonged periods of time. As a result, these operations appeared to be spectacular, but proved neither decisive nor long-lasting. At best they shut Kharj down for short periods of time and lowered Iranian oil exports. But never did they stop Iran's ability to export oil.[48]

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[45]Maj Gen Edward B. Atkeson (USA, ret), "Iraq's Arsenal: Tool of Ambition," *Army*, Mar 1991, p 24.

[46]The Iraqis were not in a position to intercept Iranian aircraft, while the attackers undoubtedly received considerable mission support from the Gulf States on the southern side of the Persian Gulf. See (S/WN/NC/NF) SPEAR, "Iraqi Threat to U.S. Forces," Appendix C.

[47]Yet as one commentator on the Iran-Iraq War noted during the war: "In practice the two air forces proved to be equally incompetent." Efriam Karsh, *The Iran-Iraq War, A Military Analysis*, Adelphi Papers 220, Spring 1987.

[48]Defense Intelligence Agency commented on the Iraqi air force's performance in the Iran-Iraq War in the following terms in early 1990: "Despite an overwhelming advantage over Iran in numbers of operational aircraft, Iraq has failed to take full advantage of its air superiority. Iraqi effectiveness has been limited by conservative employment doctrine, unsophisticated tactics, and the political leadership's reluctance to employ the air force more aggressively." Defense Intelligence Agency, "Iraqi Ground and Air Forces [sic] Doctrine, Tactics and Operations," Feb 1990.

In the air-to-air arena, the Iraqis displayed little initiative and skill. As the U.S. naval intelligence reported shortly before Desert Storm:

> Air-to-air engagements [on both sides of the Iran-Iraq War] were correspondingly unimpressive. Both sides appeared to overestimate the capability of their adversary and had an exaggerated fear of radar guided missiles. Iraqi avoidance of air-to-air engagements was continuous throughout the war. Lock-on by Iranian fighters would generally cause Iraqi aircraft conducting offensive counter-air/strike missions to abort the mission and return to base. Even when the odds were overwhelmingly in favor of the Iraqi air force, survival still dominated their tactics. Any engagements that did occur were noteworthy for a lack of aggressive maneuvering. High speed, maximum range missile launches were followed by egress and return to base by both sides.[49]

The failure of the Iraqi Air Force to play a decisive role in the Iran-Iraq conflict did not prevent Saddam from investing heavily in air power during peacetime. The Iraqis spent considerable sums to upgrade their aircraft inventory by buying more Mirage F-1s and a number of MiG-29s. Moreover, they continued efforts to expand their air bases and to provide airfields with multiple runways and taxiways as well as hardened shelters capable of even withstanding even nuclear blasts.

Yet the seventy-five years of air warfare have consistently underlined that the crucial element in aerial combat lies in the capabilities of aircrews. The Iraqis had, of course, just completed a major war against Iran–a conflict during which they had suffered significant pilot losses. Moreover, they were now taking on newer and more complex model aircraft even as the war with Iran ended. Consequently, rebuilding the Iraqi Air Force took place within the framework of upgrading to significantly more complex equipment.

The picture of fighter pilots available to western intelligence suggests that there were few first class operators in the Iraqi Air Force.[50] During

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[49](S/WN/NC/NF) SPEAR, "Iraqi Threat to U.S. Forces," p 3-63.

[50]One of the most accurate prewar analyses of Iraq's military capabilities was that performed by the SPEAR Department of the Navy's Operational Intelligence Center: (S/WN/NC/NF) "Iraqi Threat to U.S. Forces." SPEAR's accuracy in the assessment business largely reflected the fact that it was one of the few intelligence organizations in the American military that combined individuals with operational backgrounds in about

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the war against Iran, Iraqi pilots had earned "their qualifications and status with a minimum expenditure of personal effort and risk."[51] Basic training provided little on which to upgrade fighter pilots to more sophisticated aircraft; moreover, the Iraqis conducted basic instruction on a rigid and inflexible pattern. Pilots and instructors executed their maneuvers "solely by reference to instruments with little attention paid to outside, visual references." Consequently, most Iraqi pilots had difficulty transitioning to the more advanced stages of air-to-air training.[52]

The products of such a system were not exceptional. Iraqi pilots lacked the preparation to "respond proficiently to dynamic tactical situations," while they had "relatively poor air-to-air maneuvering and lookout skills." For the most part, "their overall situation awareness [was] extremely poor." Those who flew the Mirage went from basic pilot training in Iraq to France, where over 80 percent washed out of the course; that had little impact on the Iraqi air force, which qualified virtually all who flunked the French syllabus upon return.[53] The Soviets were not so demanding and generally passed everyone; the Iraqis, however, regarded Soviet training as decidedly inferior to what the French provided.[54] On the other hand, the Soviets assessed less than half the students

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equal numbers with intelligence officers. The relationship clearly brought out the best in both and SPEAR's studies were close to the mark when Desert Shield moved into its execution phase. For a less sophisticated examination of the Iraqi air force that was more positive as to its capabilities see: (S) Defense Intelligence Agency, "Iraqi Ground and Air Force Doctrine, Tactics and Operations, Feb 1990.

[51](S) *Ibid*, p 3-63.

[52](S) *Ibid*, pp 3-62 and 3-63.

[53](S) *Ibid*, p 3-63.

[54]How much the former Soviets had to learn from the Gulf War as well as their own mis-estimates of the balance of skill and technology between the east and the west is suggested by a short article written by a former Soviet advisor to the Iraqis as the Gulf War was actually unfolding: "I feel that the Iraqi fighter pilots were trained just as well as the pilots of, for instance, France and Finland with whom we in recent years have been in contact repeatedly. In truth, I will not take it upon myself to compare their professionalism with the combat skills of American pilots but, in constantly seeing the prevalence of Negroes and mulattoes among the U.S. pilots on the TV screens, I could draw some conclusions." "Former Soviet 'Advisor' Describes Experiences in Iraq," *Komsomolskaya Pravda*, 23 Feb 1991, Foreign Military Affairs, JPRS-UMA-91-014. For a thorough examination of the Russian military's examination of the air war in Desert Storm (which also tells much about how to think through the significance of the air war) see: Benjamin S. Lambeth, *Desert Storm and its Meaning: The View from Moscow*, Rand Rpt R-4164-AF

whom they passed as possessing the ability to fly in line Soviet fighter outfits, which in turn were considerably below American standards.[55]

Follow-on training in the Iraqi Air Force was no more remarkable. After the war with Iran, Iraqi Air Force leaders considered an ambitious program to upgrade pilot skills. However, one suspects that Iraq's financial difficulties prevented implementation of any serious upgrade program. The training that occurred was not particularly challenging; "Intercept tactics and training [were] still predominantly conservative, elementary, and generally not up to western standards."[56]

The emphasis in Iraqi air operations against Iran had rested on support for ground forces. Consequently, the best pilots in the Iraqi Air Force have traditionally gone into ground attack units. Air-to-air units had the leavings.[57] The basic issue here is that the Iraqis, whatever the technological sophistication of their equipment, did not possess the basic flying skills to fully exploit the capabilities of their aircraft.

The Iraqi Air Defense System

Beyond its aircraft, Iraq depended on a complex air defense network. The Iraqi system was highly centralized; four sectors, each with a Sector Operations Center (SOC), controlled air and air defense assets. The focus of that network was on meeting two threats: long distance Israeli air attacks or that posed by the Iranian Air Force, what little remained after the war. Under each SOC, Intercept Operation Centers (IOCs) ran ground control intercepts and SAM defenses and coordinated the flow of information from individual radar stations and visual reporting sites to the SOCs. [DELETED].

(Santa Monica, CA, 1992).

[55](S/WN/NC/NF) SPEAR, "Iraqi Threat to U.S. Forces," p 3-61.

[56](S/WN/NC/NF) *Ibid*, p 3-64.

[57](S/WN/NC/NF) *Ibid*, p 3-63.

Map 6
Iraqi ADEF C3 Network

[DELETED]

Information collated at the center then flowed back down to antiaircraft units, air bases, and SAM sites.

At the center, the Air Defense Operations Center (ADOC) in Baghdad made the crucial decisions, while a French-designed computer system (KARI–Iraq spelled backwards in French) tied the network's diverse

pieces together. [DELETED][58] KARI also possessed "land line and/or microwave (either troposcatter or line-of-sight)" to lower levels of command. Redundant land lines tied the section centers to the national command level, while the Iraqis placed the intercept centers near existing telecommunication trunks capable of carrying both voice and data communications. The French designed system modems so that each node could easily switch from one form of communication to another.[59] The Iraqis also provided extensive protection to both types of centers by placing them in hardened shelters.

As the war with the Coalition loomed, the Iraqi leadership viewed the strategic purpose of its air defenses as providing the means for the nation to ride out an air campaign. The defenses were to inflict heavy enough losses on the attackers to bring on a ground campaign. The primary tools for defending Iraqi air space were SAM and antiaircraft forces. On paper, active air defenses were indeed impressive: five hundred radars located in no less than one hundred sites, SA-2 batteries, SA-3 batteries, SA-6 batteries, SA-8, and ROLAND I/II systems covered different areas of the nation. The air defense system controlled about 8,000 antiaircraft pieces, but the percentage devoted to the defense of strategic targets as opposed to the defense of the army in the Kuwaiti Theater of Operations is not known. Nevertheless, the Iraqis deployed approximately 4,000 fixed and mobile antiaircraft artillery pieces and SAMs around Baghdad [see Map 8].[60]

[58](S/WN/NC/NF) *Ibid*, pp 3-7 to 3-29. [DELETED]

[59](S/WN/NC/NF) *Ibid*, pp 3-17, 3-25.

[60](S/WN/NC/NF) *Ibid*, p 3-13.

Map 7
Fighter Bases in Relation to SAM Coverage (U)

[DELETED]

Not surprisingly, the Iraqis tied the SAMs closely to computer KARI. However, antiaircraft artillery, relied on barrage firing on preset azimuths to hit attacking aircraft.[61] The Iraqis believed that a combination of SAMs and antiaircraft artillery would impose sufficient attrition on attacking forces; at medium to high altitudes SAMs would shoot down many Coalition aircraft; should the attackers go low, then antiaircraft guns

[61][DELETED]

would inflict heavy casualties. Finally, Iraqi aircraft, protected by hardened aircraft shelters, could intervene at selected moments to add to Coalition losses.

Unfortunately for the Iraqis, KARI possessed a number of weaknesses. French experts oriented the system to protect Iraq from attack from the east (Iran) and west (Israel). Coverage towards Saudi Arabia was weak. SAM and antiaircraft defenses were strong in some sectors; admittedly, Baghdad was an extraordinarily heavily defended target [see Map 8]. Strong air defenses also protected Basra, Scud-launching sites in western Iraq, and Iraq's northern oil fields. But much of the rest of the country lay open–a factor that allowed allied aircraft to approach targets from different directions. Moreover, the layout of the western and central sectors created a dead zone pointed directly at Baghdad from Saudi Arabia.[62] Not surprisingly, Iraqi defensive systems could only handle threat levels consistent with Middle Eastern force structures.[63] Indeed, to the Iraqis, the system's capacity to track targets seemed more than sufficient.[64]

But what Coalition air forces could throw at the Iraqis was something well beyond the capacity of Iraqi information, command and control, and weapons system capabilities.[65] The largest weakness, however, lay

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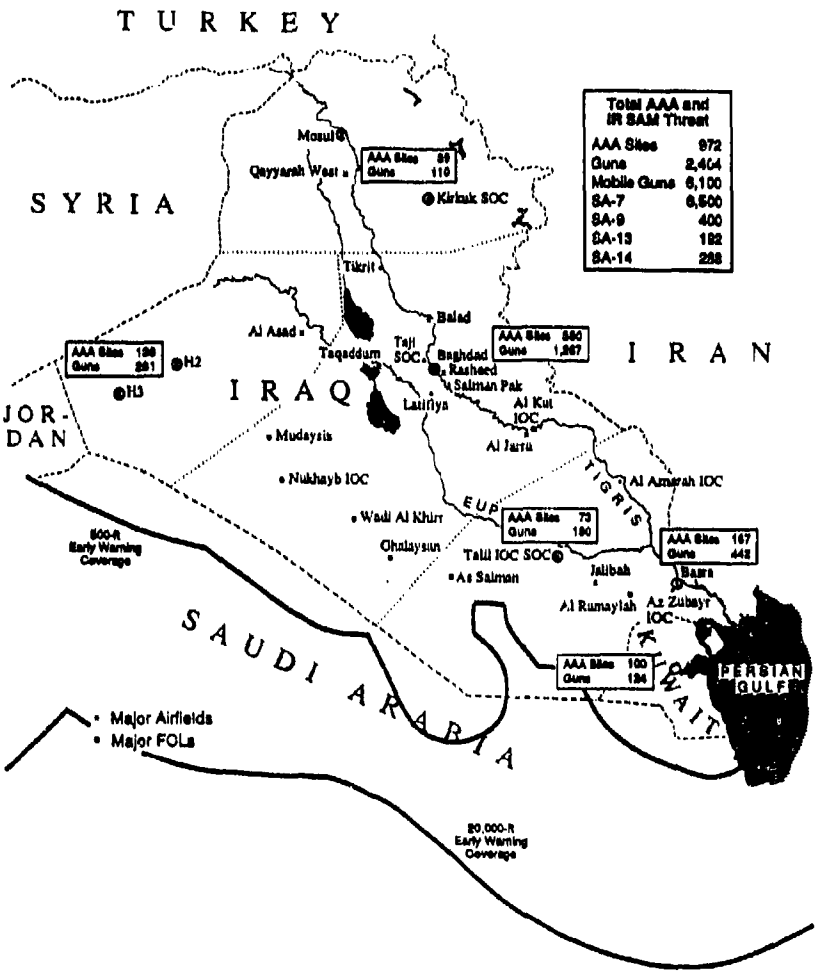
[62]Intvw with Gen Henry, GWAPS, 28 Aug 1992; "Electronic Combat in Desert Shield/Desert Storm," Brig Gen Larry Henry, GWAPS NA 358.

[63]The misapprehension that they were confronting a threat consistent with their Middle Eastern experiences marked Iraqi behavior throughout the prewar and wartime periods. Their mis-estimate of American capabilities was similar to the mis-estimate that the North Vietnamese made in 1962 in calculating the power of the United States. They may well have won the Second Vietnam War, but they inherited a nation that American firepower wrecked from one end to the other and they lost an entire generation of young men. See Bernard Fall, *Last Reflections on a War* (New York, 1967).

[64](S/WN/NC/NF) SPEAR, "Iraqi Threat to U.S. Forces," p 3-20.

[65]This is suggested by the fact that the northern SOC at Kirkuk only went down for a few days during the war; yet it proved incapable of handling the air strikes put into northern and central Iraq from Turkey by the American forces, operating out of Incirlik. Undoubtedly, there were a number of factors at work, such as "Proven Force's" SEAD efforts, but the zero loss rate is indeed suggestive. For the continuing operation of the Kirkuk SOC see (S/WN) Defense Intelligence Agency, "Desert Storm BDA Imagery Review, DDX-2900-489-91, May 1991, Vol. II, p 95.

Map 8
Iraqi IR SAM and AAA Threat



in the fact that Iraqi operators and pilots could not handle either the technological or tactical competence of Coalition forces. Exacerbating their deficiencies was the low level of training and preparation among Iraqis in comparison to the levels of their opponents.

The Coalition

The greatest potential weakness of Iraq's opponents lay in the fact that they were a Coalition. At the highest level, intense negotiations, cajoling, and careful handling all combined to achieve general agreement among the partners to use force against Iraq. The Coalition of the Saudi Arabia, Britain, France, the Gulf States, Syria, Egypt, the U.N. and myriad other nations was neither inherently stable, nor naturally united.[66] Yet, Saddam's efforts to break up the Coalition prior to 17 January 1991 showed little success, a result more of his inept diplomacy than of the Coalition's inherent strengths.

On the operational side, Coalition members deployed great military power as the crisis built towards its military climax.[67] In most of history, coalitions have found it particularly difficult to cooperate in the military sphere in the early part of a conflict.[68] In this war, the differences in the operational style of national military forces did not prove to be as great a hurdle.

The major non-Arab contributors, the United States, Great Britain, and France, all held the common experience of cooperating within the NATO framework. While the French have remained outside of NATO's command structure since 1962, they have had extensive direct and indirect contacts and working experience with their NATO allies in the field. Consequently, neither British nor French forces had significant difficulties in working with Americans. On the air side, both the British and the Saudis had participated in "Red Flag" exercises, so their pilots had regularly integrated themselves into American practices and employment concepts.

The three major NATO powers deployed exceptionally professional forces to the Gulf. Since the 1950s, the British have relied on all-volunteer forces rather than on conscription; in the early 1970s, the

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[66]The French minister of defense resigned shortly before the shooting war began to protest the anti-Iraq policy of his government and because he felt participation in the war would permanently damage French standing in the Arab world.

[67]See Chapter 1 for a discussion of the actual forces deployed.

[68]See in particular Edward Spears, *Liaison, 1914: A Narrative of the Great Retreat* (London, 1936) and *Assignment to Catastrophe* (London, 1954) for the problems that confronted the British and French in the opening years of World War I and World War II.

United States embarked on a similar road. While the French still held to conscription, the forces they deployed to the Gulf came largely from professional units. While Coalition forces lacked combat experience, they did have extraordinarily high levels of professional skill. Coalition soldiers, airmen and sailors were experts in the profession of arms, at both tactical and operational levels.

Moreover, many of the Coalition's Arab air forces had worked with the Americans. Most flew American aircraft and many had received training in the U.S. Only the Syrians, with a long history of dependence on the Soviets for equipment and training had little common experience with their allies. Consequently, whether one talks about air or ground operations, there was considerable commonality in thought pattern, concepts of operations, and tactical frameworks within which Coalition forces would operate.

The Americans

The bulk of the Coalition's military strength rested on the capabilities of the American forces deployed in the Persian Gulf. And it was on the capabilities of those U.S. forces that success or failure in the Gulf would depend. The American political system had regained much equilibrium since the Vietnam war. Under Presidents Reagan and Bush the nation again projected an image of strength and determination on the international scene. Nevertheless, beneath that exterior, substantial doubts assailed U.S. leaders and those recording American attitudes. Above all, Vietnam had created a sensitivity in all levels of leadership to the loss of American life, and this sensitivity carried over into the conduct of operations and strategy. Moreover, that sensitivity carried over into a specific and general unwillingness to put Iraq's population at hazard.[69]

Throughout the lead-up to and the conduct of this war, concerns over possible American battlefield casualties expressed this factor most directly; this was a direct reflection of the impact of Vietnam on the American psyche.[70] From the onset of the crisis, this fear of heavy losses was a

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[69]See Gen Glosson's comment in Chapter 1 of this report.

[70]Gen Glosson in his prewar briefing to American fighter pilots underlined that no target was worth the loss of an American aircraft. Glosson implied that our aircraft would be able to return to attack a target that had not been destroyed, but once an aircraft

major factor in decision-making in Washington. Saddam was a careful observer of these debates and as war approached, he made clear his belief that this American fear represented a weakness, especially when compared to the level of sacrifices that Iraq had borne in its war with Iran.[71]

The American Military

In 1973 the United States had withdrawn the last of its military forces from South Vietnam; the collapse of that polity followed shortly thereafter. The impact of the war on the American military was serious in the short run. For some in the military, defeat resulted from unwillingness of politicians, media, and even the people to stand behind the fighting man.[72] For others defeat resulted from the failure of national leaders, military as well as civilian, to create an effective strategy for the conflict.[73] Some veterans felt the military had performed badly on all the

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or aircrew had been lost, one was in an irrevocable situation. Glosson's attitude stands in stark contrast to the attitude of army air force commanders in World War II, whose attitude was that any losses were justified so long as bombers attacked the target. Intvw, Maj Gen Buster Glosson by GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 14 Apr 1992. Glosson's comments to F-16 pilots were confirmed by Maj John Nichols, member of 401st Tactical Fighter Wing, GWAPS, 20 Jul 1992.

[71]But, as with almost everything that he did in this war, Saddam's attitude may have backfired against him. Saddam's boasts "that America would not tolerate thousands of dead GIs, but that Iraq was ready for such sacrifices" directly impacted on the morale of his troops. Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "The Gulf War: An Iraqi General Officer's Perspective," 11 Mar 1991, JDC Rpt #0052.

[72]Frederick Downs, in his dispassionate account of his service in Vietnam, recounts an incident that happened to all too many servicemen after their tours in Vietnam: "In the fall 1968, as I stopped at a traffic light on my walk to class across the campus of the University of Denver, a man stepped up to me and said, 'Hi!' Without waiting for my reply to his greeting, he pointed to the hook sticking out of my left sleeve. 'Get that in Vietnam?' I said 'Yeah, up near Tam Ky in I Corps.' 'Serves you right.' As the man walked away, I stood rooted, too confused with hurt, shame and anger to react." Frederick Downs, *The Killing Zone: My Life in the Vietnam War* (New York, 1978), preface, no page.

[73]Harry Summers notes at the beginning of his work: "'You know you never defeated us on the battlefield,' said the American Colonel. The North Vietnamese pondered this remark for a moment. 'That may be so,' he replied, 'but it is also irrelevant.'" Summers, *On Strategy: A critical Examination of the Vietnam War* (Carlisle, PA, 1987), p 1.

levels of war.[74] But virtually all military professionals agreed that there was room for improvement.[75]

In the 1970s improvement dealt with reestablishing the discipline and respect essential for military effectiveness. In the 1980s with Reagan's swelling defense budgets, the U.S. military carried out a massive re-equipment of its forces, as well as a rethinking of how best to employ its growing combat power. This two-part process played a major role in the Gulf. Throughout the Reagan buildup, there was a major debate in the U.S. over the weapons that the military needed after the drawdown of the 1970s. Arguments revolved around issues of quantity and quality. The so-called military reformers argued that the U.S. should not buy complex, sophisticated weapons because they were not only expensive, but unreliable. Instead, they argued the American military needed cheaper and less sophisticated weapons, ones that were more reliable and available in larger quantities, and which required less support.[76] On the other side, the American military argued that with technological advances, rapidly evolving computers, and sophisticated volunteer soldiers (or airmen, or seamen), the U.S. military needed to ride the technological wave.

In almost every case Secretary of Defense Casper Weinburger supported "high tech" solutions in purchasing the next generation of U.S. weapons. While not all of those weapons proved out, the superiority as well as reliability of the new technologies played an important role in the

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[74]Maj Gen Buster Glosson, when he talked to a group from GWAPS, emphasized his belief that Summers was wrong and that we had performed no better on the tactical level during the Vietnam War than we had performed on the other levels of war and that we had gotten large numbers of men killed because our performance on the basic tactical level had been so inadequate. Intvw, Maj Gen Buster Glosson with GWAPS personnel (Williamson Murray, Barry Watts, Thomas Keaney, and Alexander Cochran), 9 Apr 1992.

[75]Virtually every senior officer that GWAPS interviewed for this study indicated their profound dissatisfaction with the leadership under which they had served in the Vietnam War and their desire to insure that this time the same mistakes would not occur at any level.

[76]For two of the more publicized critics of the American military see Gary Hart and Bill Lind, *America Can Win: The Case for Military Reform*, (Bethesda, MD, 1986); and James Fallows, *National Defense* (New York, 1982).

Gulf.[77] On balance, technological sophistication significantly enhanced, rather than undermined, the performance of well-trained American forces.

But the superiority of American (and Coalition) equipment explains only a portion of the success. On the second day of the ground offensive, a platoon of Marine M1A1s–manned by reservists–ran into a battalion of Iraqi tanks deploying to counterattack. Despite the fact that the Iraqis outnumbered the M1A1s, and the encounter engagement took place at close range in daylight conditions, the Marines destroyed thirty-four enemy tanks in less than ten minutes; they suffered no losses to themselves.[78] This single example underlines that the crucial factor in the Gulf War lay in the superiority of training that Coalition forces had received during the previous decade. That training advantage overshadowed whatever combat experience Iraqi forces had gained against Iran.

Vietnam had shown serious shortcomings in the tactical preparation of American forces. Above all, the Army had felt those failings; and if it did not always own up in public to its failures in Vietnam, it grappled seriously in both tactical and operational domains. In the 1970s, it rewrote its basic doctrinal manual, FM 100-5; and then packaged the new manual in such a fashion that an explosive debate occurred throughout the Army over the directions that doctrine should take.[79] That, in turn, led to a new FM 100-5–one substantially reworking the 1970s version to re-emphasize maneuver and battlefield flexibility. The crucial point is

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[77]The distances at which US M1A1 could acquire, hit, and then destroy targets in comparison to the T-72 tanks that the Iraqis deployed suggests the advantages that the high tech equipment gave US forces in all arenas in which our forces engaged the Iraqis in the Gulf War. M1A1s were capable of acquiring and killing Iraqi tanks at ranges of more than 3,000 yards; the Iraqis using T-72s could acquire and fire at US tanks at ranges barely more than 1,000 yards unless direct visual conditions were operative.

[78]Lt Col J.G. Zumwalt, "Tanks! Tanks! Direct Forward!" *Proceedings of the U.S. Naval Institute*, Jul 1992, pp 78-80. What is significant about this engagement, as opposed to most others in the Gulf War, was the fact that it occurred at relatively close range and with both sides caught by surprise. Thus, the combat conditions should have negated some of the technological advantages of US weapons systems. The results, however, were the same: the utter destruction of the enemy forces and minimal damage to US forces.

[79]For a careful study of Gen Depuy's formulation of the new version of FM 100-5 see Paul M. Herbert, *Deciding What Has to be Done: General William E. Depuy and the 1976 Edition of FM 100-5, Operations*, (Leavenworth, 1988).

that not only has the Army rewritten basic doctrine twice since Vietnam, but that doctrine has become an essential preparatory element for combat.

Similarly, in its professional education, the Army emphasized warfighting skills at every level. In the mid-1980s it created the School for Advanced Military Studies (SAMS); that specialized school provided the top graduates of the Command and Staff College with a second year of intensive study concentrating on the operational level of war–the employment of military forces within a theater to destroy the enemy. In their succeeding assignments, the graduates of SAMS provided the Army with an intellectual leavening that broadened its understanding of war. Above all, it prepared its graduates to think through employment of ground forces to achieve goals larger than simply battering enemy divisions on the front lines.

The Air Force and the Navy followed similar paths during this period.[80] The air war against North Vietnam was one of the most controversial aspects of our mishappened efforts in Southeast Asia. Ill thought-out political considerations had dominated the conduct of air operations. Yet, postwar claims that political naivete was solely responsible for the failure of the air campaign missed a basic issue. The organization of American air power had also been less than satisfactory; to all intents and purposes Air Force and the Navy had waged entirely separate air campaigns. But even within its own domain the Air Force hardly provided coherent direction:

> The absence of a single air commander produced chaos. The 2nd Air division in Saigon, the air force headquarters with direct control over fighter wings participating in the campaign, received guidance not only from PACOM and PACAF, but also from [Thirteenth] Air Force in the Philippines. . . .To simplify the multi-layer air force command arrangement, PACAF changed the 2nd Air Division to the [Seventh] Air Force in early 1966. The confusion then increased, however. Instead of providing [Seventh] Air Force with complete control over the 2nd Air Division assets, PACAF gave the [Seventh] Air Force 'operational' direction over the fighter wings, while the [Thirteenth] Air Force retained 'administrative' control. The ultimate result of this bizarre

[80]Since this study is largely concerned with air power it will discuss the US Navy and the Marine Corps only in so far as their air power capabilities affected the battlefield in the Gulf.

arrangement was the creation of the [Seventh]/[Thirteenth] Air Force in Thailand, which then assumed *administrative* control of the fighters![81]

A discouraging aspect of the air war lay in the exchange ratios between American aircraft, naval as well as air force, and their North Vietnamese enemies. In the last two years of World War II and in the Korea, American pilots averaged exchange ratios of well over ten-to-one in air-to-air combat against their opponents. Yet, from 1965 to 1968 the ratio of American kills versus losses against North Vietnamese aircraft in air-to-air combat was barely two-to-one. When the raids against North Vietnam stopped in 1968 the Navy rethought its approach to air-to-air combat. "Top Gun" resulted, and its impact on the skills of Navy fighter pilots showed in 1972, when they established a twelve-to-one exchange ratio against their North Vietnamese opponents. The Air Force, however, suffered an even worse air-to-air exchange ratio during the initial months of Linebacker I than the barely 2-to-1 it had posted during the 1965-1968 period, even though, by the year's end, an influx of more seasoned pilots enabled it to achieve a 2-to-1 exchange ratio for 1972.[82]

The success of "Top Gun" resulted in substantial changes in how the Air Force approached its tactical business after 1973. The Air Force established "Red Flag" to address the tactical problems of air warfare across the board. "Red Flag" taught a whole generation of air force pilots and commanders how to deal with enemy defensive *systems* from fighters, to SAMs, and AAA, as well as how to get bombs on target. It was in the hard-to-measure areas of training and preparation for countering threats that Coalition air powers, especially Americans, enjoyed enormous advantages over their Iraqi opponents. One pilot in a "Weasel" squadron underlined the advantage in a comment made during the war:

> Going into the first combat mission, I don't think I was ever scared. . . .I've trained for eight years for this; Major Moore has trained for ten or eleven years. . . .The fact that I see stuff shooting at me is a little different, but I was well prepared for it. In fact, when the SA-2 launched, I didn't feel scared at all. . . .I knew exactly what to do. In fact I didn't think at all. It was instinct. I knew I had to get out of

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[81]Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York, 1989), p 128.

[82](S) USAF Tactical Weapons Center, Project Red Baron, *Air-to-Air Encounters in Southeast Asia*, (Nellis AFB, 1973-74).

there. I'm sure that's what Major Moore was thinking. He knew exactly what he had to do in the back seat; I knew exactly what I had to do in the front seat. He's getting out the chaff; he's putting on the pod. I'm moving the jet. It's just like we have trained for years and years . . . they train us a lot better than you can imagine. So we can handle any threat we see up there--air-to-air or ground-to-air. Anything that comes up. We've seen it before; we know exactly what to do when we get it. It's all instinct. The reason we are all doing well in this war is the fact that we are all well trained.[83]

An F-111 pilot commented at a NATO conference 1992 in the following terms:

> Training saved our lives! We trained for the low and the medium altitude war. Eighty percent of our training was for the low level altitude environment, but we found that training for a low war made fighting high a little bit easier. We also had local airfield attacks; we also had our HHQ composite force exercises; we had tanker exercises, and we had all kinds of training down in Saudi Arabia. Our training allowed us to verify the operability of our systems, prior to the war. We made sure that bombs would indeed come off the jet, when you push the pickle button, which did not always happen, unfortunately. And of course, we fought like we trained.[84]

The appearance of precision-guided munitions in the late 1960s began a revolution in weapons technology; the arrival of stealth aircraft in the 1980s significantly extended that revolution. The training and preparation of American aircrews for combat allowed U.S. forces to maximize the potential of these revolutionary changes in weapons technology. The training programs prepared pilots for the actual environment in which they would fight and extended their capacity to adapt to the conditions of combat.

There was one last, intangible advantage to the Coalition. Western military forces had spent the previous forty years in preparing to fight

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[83]TSgt Charles L. Starr, "Special Study, History of the 35th Tactical Fighter Wing (Provisional): Operations Desert Shield and Desert Storm," GWAPS NA 277.

[84](S) Capt Kelly, "F-111 Operations--Desert Storm," Appendix 21 to Annex C to 1730.13.7/AFOOAT/S-078/92, 20 Feb 1992, NATO.

Following the first daylight attack, Lt Col Bruce Wright, 614th TFS commander expresses confidence.

Soviet ground and air forces. Western military organizations had thoroughly prepared in their training, doctrine, and exercises for a great clash with the Warsaw Pact. That clash never occurred, but Western forces that entered the Gulf confronted an opponent, much of whose doctrine, training, and equipment largely derived from the Soviets. Consequently, many aspects of the Iraqis' style of war and doctrine were familiar to Coalition military leaders as well as pilots and tank crews; the enemy's tactical doctrines and styles of fighting were ones that U.S. forces were thoroughly prepared to disassemble. Even more advantageously, Iraqi forces lacked the staying power and depth of Soviet forces. Finally, desert conditions in western and southern Iraq–and Kuwait–magnified the superiority of Western technology over Soviet technology.

Preparing to fight in the Central European environment over the past several decades against a vastly more numerous foe conveyed a number of other advantages on U.S. forces in the Gulf. On the ground and in

the air, that preparation forced them to develop maximum skills to utilize the advantages conveyed by western technology. In the aerial arena which not only demanded the rapid achievement of air superiority but the conduct of operations deep behind the enemy's front lines to stem the forward movement of Soviet echelons, U.S. air forces developed highly sophisticated means of attacking, deceiving, or jamming Soviet air- and ground-based air defenses. Electronic warfare became more than an arcane art, and the suppression of enemy air defenses (SEAD) became a realizable goal. These skills and technologies, which would have presented considerable difficulties to Soviet air defense systems, were beyond the experience or comprehension of Iraq's air defenders.

Conclusion

In the comparatively static kind of ground warfare–reminiscent of the Western front in World War II–that dominated the Iran-Iraq War, the Iraqi regime had demonstrated enormous staying power; in that conflict it proved that it could mobilize as well as drive its military to suffer extraordinarily heavy casualties. But because of its striking misestimates of the U.S. and its allies, as well as the willingness and ability of Coalition leaders to attack Iraq's military weaknesses, Saddam Hussein's regime would ultimately fare far less well against the Coalition than it had against revolutionary Iran.

In retrospect, Iraq's strengths and weaknesses appear to have been different from what many Western observers and military analysts outside the theater assessed them to be prior to the war. Its greatest strength may have lain in the ruthlessly effective political control that Saddam had established over his nation. Even the catastrophic defeat of his air force and air defenses, the bombing of targets throughout Iraq for forty-three days, and the destruction of the bulk of his army in the Kuwait theater did not suffice to overturn the regime. Like Stalin's Soviet Union in 1941, military disaster on the frontiers did not quite manage, given the limited objectives under which the Coalition prosecuted Desert Storm, to decapitate Saddam Hussein's "Republic of Fear."

On the other hand, the Iraqi military, outside of its utilization of mobile Scuds, displayed little capacity to adapt to the very different kind of warfare, with its emphasis on advanced technology and operational art,

that the Coalition imposed on it. The Iraqis had just finished a long and exhausting war against Iran, a conflict that certainly had not turned their army into the "battle-hardened force" that some in the West perceived.[85] While Iraq's opponents possessed little direct experience with combat–at least in the lower ranks–Coalition air and ground forces had undergone complex training and preparations for the actual conditions that they eventually encountered. Those preparations were far more realistic than anything that occurred in the Iraqi military.

It was at the strategic level that the Iraqis made their greatest miscalculations. To put it simply, they proved incapable of changing their assumptions in the light of what was actually happening. As Dr. Norman Cigar has noted:

> Such [strategic and political] assumptions, by their very nature, are usually deeply held. Their rejection or modification requires painful soul-searching and the willingness to admit a mistake in one's original basic calculations, if not the rejection of one's entire analytic framework. This is never easy–even in the face of overwhelming evidence . . . [yet Saddam] remained intractable to the end, being willing to risk war, and believing until relatively late into Operation "Desert Storm" that Iraq would acquit itself well on the battlefield.[86]

Only the complete collapse of his military forces eventually led Saddam to recognize what was happening and to request a ceasefire.

A quote from an Iraqi newspaper in summer 1990 underlines the greatest imbalance between Iraqi and Coalition forces. An Iraqi reporter commented as follows on reports that American troops were requesting Chapstick and insect repellant:

> There is no army in the world that requests such supplies. This runs counter to the existing concept of the military, which [demands] toughness, rigor, manliness, and adaptability to conditions. . . .What kind of

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[86]Dr Norman Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," *Journal of Strategic Studies*, p 23.

soldier is this that puts cream on his lips? What is the difference between U.S. soldiers and singers and dancers?[87]

The difference was that the Americans took care of the needs of their troops in the most fundamental ways; the Iraqis did not.[88] Against the Iranians, who were equally disdainful of basic human needs, this did not matter; against the Americans it did. Saddam assured his people and the world that Iraq was happy to suffer hundreds of thousands of casualties, while America could not even suffer casualty lists in the thousands. To the poor bloody Iraqi infantryman, this casual statement underlined the tyrant's disinterest in whether the infantryman lived or died. And that disinterest factored into his willingness to fight. This had not mattered in the war against Iran, because Saddam's regime retained control of the battlefield and its rear areas. In this war, the Iraqis did not control the battlefront or even the air over their own nation. On the other side of the hill American soldiers, sailors, marines, and airmen knew that their leaders cared.[89]

[87]Hamza Mustafa, "American Troops and their Hurried Requests," *Al-Jumhuriyya*, 17 Aug 1990, p 4.

[88][DELETED]

[89]To a great extent this was *not* true in much of the Vietnam war, as much of the literature of this war underlines. Particularly worthwhile in this respect is the brilliant novel by the former Secretary of the Navy: James Webb, *Fields of Fire* (New York, 1978).

3

The Opening Days: Final Plan and the Scripted War

This chapter will examine the conduct of the first two days of the air campaign against Iraq; to set the stage, it will discuss the immediate and long term objectives of the air operations. In this short span of time, Coalition air attacks achieved a solid basis from which allied air commanders could mount systematic and sustained attacks against strategic targets in Iraq, the enemy's military forces, and the infrastructure that supported those forces. The success of these first strikes ensured the possibility of a sustained offensive against the present dangers of Iraqi military power as well as Iraq's long range potential.

When the Gulf War ended with U.S. troops on the Euphrates and the outskirts of Basra, commentators hailed the ground campaign as a masterpiece of "operational art." Indeed, it was; the conception of a wide sweep, deep into Iraq behind the entrenched Iraqi forces, a clever deception effort, thorough logistic planning and deployment, and effective execution by U.S. and Coalition armies represented an enormous achievement. Yet, the most impressive operational achievement of the Gulf War was the successful battle for air control, fought, and largely won, in the opening days of Desert Storm. That air battle, against the Iraqi air defenses, broke the enemy's capacity to defend himself from the blows that would fall throughout the remainder of the war. It placed Iraq and its military forces, in the words of a senior commander, in the position of a "tethered goat, being pounded to death from beyond its reach."

This air battle sought to achieve operational effects beyond the mere destruction of targets; on opening night, Coalition aircraft found enemy air defenses that were on full alert and that had received plenty of strategic warning. By way of comparison, the February ground war occurred against an opponent whom air attacks had pounded for weeks and whose morale had clearly suffered. This chapter aims to provide the reader with a sense of what that operational employment of air power

hoped to achieve, how Coalition air forces went about that task, and what the opening blows achieved.

Deployment of American forces into the Gulf had accelerated in late November in response to the President Bush's decision to prepare for the worst case: war. Arriving forces were soon to wage offensive air *and* ground campaigns. The addition of VII Corps and more air units represented an insurance policy; the two Army corps and a Marine corps could now defeat the Iraqi Army, if the air offense failed to force Iraq to disgorge its gains. Nevertheless, the buildup of powerful ground forces had resulted in a gradual shift in the emphasis of Coalition military plans. In August and September, the balance of forces between the opposing sides had precluded anything outside of defensive ground operations; offensive operations would have to rest entirely on air power. By November, allied ground forces were in a position to launch a limited ground offensive; by early January the logistical and operational strength of ground forces had reached the point where Coalition armies could strike deep and hard.

On the operational level, this resulted in a shift from an almost exclusive concentration on an air campaign aimed at centers of gravity in Iraq to an air campaign with divergent goals: the first, a strike at the Iraqi homeland–a "strategic" air offensive; and the second, "preparation of the battlefield" in the Kuwaiti Theater of Operations, to use U.S. Army terminology. The first three phases of the air campaign–strategic offensive, destruction of enemy air defenses in the KTO, and preparation of the battlefield–would begin concurrently, although initially emphasizing the first.[1] The fourth phase, ground invasion, would not begin until the ground war was initiated by either the Iraqis or the Coalition.

For the air war, a tight-knit group of officers under Glosson had carefully planned operations for the first two days. The offensive sought to attack a wide variety of targets in order to achieve synergistic effects. The plan emphasized an "inside-out" campaign in which air operations would begin at the center of Iraqi power and aim at functional effects

[1]In terms of the changing perspectives of the commanders, Schwarzkopf, who had been one of the strongest supporters of the "strategic" bombing options in the early days of Desert Shield, blew up at Horner just before the beginning of the air campaign in front of the latter's staff because of the supposed lack of emphasis in CENTAF plans on the Republican Guard.

rather than levels of destruction.[2] Crucial would be attacks against certain target categories whose destruction or degradation would affect others. These effects in turn would cascade through other sectors of Iraqi defenses or military efforts.

This approach by the Special Planning Group (hereafter referred to as the "Black Hole") represented an effort to utilize air power as an operational rather than a tactical instrument. The first air attacks did not seek the absolute destruction of single targets or target sets, but rather damage to a wide variety of targets. The combination of damage to these targets would, hopefully, degrade Iraq's defensive responses for the remainder of the campaign. Degradation to the electrical system, communication nodes, discrete elements in the air defense system, and certain leadership targets would, planners in the Black Hole believed, mutually reinforce difficulties in other areas as well as the defects in the Iraqi system.

Glosson and his deputy in charge of the strategic air campaign, Lt. Col. David Deptula, believed that such an approach would exacerbate inherent weaknesses in the Iraqis' military due to the political biases of their system.[3] The air campaign thus represented an effort to maximize operational effects by causing complex frictions within the enemy's military organizations and structure. This may well have been intuitive rather than doctrinal, but it reflected an imaginative understanding of the operational conduct of war.[4] The interplay between plans and operations in this first and decisive period of the war suggests much about the operational potential of air power, as well as the inevitable frictions

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[2]See GWAPS Effectiveness report, Chapter 1 for a closer examination of the synergistic effects that the planners aimed to achieve in the first series of air attacks. The discussion in this chapter, particularly in regards to the SEAD plan, also aims to bring out how the air campaign aimed to achieve an impact well beyond the direct destruction of mere targets.

[3]Intvw, Maj Gen Buster Glosson, with GWAPS personnel, 9 and 14 Apr 1992. Also see the intvw, Lt Col David Deptula with GWAPS personnel, 20 and 21 Dec 1991.

[4]Maj Gen Larry Henry commented to GWAPS interviewers that the SEAD plan had aimed at throwing sand into the Iraqi gear box to cause the structure to break down at critical moments, particularly during early phases of the war. Intvw with Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992.

involved in any combat–or as Clausewitz suggests, "the factors that distinguish real war from war on paper."[5]

A number of factors contributed to the success of initial air plans. The plans themselves represented a realistic mix of understanding the enemy and his *actual* capabilities and a keen appreciation of Coalition strengths. Above all, Coalition air leaders proved flexible and adaptable to the actual conditions they confronted. Finally, the Iraqi system and its commanders did not or could not adapt either to the weight of attacks or to the form that the air offensive took.

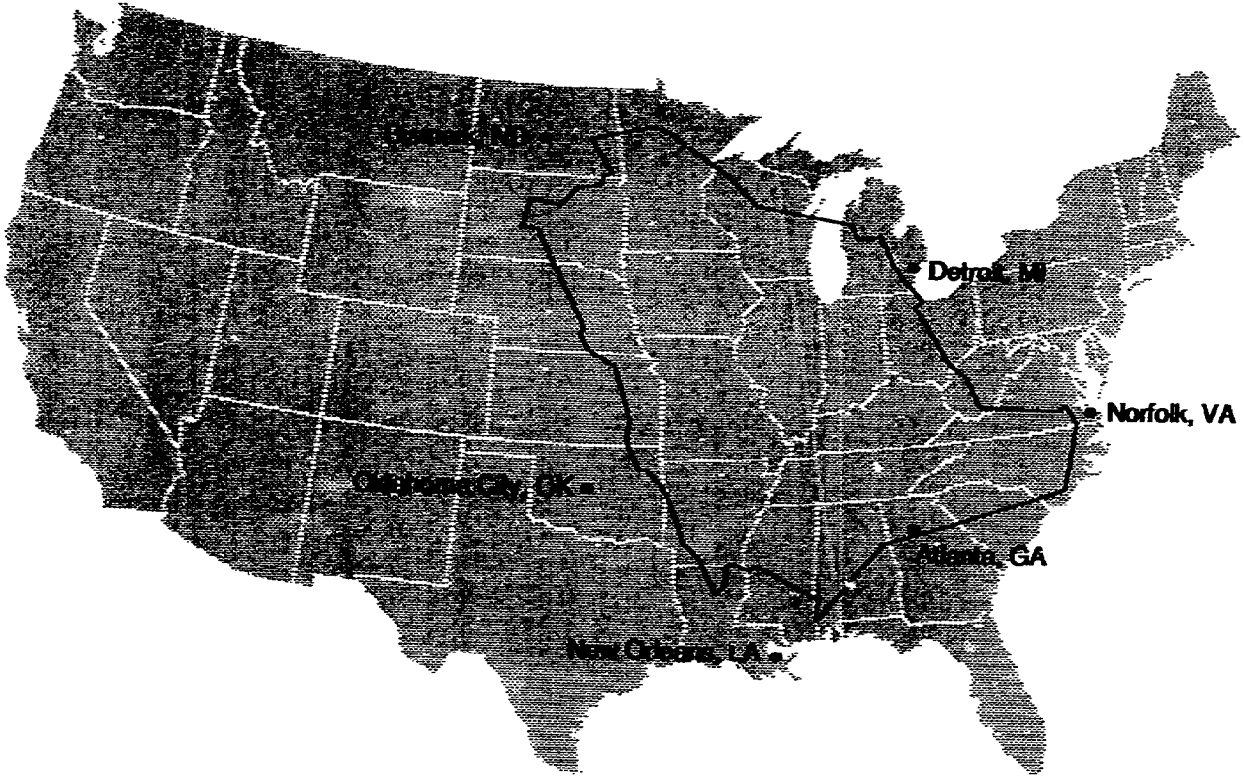
The Operational Problems in Projecting Air Power

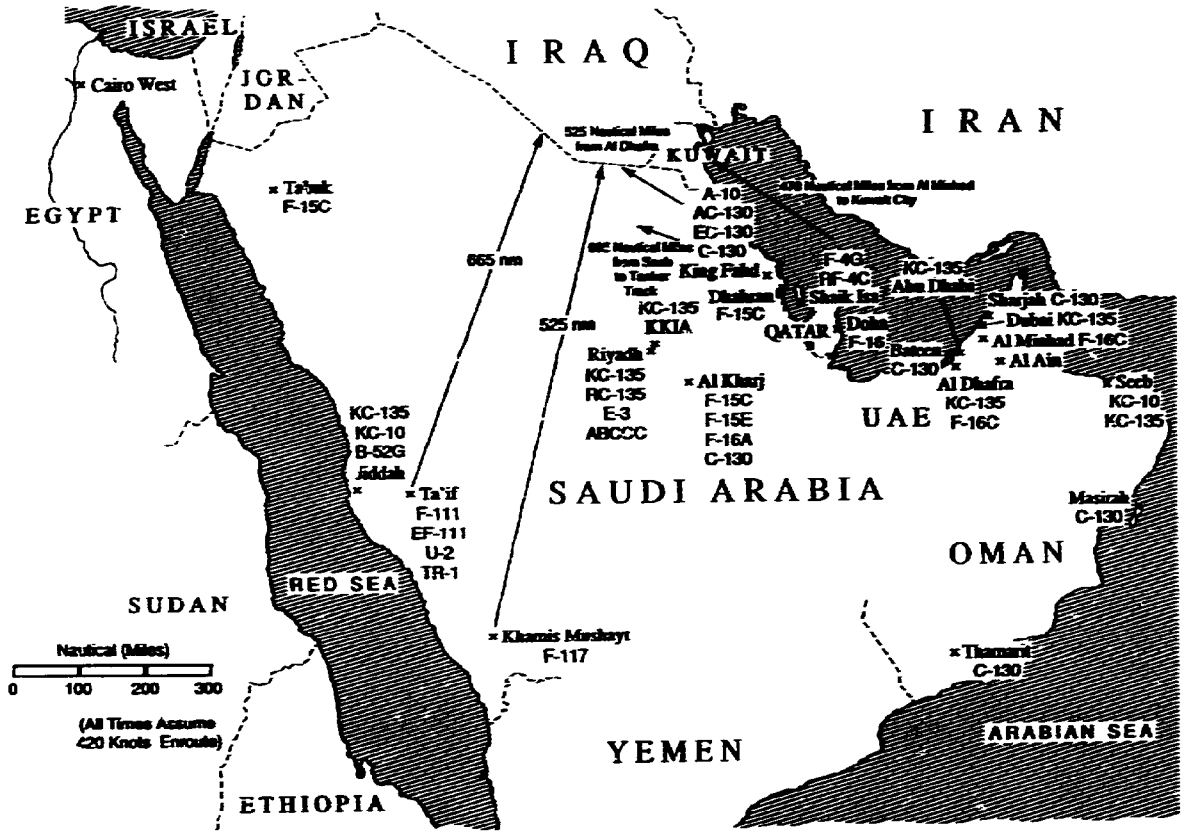
The discussions in much of the rest of this report (and chapter) center on the operational employment of air power against targets throughout Iraq and Kuwait. However, that application depended on the complex movement of aircraft from bases not only scattered widely throughout Saudi Arabia and the Gulf States but which were situated hundred of miles from the Iraqi frontier. The Saudis had constructed those bases to confront diverse threats from Israel in the west to Iraqi, Iranian, and possible Soviet threats from the north.

Saudi Arabia is an enormous country; Map 9 suggests its extent. Superimposed on a map of the United States, it would run from South Dakota to eastern North Carolina. From north to south it would run from Minnesota to southern Alabama. Over the past three decades the Saudis have constructed a considerable number of bases to protect those frontiers. Consequently, when Coalition air forces deployed into the Arabian peninsula they found themselves at bases separated by great distances from Iraq. Just to reach Iraq, F-117s, faced a journey of more than 665 nm (nautical miles). F-111Fs and EF-111s at Taif had a 525-nm trip to reach the Iraqi boarder. Many other USAF fighters had almost as long a haul. F-16s at Al Dhafra and Al Minhad had flights of nearly 528 nm, while F-15s at Dhahran, Al Kharj, and Tabuk, as well as the F-4Gs at Shaikh Isa all had flights of approximately 250 miles before they reached Iraqi air space. [See Map 10] In fact, they often had

[5]Carl von Clausewitz, *On War*, translated and edited by Michael Howard and Peter Paret (Princeton, 1976), p 119.

Map 9
Saudi Arabia - U.S. Size Comparison





Map 10
CENTAF
Deployment by
Aircraft Type and
Selected Distances to
Iraq

longer distances, because the missions formed up on tanker tracks and then crossed the frontier as integrated packages.

The problems confronting naval aircraft were just as daunting. Carrier aircraft from the Red Sea had to fly approximately 600 miles to reach Iraq. For aircraft flying from the entrance to the Persian Gulf, distances would have been over 800 miles, depending on the location of the carrier. However, by 17 January, the carriers had moved into the Persian Gulf. But even then their aircraft had distances of 300 miles to fly before they reached Iraqi territory. [See Map 11]

Given the distances of Iraqi targets from Coalition bases, allied aircraft required extensive mid-air refueling to execute their missions. By January CENTAF had established a series of tanker tracks running across northern and central Saudi Arabia for tankers to pick up Coalition aircraft as they came off airfields and accompany them to final drop off points just short of enemy territory.[6] From that point allied aircraft had to fly considerable distances to reach their targets. [See Map 12 for a depiction of the general pattern of tanker tracks] But the fact that the movement of aircraft involved not only north-south flights to the Iraqi frontier but east-west movements as well, given the placement of aircraft on the Arabian Peninsula, only served to exacerbate the difficulties of providing tanker support when needed.[7]

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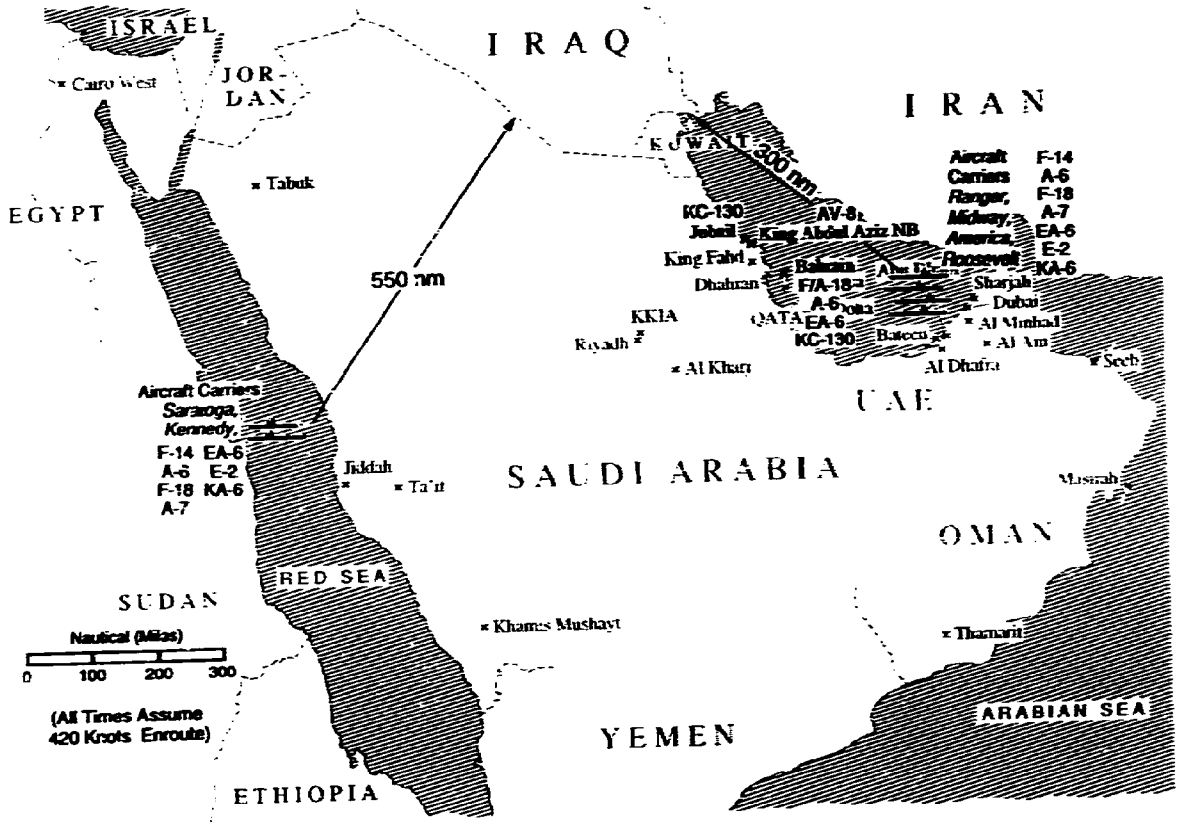
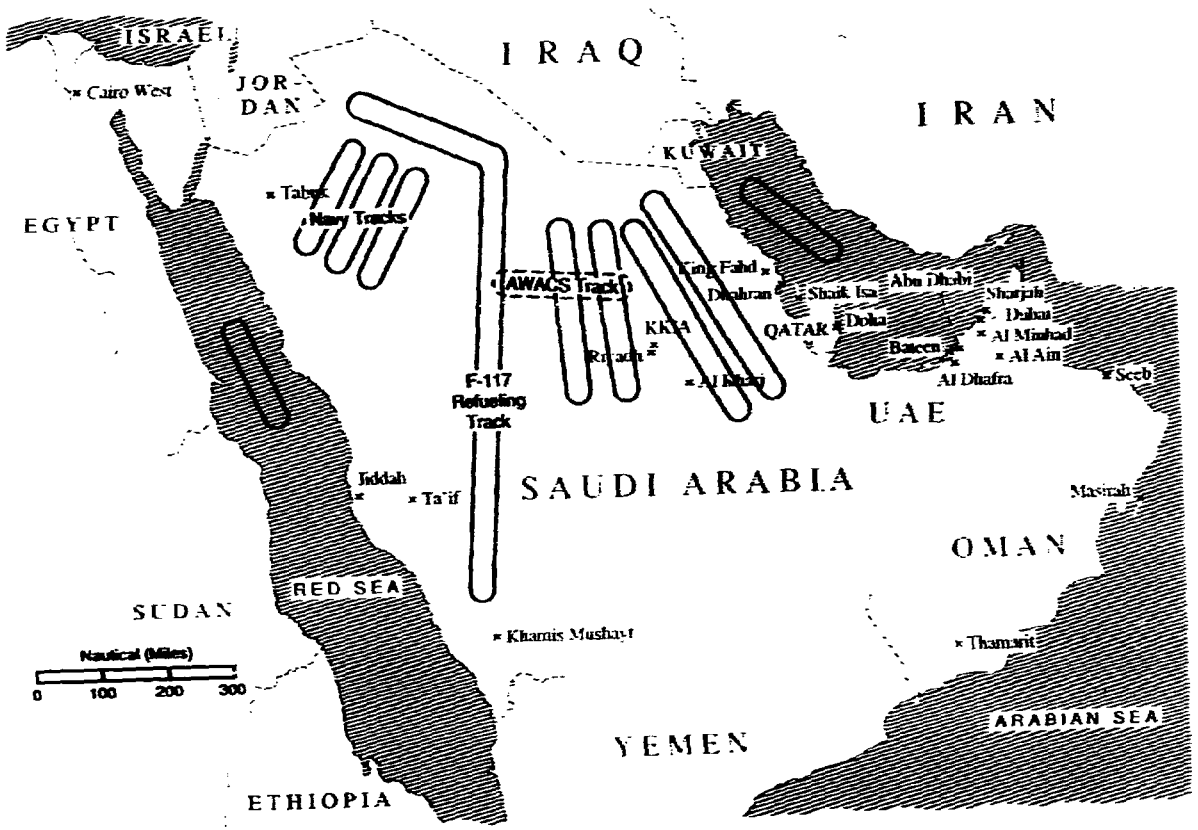
[6]The RAF confronted the need to establish an east-west track to serve their Tornados. They solved the problem with typical British imagination. "These two problems always meant that we had something to negotiate with the other middle airspace users, even artillery. Despite this, we were always welcome, and I even suspect that the challenge used to brighten their day. We also had our little triumphs like the occasion the Prince of Wales visited the RAF Headquarters, and the American airspace team, being typical schizophrenic Republicans, were desperate to meet him. We had them around the corner of the building, and at the right moment, pushed them forward to be introduced, handshakes, photos, and all. They were very impressed, not to mention grateful. The result of this gratitude was 'Olive Trail'–an east/west refueling route for the Tornados when all the other trails were north south. If the visitor had been the Princess of Wales we could have named our price." (S) Squadron Leader Minns, HQ STC, "Airspace Control," Appendix 2 to Annex C to 1730.13.7/AF00AT/S-078/92, 20 Feb 1992, Nato.

[7](S) *Ibid.*

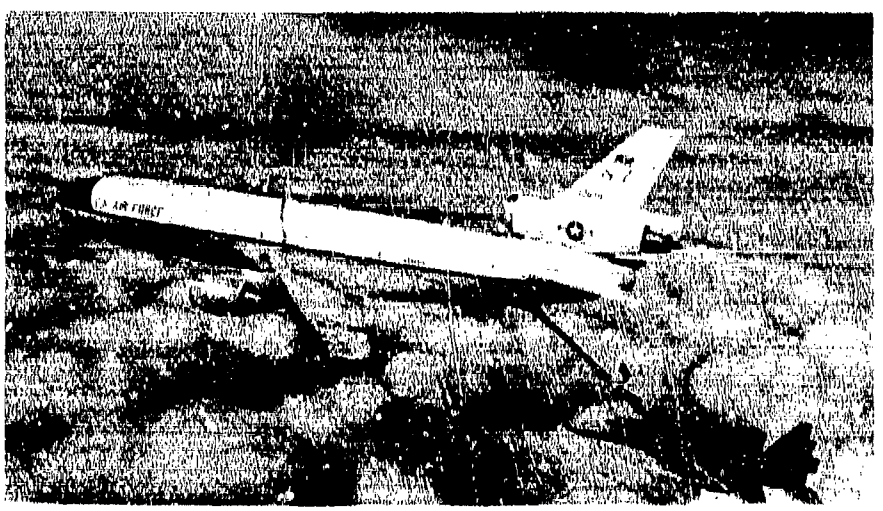


Map 11
Naval and Marine Corps Air Deployment and Selected Distance to Iraq



Map 12
The General Pattern of Tanker Tracks

Not surprisingly, since tankers and aircraft often came out of different airfields, the process of refueling required careful coordination. Admittedly, the process depended on the experience and expertise that the Air Force and Navy had built up over the past forty-five years in extending aircraft range by mid-air refueling. Moreover, with the large number of aircraft flying along with numerous changes in the air tasking order (ATO), the tanking operation depended on the flexibility of aircrews and tankers in adapting to difficulties in the aircraft flow.[8]



KC-10 tanker refueling F-15C fighter of the 27th TFS.

But refueling Coalition aircraft was only one part of a larger problem in coordinating movement of strike packages to the frontier. A package

[8]One of the Weasel crew members commented during the war: "We went up on another mission and couldn't find our tanker. I [don't] know if you would call it skill or luck, but I locked onto the biggest contact I had on the radar and it happened to be a tanker. He had no other aircraft on board. He wasn't our tanker, but he had his boom down and was ready to pass some gas, so we went up and topped off with gas and made it home. Otherwise we would have had to divert to another airfield. . . .The unexpected can happen at a moments notice. . . .We were flexible [enough] to cope with it." TSgt Charles L. Starr, "Special Study, History of the 35th Fighter Wing (Provisional): Operations Desert Shield and Desert Storm," GWAPS, NA 277, pp 159-60.

targeted against the Baghdad area might contain F-16 fighter bombers from Al Dhafra and Al Minhad, F-15 air superiority fighters from Al Kharj, F-4G Wild Weasels from Shaikh Isa, and EF-111s from Taif; in addition, Navy and/or Marine SEAD aircraft such as EA-6Bs and F/A-18s with fighter support aircraft might also support the effort in its flight into Iraq. The aircraft would join up at the southern end of a tanker track (or tracks), refuel, and then move across the frontier as a coherent, articulated force, that could jam enemy radars, fire HARMs at SAM sites threatening the package, attack enemy fighters that rose to challenge, and then bomb the target.

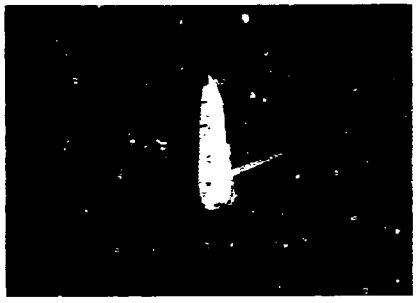
Here again peace-time training paid large dividends. A substantial portion of the aircrew, particularly mission and package commanders, had flown in "Red Flag" or the Navy's equivalent exercises at Fallon and "Top Gun;" they were thoroughly familiar with coordinating, planning, and flying such missions. The Navy undoubtedly had an advantage here: carrier air groups on board the carriers possessed a broad spectrum of aircraft, because the carrier might have to operate by itself; therefore each possessed air superiority, SEAD aircraft, and bomb droppers, and those aircraft operated together on a day-to-day basis.[9] But Red Flag had provided the Air Force with a solid basis on which to plan and execute strikes involving multiple types of aircraft.

To illustrate how such strike packages assembled, we can look at the war's biggest package, Package Q, flown on day three of Desert Storm.[10] This mission was to strike at Baghdad with seventy-two F-16s, fifty-six from Al Minhad (388th Tactical Fighter Wing) and sixteen from Doha (401st Tactical Fighter Wing); it received the support of eight F-15Cs from Tabuk as air cover against enemy fighters; eight F-4G Wild Weasels from Shaikh Isa to attack enemy air defenses; and two EF-111s

[9]The Air Force with its new composite wing structure is moving toward a similar system in which each wing will control most of the aircraft necessary to accomplish its mission without requiring the support of other wings.

[10]For a discussion of the actual course of this mission see Chapter 4.

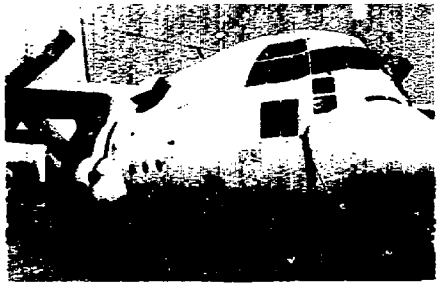
Package Q Aircraft:



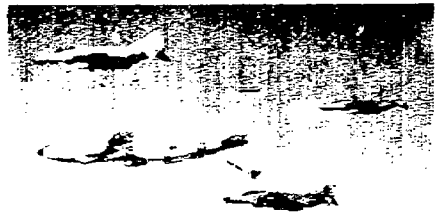
Rivet Joint

F-15

EF-111



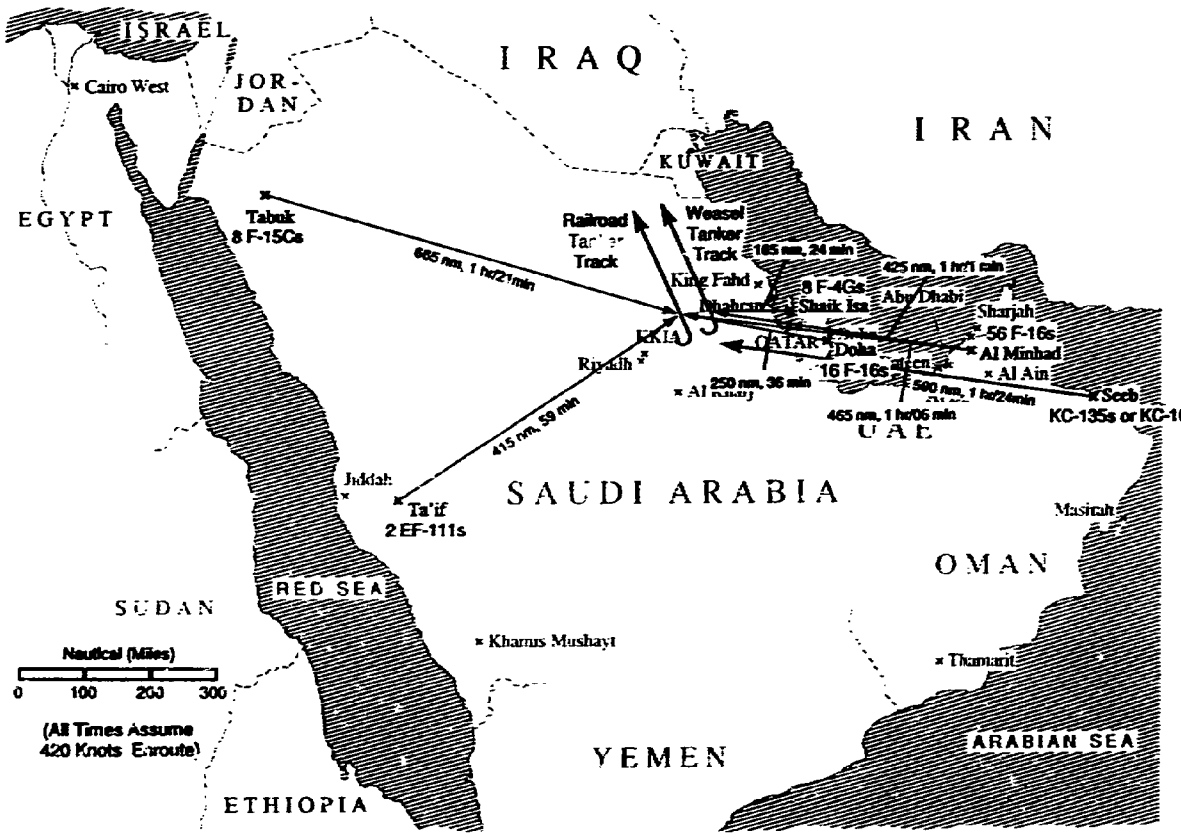
EC-130 (ABCCC)



KC-135R Refueling
F-4G Wild Weasels

AWACS

F-16



Map 13
Package Q Air Elements

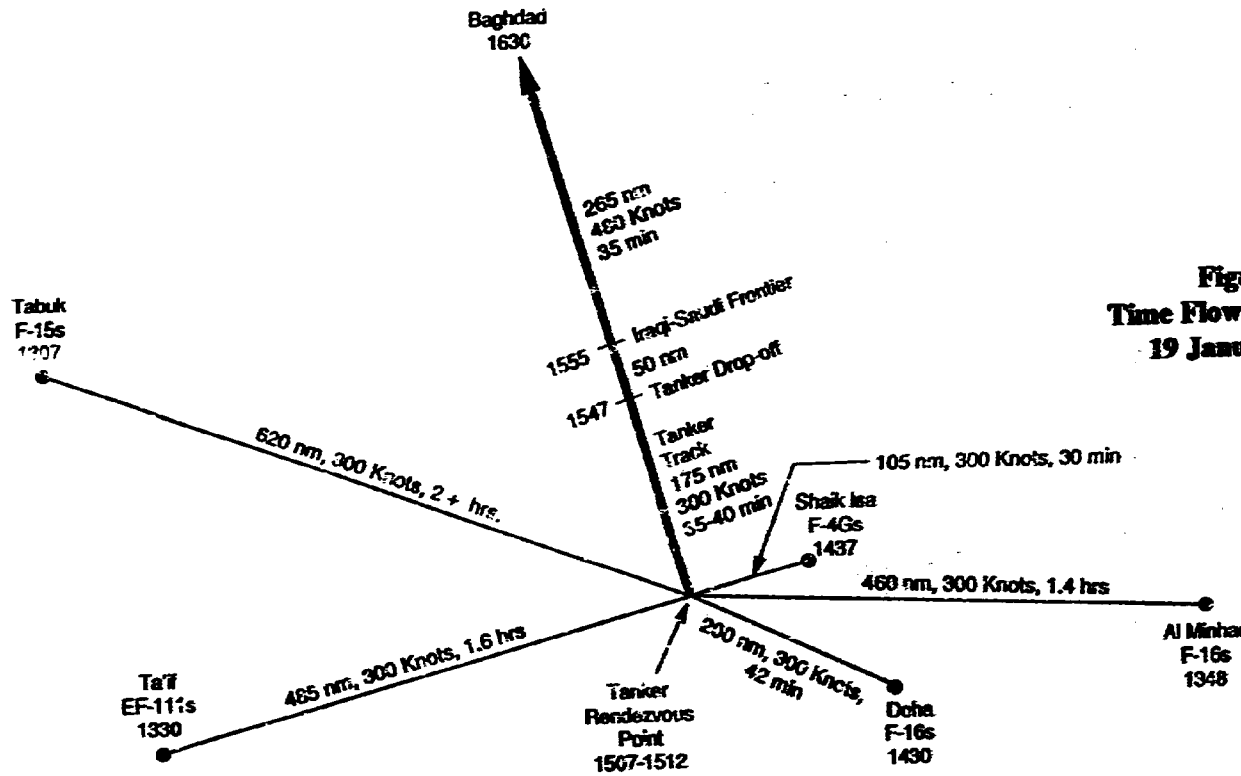


Figure 1
Time Flow: Package Q
19 January 1991

from Taif to jam enemy radars.[11] With a time on target of 1630L the strike package would have to cross the frontier at 1555; aircraft would begin dropping off tankers at approximately 1547.[12] The tankers, of course, would have to be ready in their tanker orbits at the right position to refuel Package Q's aircraft in the flight to Iraqi airspace.

Beyond the articulation of tanker support, Package Q also depended on a number of airborne platforms to coordinate and control its progress as well as to warn its mission commanders as to the tactical situation in Iraq. AWACS (Airborne Warning and Control System) and ABCCC (Airborne Battlefield Command and Control Centers), specially configured aircraft with complex communications equipment and controllers on board, would coordinate and update as the package marshaled its component parts and then launched them into Iraq. Meanwhile, Compass Call EC-130s would begin jamming the signals from enemy communication centers in Iraq; at the same time AWACS would also provide warnings of enemy aircraft threats, navigational assistance, airspace control, and changes to the tactical mission. In particular, Package Q would depend on AWACS for a coherent evaluation of the emerging enemy air-to-air threats in the theater. Finally, RC-135 Rivet Joint aircraft would monitor the enemy's electronic signals to evaluate how he was reacting to the raid's progress. All these platforms would be airborne and on station to provide support for the strikers as they moved up to and eventually into Iraqi airspace. Their station times in orbits over Saudi territory and their knowledge of the intent and mission responsibility for Package Q would, of course, have been arranged ahead of time in the ATO process.

To get to tanker tracks Railroad and Weasel, Package Q's aircraft would have to leave four different bases at four different times. [See

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[11]The Master Attack Plan called for three such large daylight strikes against targets in the Baghdad area on day three; however the first two were cancelled due to weather, while the third, Package Q did fly. When we get to day three we will discuss the difficulties that this package ran into during the course of its operation in Iraqi territory. Unfortunately the ATO for the third day is not in the GWAPS files. Consequently, while we are describing Package Q, this chapter is forced to discuss the movement up to the Iraqi frontier in general terms. The reconstruction has been accomplished with the help of Lt Col Robert Eskridge and Maj Theron Severance, both of the GWAPS Staff.

[12]Again, the ATO for Day Three does not exist in GWAPS files; as a result, we have reconstructed probable takeoff times and tanker rendezvous times on the basis of known distances and flying times.

Map 13 for a depiction of distances travelled to tanker tracks by the mission packages.] Each tanker track had somewhere between five and eight tankers. The lead tanker would be the low man in the cell; succeeding tankers would stack up (offset to the right) with one mile separation distances and each 500 feet higher in altitude. Mission commanders would plot out the times required to join up with tankers and determine their launch times on that basis. At approximately 1346 the first F-15 began rolling at Tabuk. The fifty-six F-16s from Al Minhad began launching next around 1401; their sister aircraft from Doha lit their after burners later, at 1431. The EF-111s from Taif needed to begin rolling by 1408. Finally, Weasels from Shaikh Isa would not have to take off until 1443. Like a finely tuned watch, mission commanders adjusted their speeds so that aircraft arrived at the tanker tracks on the mark; the ATO had already coordinated call signs, targets for the various missions, and times on target for the segments within Package Q. [For a time line illustrating how the mission was supposed to go, see Figure 1.]

As depicted in Figure 1, aircraft movement to the jump off point seems a relatively easy task. It was, but only because Air Force, Navy, and Marine flight crews had prepared carefully and thoroughly to fly such missions for more than forty years. Practice had created a state of mind in which the operators can and do change and adapt flexibly to actual conditions. All of this carefully planned and organized articulation only involved getting Package Q to the *frontier* with Iraq. We will discuss the actual fate and operational experience of the package in the next chapter.

The Iraqi Strategic Framework

There is little evidence with which to examine Iraqi preparations and conceptions. Even if Iraqi records were available, substantial elements of uncertainty would remain, because so much rested on Saddam's enigmatic mind. Nevertheless, the actions and experiences of the Iraqis in previous wars allow substantial judgments. In the largest sense, it appears probable that Saddam, and therefore his military leaders, never expected war.[13]

[13][DELETED] Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "Analysis of Source Debriefings," JDC Rpt #065, 15 Mar 1991.

The Iraqis appear to have calculated that the Coalition possessed serious fault lines, not only between Western and Arab members, but among the Western partners as well.[14] Saddam's estimation of the United States and its performance in the Vietnam War led to a belief that President Bush would not launch American forces into a conflict.[15] As the Iraqi press noted early in the crisis: "We know that Washington's threats are those of a paper tiger. America is still nursing the disasters from the Vietnam War, and no American official, be it even George Bush would dare to do anything serious against the Arab nation."[16] Even as the buildup of Coalition forces reached ominous proportions in late December, the Iraqis failed to change their fundamental misperceptions of American resolve.[17]

On the strategic level, Saddam aimed at three distinct objectives: 1) to retain Kuwait, 2) to avoid humiliation, if forced from Kuwait, and 3) if forced from Kuwait, to maintain control over the Iraqi Army.[18] If it came to war, he believed that he could achieve substantial gains. This reflected two assumptions: first, that air power could not play a war-winning role, if the Coalition unleashed its forces;[19] and second, that none of the powers in the Coalition–especially the United States–could sustain

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[14]See footnote 66, Chapter 2.

[15]The Soviet diplomat Evgeniy Primakov commented after the war on the basis of his conversations in Iraq both before and during the conflict that "it seems that Saddam Hussein up to the last moment still was operating on [the basis] that the 'multinational forces' would not initiate military operations." Quoted in Norman Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," *The Journal of Strategic Studies*, Mar 1992, p 8.

[16]*Ibid*, p 3.

[17]In the last month before the war, the statements of many American congressmen which received great attention from the media and which both C-Span and CNN broadcast in excruciating detail did nothing to disabuse Saddam of his notion that the Americans would not use force.

[18](S) CIA Brfg, "Iraqi Strategy and Conduct of Operations in the Gulf War," 25 Jun 1992. The SPEAR intelligence analysis done immediately before the war underlined that the survival of the air force and the Republican Guard were essential to the future political stability of the regime. See (S) SPEAR, *Iraqi Threat to U.S. Forces*, p 3-4.

[19]As Saddam noted before the war: "Air power alone will not decide the battle." Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," p 18.

heavy casualties.[20] Underlying both assumptions, influenced by Iraqi experiences against Iran, was a belief that only ground operations could be decisive and that casualties would be high on both sides.

The Iraqis did recognize that in case of war, Coalition air forces would soon dominate the skies over Iraq. However, they believed that their military, industrial, and political infrastructure could absorb any level of punishment that Coalition air power could impose. At the same time, their air defenses would inflict losses on attacking aircraft sufficient to force the Coalition to begin ground operations. The resulting "Mother of All Battles" would lead to such heavy casualties that Iraq would achieve at least a moral victory, if not an actual one.[21]

Such assumptions obviously affected Iraqi preparations. The Iraqi military did recognize that there would be a separate air campaign if war were to come; but they estimated its duration, depending on success of defensive efforts, at no longer than approximately a week.[22] During that time, they estimated that Coalition air attacks could inflict only limited damage on their ground forces and infrastructures. Saddam confidently assessed that the Coalition would then have to attack on the ground and that "the [Iraqi] lads will show themselves and [the attackers] will see them [i.e. the Iraqis] as they raise their heads [still] safe and sound and ready for battle."[23]

The Iraqis never intended to contest for control of the air. They hoped to preserve most of their air assets for use when the ground war started, or even for the postwar period after the war's outcome.[24]

The Iraqis placed a high value on active and passive air defenses to deflect the air campaign. SAM and antiaircraft defenses provided the basis for defense against air attacks; from the Iraqi perspective, these weapons would inflict sufficient attrition on attacking aircraft; equally important

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[20](S) CIA Brfg to GWAPS, 25 Jun 1992.

[21](S) *Ibid.*

[22][DELETED]

[23]Quoted by Cigar, "Iraq's Military Mindset and the Gulf War: Blueprint for Defeat," p 18.

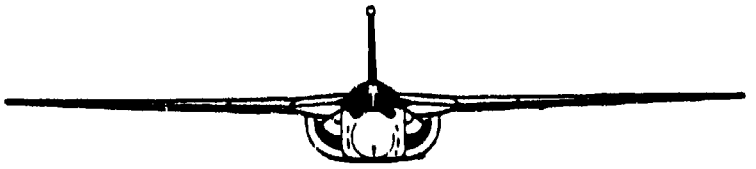
[24]CIA Brfg to GWAPS, 25 Jun 1992.

such defenses would degrade the accuracy of Coalition air strikes.[25] Again, the Iraqi leader seriously underestimated the U.S. capabilities in his comments before the war:

> When powder and smoke rise [from the battlefield], aircraft are forced to approach to within five kilometers in order to see their targets. . . . When they approach to a distance of five, ten, twenty, or thirty kilometers, our weapons are able to shoot them down. They [i.e., the Americans] will [only] be engaging in Rambo stunts [in that case].[26]

As for the threat that stealth aircraft represented, the dictator was equally dismissive: stealth aircraft, he noted, "will be seen by a shepherd in the desert as well as by Iraqi technology, and they [i.e., the Americans] will see how their Stealth falls just like . . . any [other] aggressor aircraft."[27]

On the passive side, the Iraqis carried out massive efforts to protect everything from tanks and ground equipment to nuclear and chemical facilities. They constructed bunkers and berms throughout Iraq and Kuwait. From August to January, Iraqi engineers moved millions of



[25]SPEAR reported before the war that "the limited number of fighters compared with Iraq's large number of SAMs . . . makes the SAM the logical choice as the primary air defense weapon." (S/WN/NC/NF) SPEAR, *Iraqi Threat to U.S. Forces* , p 3-51.

[26]Quoted in Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," p 19.

[27]*Ibid*, p 19.

tons of dirt; those efforts paid considerable dividends.[28] Moreover, the Iraqis removed much of the equipment from research facilities in the period before the war; how much still remains uncertain, but UN inspections suggest that the dispersal effort was quite considerable.[29]

Scud missile recovered by an explosive ordnance disposal team.

Finally, there was an offensive element to Iraqi strategy: the Scuds. Here, Saddam hoped to intimidate the Saudis by hitting targets throughout the Arabian Peninsula. More importantly, he calculated that he could involve the Israelis in the war by firing Scuds at the Holy Land. Any Israeli countermoves, involving attacks on Iraqi soil, would, he believed,

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[28][DELETED]

[29]See particularly David Kay, "Arms Inspections in Iraq: Lessons for Arms Control," unpublished paper, 12 Aug 1992, GWAPS, NA 375.

break up the Coalition.[30] Many senior leaders in Washington certainly felt so, and the pressure to find the Scuds would continue to absorb Coalition air assets throughout the war. In the end, Saddam's strategy depended on his military organizations imposing heavy enough losses on the Coalition both in the air and on the ground for Iraq to emerge with its prestige intact. If he achieved even the semblance of a stalemate with the Coalition, Iraq would achieve enormous political dividends in the Arab world.

The First Night

(S) U.S. Central Command stated the following as its theater objectives for Operation Desert Storm:

1. Attack Iraqi political/military leadership and command and control.
2. Gain and maintain air superiority.
3. Cut Iraqi supply lines.
4. Destroy Iraqi supply lines.
5. Destroy Republican Guard Forces.
6. Liberate Kuwait City with Arab forces.[31]

The achievement of these objectives was to involve a three-phased air campaign. It would lead to a ground offensive to complete destruction of Iraqi military forces in the KTO.[32] In fact, these three air phases began concurrently and continued right to the end of the war. Only the relative weight of effort involved in each changed.

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[30]One staff officer in Riyadh recounted that when word first came in the control room where he was present that a Scud had impacted on Israel, the Saudi officers cheered.

[31](S) Headquarters US Central Command, "Combined OPLAN for Offensive Operations to Eject Iraqi Forces from Kuwait," was issued to all Coalition forces. It used slightly different language than that quoted above for reasons discussed in the Effectiveness report of this study. The Operational Order, quoted above, was issued to US forces only: HQUSCENTCOM, OPORD 91-001, paras. 1D, 3A, 3B, GWAPS, CHC 18-1. See Also Title V pg 74.

[32](S) *Ibid.*

Iraqi Military Headquarters in Kuwait City destroyed by Coalition bombing.

But underlying the planning for the air campaign was a belief that Coalition air power needed to achieve air supremacy early in the war. To do so it had to suppress Iraqi air defenses to the point where Coalition aircraft could accomplish their missions in a relatively benign environment. Consequently, the destruction of Iraqi air defenses would be essential to the success of the air campaign over succeeding weeks. Four individuals, Lieutenant General Horner and Brigadier Generals Larry Henry and Buster Glosson, and Colonel Deptula, supported by planners and electronic warfare experts, designed a SEAD campaign that eviscerated Iraqi air defenses.

At the same time that Checkmate had begun their design for Instant Thunder, Gen. Robert Russ, Commander of Tactical Air Command ordered his Inspector General, General Henry, to fly to Saudi Arabia and support CENTAF. Henry, a backseater in the F-4, had a career in which he commanded both an F-4E squadron and then a wing of F-4G Wild Weasels. While a student at National War College in 1982, he had carefully studied the tactics that the Israelis had used in the Beka'a Valley to deceive and then destroy the complex air defense system that the

Syrians had established with the help of Soviet advisers.[33] With this background, many in the Air Force regarded Henry as one of the premier SEAD experts in the tactical air forces. The problem with regard to the Iraqi air defenses as opposed to those of the Syrians on the Beka'a Valley was that Saddam's defenses represented an order of magnitude increase in their complexity, extent, and numbers, as well as the distances over which the Coalition would conduct the air campaign.

Henry had worked with Horner on previous exercises; in particular, they had looked at the problem of how one might disrupt a Soviet invasion of northern Iran by attacking Soviet command and control systems. The actual problem in the Middle East in mid-August was, of course, quite different. CENTCOM confronted the possibility of an Iraqi invasion of Saudi Arabia from Kuwait, and Iraqi forces not only held the airfields, but a large number of mobile SAM systems (SA-6s). In the event of an invasion, they would naturally move these systems forward to cover advancing spearheads.[34]

[DELETED] HARMs were weapons that homed in on the various signals and signatures that enemy radars emitted. By striking the emitters they would at a minimum destroy the capacity to track targets and control SAMs; in many cases where the emitter and the SAM site were coterminous the HARM would eliminate both. None of the planners believed that the Iraqis could put up much of a defense once their command and control system collapsed. With destruction of the air defense system, Coalition air power could concentrate on Iraqi armored units in the open. In addition, they also estimated that Iraqi fighters would not interfere significantly with Coalition air attacks due to the superiority of allied crews and tactics.[35]

Here Warden's efforts in the Pentagon paid considerable dividends. The Instant Thunder briefing makes clear that the Checkmate conception provided for a mass SEAD attack on Baghdad at the opening of the campaign–one that would mislead the Iraqis into believing that the

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[33]Intvw, Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992.

[34]*Ibid.*

[35]"Electronic Combat in Desert Shield/Desert Storm," Brfg by Brig Gen Larry Henry, CENTAF/EC, post war, GWAPS NA 358. Also intvw, Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992.

Coalition was beginning the war with a major raid on the capital. But the principal weapon for the attack would be HARMs that would attack the radar sites. The Checkmate briefings by Warden may not have received a warm reception from Horner, but they did receive considerable attention from Glosson and Henry.[36]

These influences eventually formed the basis for the SEAD effort that Coalition air forces used against the Iraqis with such devastating effect in January.[37] The final result was a plan that attacked the heart of Iraqi defenses; it aimed to break the connections between nodes in the KARI system and to swamp the defenses. From the first, Coalition air attacks would place constant, relentless offensive pressure on the Iraqis; they would overload enemy defenses to the maximum extent. And they would attack Iraqi air defenses from the inside out--in other words incapacitate the center where the Iraqis made their decisions. Above all, the initial waves would overload the Iraqi system with a massive attack at its heart. There would be no roll back or incremental approach; confronted with a massive attack at the war's onset, the Iraqis would have no time to adapt to Coalition tactics and attacks.[38]

With the command and control system breaking down, Iraqi defenders would have to operate in an autonomous mode–one in which they had had little preparation to handle. The underlying principle of the SEAD plan was to attack KARI as a whole. It would not be necessary to kill all the SAM sites; it would be enough, if the Coalition SEAD assets intimidated the Iraqis to the point that those running SAM sites would refrain from turning radar on.[39] Finally, the plan to suppress enemy air defenses aimed to defeat the SAM threat, so that allied aircraft could operate at medium altitudes which would minimize the threat posed by Iraqi AAA.[40]

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[36]Instant Thunder Brief, "Campaign Flow," 16 Aug 90/2000.

[37]Intvw, Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992.

[38]*Ibid.*

[39]As Gen Henry put it to the GWAPS interviewers, "we wanted every Iraqi SAM site to know that if they kept their radar on long enough to acquire, track, launch, and guide a missile into an allied aircraft, they were definitely going to pay with a HARM down their throat." Intvw, Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992.

[40]In World War II the most serious threat at low altitudes proved to be AAA and Allied fighters that beat up well protected German airfields suffered appalling losses.

In effect, the planners looked to maximize the inherent inefficiencies and frictions within KARI. They believed that the Iraqis could not operate effectively without centralized direction; once the system began to break down at the center, it would no longer function at all. As Henry noted after the war, the SEAD campaign aimed to throw sand into the Iraqi gear box.[41]

Coalition air operations before initiation of hostilities set the Iraqis up for what was coming; these operations also indicated to Coalition air commanders the weaknesses within the Iraqi defenses. Early on, Glosson and Henry recognized a significant electronic and command and control gap between western and central sectors in Iraqi air defenses; Coalition air power would utilize this gap throughout the war. [DELETED].[42]

Over the five and a half months of peace, electronic monitoring also determined the pattern and nature of Iraqi defensive operations. Allied planners deliberately chose H-hour as 0300L (3:00 a.m. local or Riyadh time) on the morning of 17 January because it was at that time that Iraqi defenses were weakest.[43] Finally, over this period, the Coalition gradually built up the number of sorties flying close to the border with Iraq. Consequently, the Iraqis became accustomed to armadas of aircraft–F-15s on CAP (combat air patrol), AWACS, tanker tracks, and assorted other aircraft moving in and out of training areas located immediately south of their border with Saudi Arabia.[44]

American preparations resulted in a carefully prepared script for the first two days. They also involved a carefully laid out deception effort. With similar air operations occurring across the length of the Saudi-Iraqi frontier day in and day out, enemy controllers became familiar with similar patterns. The Iraqis would see little difference over the night of 16-17 January, until the full weight of Coalition air power fell on their defenses.

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[41]Intvw, Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992. See also intvw, Maj Gen Buster Glosson with GWAPS personnel, 9 Apr 1992.

[42]*Ibid*

[43]This account will use local Saudi time on all occasions, unless otherwise specified.

[44]*Ibid*. Gen Henry in his post war briefing on the SEAD planning referred to this area directly south of the border as the "junkyard." Brig Gen Larry Henry, CENTAF/EC, "Electronic Combat in Desert Shield/Desert Storm," GWAPS, NA 358.

On the day before Desert Storm, Coalition forces displayed no change in the intensity of operations; F-16s did substitute for F-15s on combat air patrol missions, so that the latter could gain down time in the hours immediately before war. [DELETED]. The pattern of activity in the last minutes of peace was sufficiently familiar to mislead Iraqi controllers. The enemy failed to react until the initial strikes had commenced.

In the last hours before war, the mood among senior leaders was one of cautious optimism. Senior American airmen were veterans of the mishappened air campaigns against North Vietnam; to them, the preparations in the Gulf at the tactical and operational levels were significantly different from that conflict. At the strategic level, the Coalition possessed clear goals that appeared attainable. Nevertheless, these men remembered the terror, confusion, and uncertainties reminiscent of Southeast Asia, and they knew the terrible environment into which they were committing their forces.

In the early morning of 17 January, F-4G Weasels of the 35th Tactical Fighter Wing (P) taxied out onto the active runway. At the end of the taxiway, maintenance crews had set up a spotlight and an American flag. One crew member recalled: "I didn't see it [the flag] when I stepped out of the van. When I got to the jet I saw the light shining on it. That brought chills down my spine. It really meant something that we were Americans and were fighting for America."[45]

At 0239, twenty-one minutes before H-hour, Army Apache helicopters, led by three Air Force MH-53s, attacked two Iraqi early warning sites up on the frontier.[46] This first mission opened a corridor for several packages of aircraft with early missions. [See Maps 14 and 15 for depictions of the flow of allied air operations during the first night.] A package of F-15Es, a four ship in the lead, moved through the gap to attack Scud sites in western Iraq; two EF-111s supported that strike by jamming Iraqi radars. Another eighteen F-15Es followed to attack other fixed and mobile Scud launchers. Along with the first package, the EF-111s moved forward to provide jamming for the attackers on the Scud sites; they were

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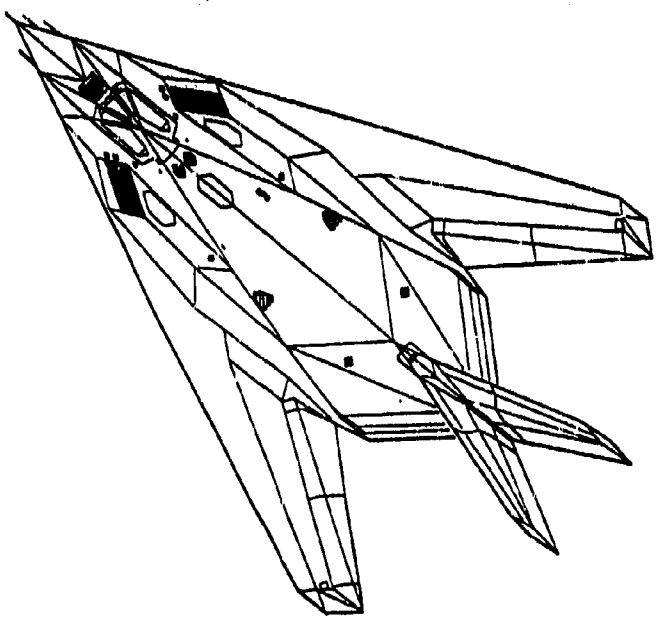
[45]Starr, "Special Study: History of the 35th Fighter Wing (Provisional): Operations Desert Shield and Desert Storm, 2 Aug 1990–2 Aug 1991," GWAPS NA 277, p 151.

[46]This appears to have been the only time that army air assets actually were included in the Master Attack Plans or the ATO.

later supposed to jam into the Baghdad area; in fact they never did support the first stealth strikes on the enemy's capital.[47]

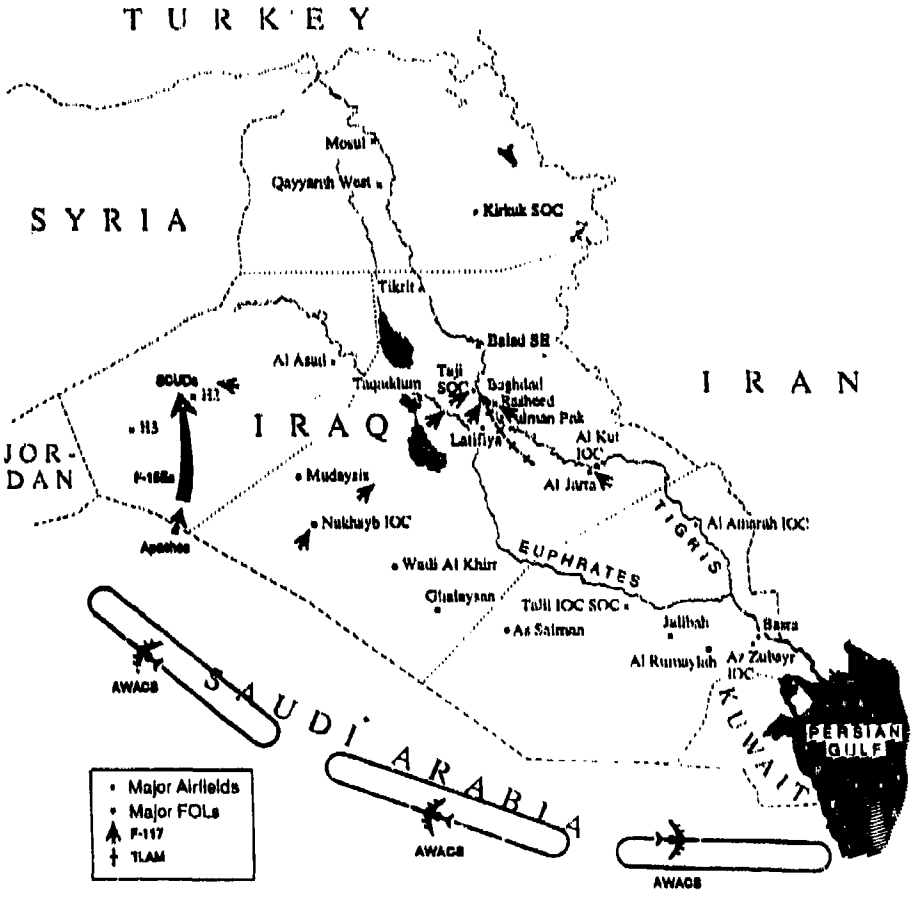
U.S. air power was already deep in Iraq as these opening moves by conventional aircraft occurred. Two F-117s had already crossed the frontier and were on their way to Baghdad when the early warning sites came under attack from the Apaches at 0239. Six more F-117s crossed the border shortly thereafter. By the time that the EF-111s were to have turned on their jammers (0258) at Baghdad, the first F-117s would already be within range of acquisition and targeting radars from the capital's redundant SAM defenses, as well as within the lethal range of the missiles themselves.[48]



[47](S) Master Attack Plan, "First 24 Hours;" GWAPS Database; and (S) Reconstruction of aircraft mission profiles by AFSAA (Air Force Studies and Analysis), GWAPS.

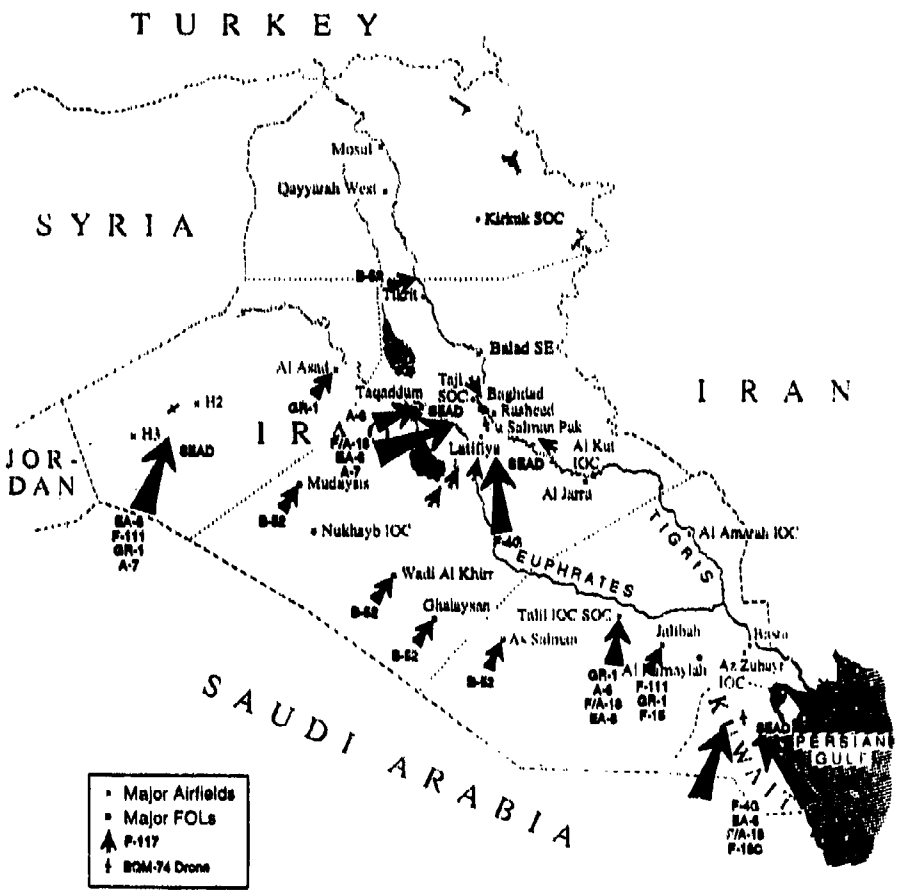
[48](S) *Ibid.*

Map 14
Day One [H-21(0239) to H+20(0320)]



The first F-117 attack came at 0251 with a bomb on the Nukhayb Intercept Operations Center; Nukhayb was the central reporting node with the best chance of detecting the F-15Es. Moreover, it was best positioned to coordinate Iraqi defensive efforts against succeeding allied SEAD at-

Map 15
Day One (0320 to 0430)



tacks.[49] Ironically, in view of the controversy that erupted after the war,[50] the EF-111s never provided jamming into the Baghdad area during the first strikes, so that the F-117s that attacked the first targets in the capital,

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[49](S) Master Attack Plan, "First 24 Hours;" GWAPS Database.

[50]For reports that indicate the F-117 did not operate without jamming support see: Bruce D. Nordwall, "Electronic Warfare Played Greater Role in Desert Storm than any Conflict," *Aviation Week & Space Technology*, 22 Apr 1991; and Michael A. Dornheim, "F-117A Pilots Conducted Precision Bombing in High Threat Environment," *Aviation Week & Space Technology*, 22 Apr 1991.

including the AT&T Building and the Telecommunications Center flew into, over, and through the heart of the fully operating air defenses of Baghdad with no support from electronic countermeasures.[51] As American television made clear with stunning clarity, the first F-117s hit their targets, and telephone and television communications between Baghdad and the outside world thereupon ceased.

Within five minutes, six more F-117s struck at the Baghdad air force headquarters (targeted twice), the Air Defense Operating Center (ADOC), the presidential palace, the AT&T Building (a second time), the Tallil Sector Operations Center (SOC), and the Salman Pak Intercept Operations Center (IOC). These aircraft had also been in Iraqi airspace before the first strike on the early warning sites.[52]

Meanwhile, the U.S. Navy had launched fifty-two TLAMs (Tactical Land Attack Missile–Tomahawks) against leadership, chemical, and electrical power targets in and around Baghdad; their time on targets (TOTs) ranged between 0306 and 0311.[53] The Master Attack Plan placed twelve Tomahawks against electrical generating sites, six against the Ba°th Party headquarters, eight against the presidential palace, and twenty against a variety of chemical facilities at Taji. The timing of the missile attacks, shortly after H-hour, reflected the fact that the Navy could not estimate the arrival of these weapons at their targets exactly due to factors such as wind. Nevertheless, almost concurrently with the first wave of F-117 attacks, the Tomahawks began hitting their targets around Baghdad.[54] The results were widespread system shut downs in the electric grid.[55] Where Iraqi power went down, the results forced the affected units–including crucial command and control centers–to rely on less satisfactory back up power.

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[51](S) Master Attack Plan, "First 24 Hours," GWAPS Database; (S) reconstruction of aircraft mission profiles by AFSAA (Air Force Studies and Analysis), GWAPS; intvw, Lt Col David Deptula with GWAPS personnel, 20 Dec 1992; and GWAPS Database

[52](S) Master Attack Plan, "First 24 Hours;" GWAPS Database.

[53](S) Master Attack Plan, "First 24 Hours;" GWAPS Database.

[54](S) Master Attack Plan, "First 24 Hours;" (S) reconstruction of aircraft profiles by AFSAA; Harold P. Myers, "Nighthawks over Iraq: A Chronology of the F-117A Stealth Fighter in Operations Desert Shield and Desert Storm," Special Study 37FW/HO-91-1.

[55][DELETED]

As the first F-117s withdrew, their missions completed, F-15Es and EF-111s approached their targets, while F-15Cs and F-14s moved up ready to pick off any Iraqi fighters that enemy controllers had scrambled. The enemy aircraft that scrambled were not only scarce but badly prepared for the arena of air-to-air combat. According to post-flight review of F-15E infrared imagery, one MiG-23 crossed over in front of a MiG-29 and was shot down by his comrade. A MiG-29 also flew into the ground--hardly an auspicious beginning while the F-15Es were approaching H-2 and H-3.[56]

At approximately the same time that the F-15Es were beginning their strikes on the Scud sites at H-2 and H-3, other Iraqi fighters launched. AWACS picked up bandits moving south in the general direction of the F-15Es as two flights (Penzoil and Citgo) were refueling. The lead pair in Penzoil swept forward at .95 mach at 30,000 feet. As the flight neared the forward operating location at Mudaysis, the first group of bandits turned back north almost immediately to land again. However, another aircraft, soon identified as a MiG-29, made its appearance thirty miles to the north at 11,000 feet and climbing. AWACS called possible multiple aircraft, but there was no individual breakout at final lock-on which occurred at twenty to twenty-two nautical miles. Finally, certain that the target was a "bandit," the F-15 fired his AIM-7M at sixteen miles. After firing, the lead F-15 executed a hard turn to the east as the missile impacted the MiG-29. The Iraqi pilot apparently undertook no evasive action but continued to climb straight into the missile.[57]

Citgo flight by now had dropped off the tankers and was rapidly moving up into Iraqi airspace. As it approached Mudaysis, it picked up two trailing groups of Iraqi fighters tracking F-15Es coming off their targets. Because it was approaching midnight (Zulu or Greenwich mean time) and the IFF (Identification Friend or Foe) were due for change, the F-15s were unsure whether or not the tracking group consisted of Iraqi aircraft. However, the fighters then turned north (still out of range); but another group of Iraqi aircraft now climbed out of Mudaysis airfield.

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[56]"4th Tactical Fighter Wing in Southwest Asia," Aug 1990-Jun 1991, Unit History, 12 Nov 1991, GWAPS NA 168, p 44; "Tim Bennett's War," *Air Force Magazine*, Jan 1993, p 36.

[57]Abstracted from (S) "Desert Storm Air-to-Air Engagements, 33d Fighter Wing Air-to-Air Engagements, Desert Storm," 3 Mar 1992, pp 1-11.

One of the aircraft (later identified as a Mirage F-1) failed to turn on his radar until the last minute. At 8.5 nautical miles, seconds after the Iraqi pilot had turned on his radar, Citgo's flight lead fired an AIM-7M. Seconds later, the missile hit and resulted in a large fireball, followed shortly thereafter by a second fireball as the wreckage impacted on the ground. The remaining Iraqi fighters flew to the west and the comparative safety of H2/H3 airfields underneath their SAM coverage. Citgo flight then turned back rather than hazard a flight into the SAM belt.[58]

By now, fifteen minutes after H-hour, the Iraqis knew that they were under attack. In fact, they had known that something was going on from the strike against early warning sites near the border at 0239; shortly before Hellfire missiles from the Apaches had struck the radar sites, one station managed to get out word that it was under attack. Antiaircraft defenses around Baghdad then opened up with a furious barrage against what their radar screens showed as an empty sky. The enemy fire subsided until the F-117 bombs brought the Iraqis back up to a frenzy of wild firing around 0300. By 0315 (Riyadh time), the air force headquarters, the Air Defense Operations Center, the Tallil and Taji Sector Centers, communications centers, and electrical plants had all come under attack from F-117s and Tomahawks. In some areas, power was already out.[59]

At this point, the full weight of U.S. SEAD forces attacked the Baghdad area to break the capabilities and the morale of the defenders. [For the attacks on Baghdad during the first hour see Maps 16, 17, and 18] The intent behind the SEAD attack was that the opening F-117 and Tomahawk missile attacks would disrupt enemy defenses, but at the same time bring the air defenses up to full alert and readiness to engage attackers.[60] The planners also believed that General Michael Dugan's Septem-

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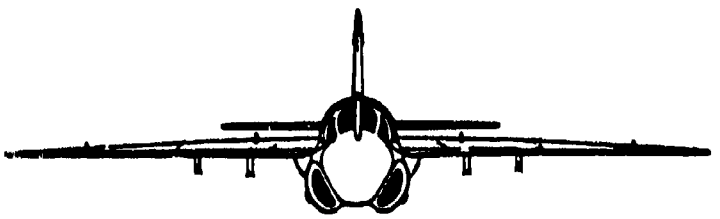
[58](S) *Ibid.*

[59]*Ibid*

[60]The crucial point is that the staff of a SOC or IOC that had received a direct hit from a GBU-27--even if the weapon had not managed to penetrate the hardened concrete--would have received a severe shock that would hardly have made them capable of operating at full efficiency, especially if they had come under attack when none of their radars indicated that there were allied aircraft in the neighborhood. The Tallil SOC received three hits from F-117s in the first two days of the war; post war inspection by DIA/DNA when the airfield fell into American hands at the end of the war revealed that the Iraqis could have continued to use the facility. The intelligence at the time suggested to both Checkmate and Black Hole planners that the Iraqis had abandoned using it,

ber remarks--which had resulted in his removal from office--would lead the Iraqis to expect an all-out attack on downtown Baghdad.[61] Soon after the F-117 and Tomahawk attacks on Baghdad, Iraqi early warning radars showed Coalition aircraft massing south of the border for just such a raid.

In fact it was nothing of the sort. Two large SEAD packages were now moving forward into Iraqi airspace. From the west, three EA-6B jammers accompanied by three F-14 top cover, ten F/A-18, two A-6, and eight A-7 HARM shooters, and three KA-6 tankers flew in from carriers in the Red Sea; they would attack Baghdad's defenses from the west. In addition, slightly behind the western package, four A-6 bombers and four RAF GR-1 Tornados would strike Al Taqaddum airfield; the effort would receive cover from four additional A-6s with TALD (Tactical Air Launched Decoy) decoys to further confuse Iraqi defenders.[62] In the south, twelve F-4G Weasels were flying north against Baghdad's southern defenses. Along with the Weasels, EF-111s would jam the Iraqi radars to further the confusion. [DELETED][63] Finally, backing up later packages were EC-130 Compass Call aircraft that also jammed Iraqi communications from orbits just inside Saudi Arabia.[64]



largely because of the threat of further Coalition air attacks. Discussion with Lt Col Allan W. Howey, 12 Jul 1992.

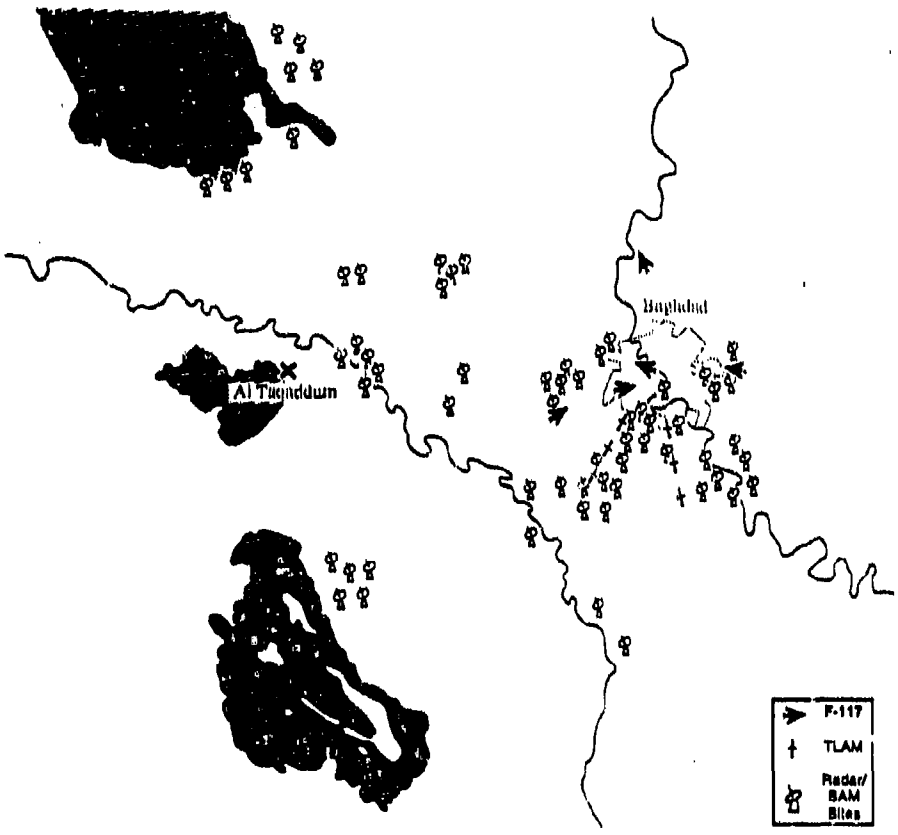
[61]See particularly, Intvw, Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992; see also Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992.

[62](S) Master Attack Plan, "The First 24 Hours," 16 Jan 1991, GWAPS Database; and Center for Naval Analysis, "Desert Storm Reconstruction Report," Vol. VIII, "C^3/Space and Electronic Warfare," p 3-3; and GWAPS Database.

[63](S) Master Attack Plan, "The First 24 Hours," 16 Jan 1991, GWAPS BH 1-3-1; and GWAPS Database.

[64]AFEWC, "Operation Desert Storm Electronic Combat Effectiveness Analysis," Jan 1992, p 9-15.

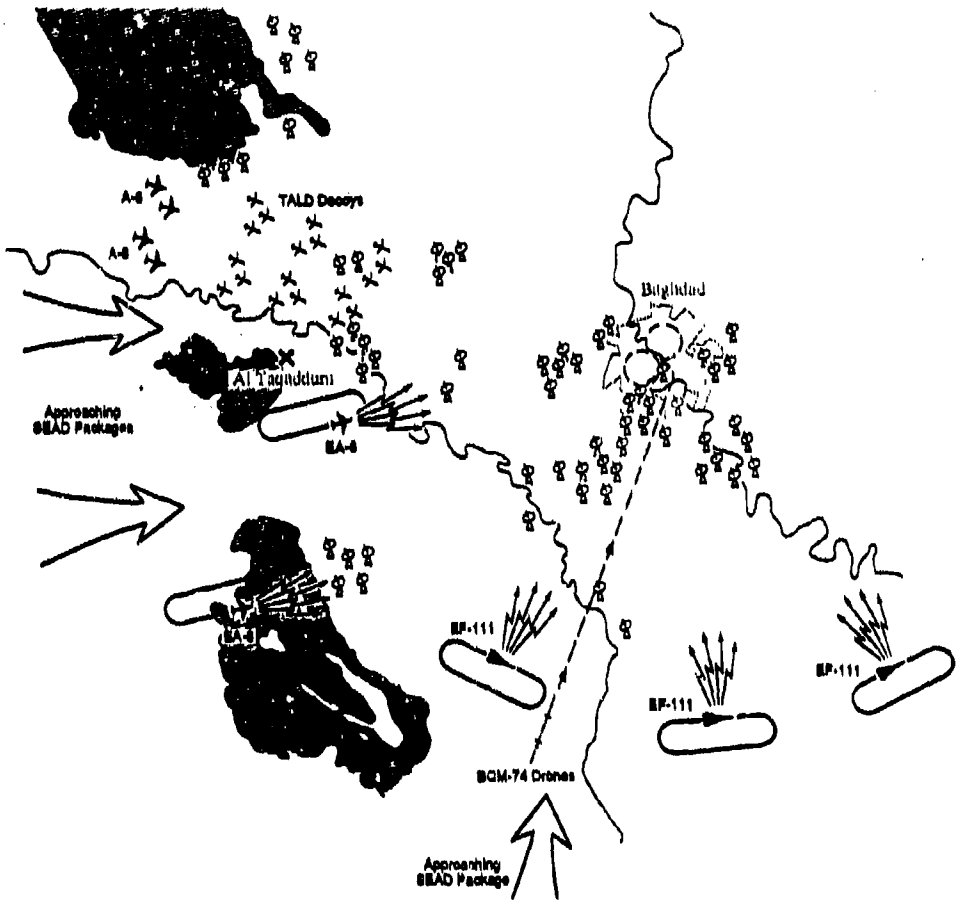
Map 16
Day One (0300 to 0310)



[DELETED].[65] At approximately the same time that the first BQM-74s reached the capital, the A-6s were each close enough to drop the

[65](S/WN/NF) Air Force Intelligence Command, Air Force Electronic Warfare Center, " Operation Desert Storm, Electronic Combat (EC) Effectiveness Analysis," p 11-2.

Map 17
Day One (0346)



Navy's air-launched decoy, the TALDs.[66] [DELETED].[67] In all, the Navy SEAD strikes against Baghdad and Al Taqaddum dropped twenty-five decoys within the space of twenty minutes.[68]

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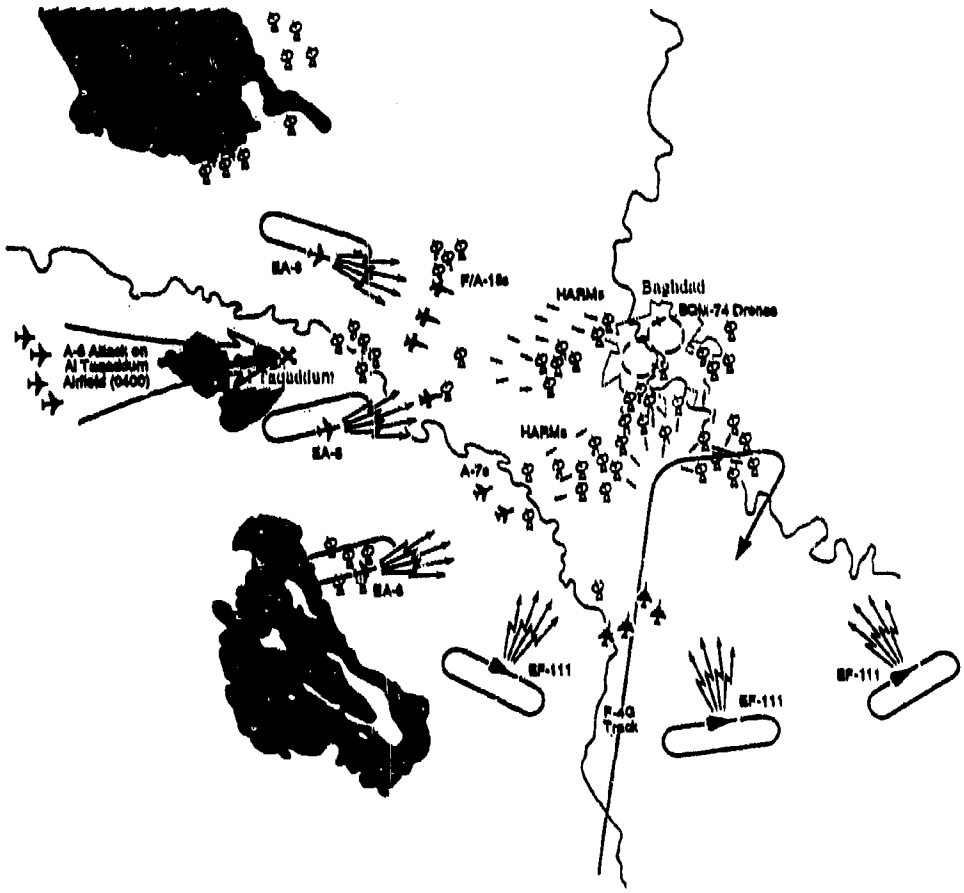
[66](S) Center for Naval Analysis, "Desert Storm Reconstruction Report," Vol. VIII, p 3-8.

[67]Brunswick Defense, "Specifications for TALD."

[68]Center for Naval Analysis, "Desert Storm Reconstruction Report," Vol. VIII, "C³/Space and Electronic Warfare," p 3-9.

Map 18
Day One (0348 to 0355)



The combination of BQM-74s and TALDs further increased the numbers on their radar screens that Iraqis were seeing.[69] At the same time, the jammers forced radar sites to up their power to handle the electronic jamming. Up to the arrival of the drones over Baghdad and the appearance of TALDs, Iraqi radar activity had been sporadic. Most

[69]The large number of aircraft that the Iraqis claimed on the next several days to have shot down, undoubtedly reflected their success against air force drones and navy decoys.

emitters had been blinking–turning their radars on and off and thus providing no consistent source. "Once the drones started to orbit over Baghdad, the Iraqi target acquisition/tracker/fire control radar activity not only became steady, but increased. . . .[P]ost-attack analysis confirmed that Iraqi 'lethal' activity increased dramatically in the immediate area of the drones."[70]

Tactical Air Launched Decoys (TALD) and drones were used to deceive Iraqi radar during initial strikes on Baghdad.

[70]Message from AFEWC, Kelly AFB, 182100Z Sep 1991, Subj: "Constant Light Report No. 11–Air Force Unmanned Aerial Vehicle (UAV) Effectiveness," GWAPS CH3, 3-4A. Interestingly, Col Warden had apparently alerted Glosson and Henry about the possibility of using drones: Message 080103Z Sep 1990, HQ USAF Washington, DC, same GWAPS folder.

All of this activity had precisely the result that the planners had hoped.[71] At this point, the HARM shooters began to fire. F/A-18s and A-7s from the Navy SEAD package fired forty-five HARMs in their prebriefed mode–at targets already designated as known SAM sites–and six more at targets of opportunity. The F-4Gs, however, possessed the capability of identifying active SAM sites from the air; consequently, their backseater Electronic Warfare Officers (EWOs) could mark active sites from the aircraft's equipment and then fire at the site by programming the HARM on board the aircraft.

The SEAD package of F-4Gs headed straight for Baghdad, and then just short of the capital swung northeast. As the aircraft did so, the EWOs picked sites that intelligence had identified.[72] If those sites were not operating, they then went after targets of opportunity. The Weasel wing reported:

> The WILD WEASELs picked up SAM activity 100 NM from Baghdad. At 0037Z SA-8s, radar AAA, and I-HAWK came up. From 0048Z on, the activity was very heavy. The WILD WEASELs had radar contacts on the drones. We did not observe any hits on the drones by Iraqi air defense. The 35th TFW felt the drones were highly effective in stimulating the threats. This provided a "target rich" environment for the WEASELs.[73]

In all, the southern strike of Air Force Weasels fired twenty-two HARMs with ten shots assessed as successful (a 46 percent success rate).[74] Overall, there is no exact evidence as to the damage done to the Iraqi air defenses by the first strike; there were, however, significant numbers of

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[71]After the war a major NATO Conference in Belgium assessed the contribution of SEAD to the Gulf War in the following terms: "The Joint SEAD campaign and SEAD support of the Gulf War will long be remembered as an outstanding success. The role played by EC assets, and in particular the EC-130 Compass Call, was critical to that success." (S) AAFCETLP Gulf War Conference Report, 1730.13.7/AFOOAT/S-078/92, 20 Feb 1992 NATO.

[72]Starr, "Special Study, History of the 35th Tactical Fighter Wing (Provisional): Operations Desert Shield and Desert Storm," p 148.

[73]Air Force Intelligence Command, Air Force Electronic Warfare Center, "Operation Desert Storm, Electronic Combat (EC) Effectiveness Analysis," January 1992, p 11-9. The Hawks were US surface-to-air missiles possessed by the Kuwaitis; they and their supporting systems had been taken over by the Iraqis.

[74]*Ibid*, p 11-9.

radars that ceased operating when incoming HARMs would have impacted. While the Baghdad SEAD strike went in, two other similar SEAD packages, also supported by drones and decoys to stimulate the defenses, struck the enemy defenses in the west–near Scud bases–and in the east around Kuwait City and Basra. These attacks achieved similar levels of success against the Iraqi defense system.

Evidence indicates that the tactic of using drones to stimulate the defenses achieved its aim. Over their operating period on the first night, there was a 22-percent rise in active lethal radars seeking to acquire targets. Moreover, the correlation between F-4G HARM firings and the cessation of activity by radar sites suggests that 45 percent of the HARMs fired by Weasels caused the targeted emitters to go off the air.[75] Data for the Navy SEAD packages is less clear.[76] Nevertheless, there is no reason to believe that the Navy's strikes were any less successful in achieving the desired functional effect. The crucial point is that Weasel and Navy SEAD attacks intimidated Iraqi air defenses and operators beyond the mere destruction of individual SAM sites. As the wing commander of the F-4Gs noted:

> The key is that very early on while the F-15s maintained air superiority, the weasels maintained suppression of enemy air defense[s] as far as I am concerned, because they beat them down quickly, efficiently and the enemy knew if he turned his radar on, he'd be dead. As a result of that, they are not turning their radars on. If they do anything, they are blinking them off and on just to be able to say they are doing it and to maybe get some cuts on where the strikers are coming in. They're firing their missiles off ballistically. For the most part they are completely ineffective, and I hold that almost exclusively at the value of the suppression of the enemy air defenses during that first week.[77]

concurrently with SEAD attacks on Baghdad, the next wave of F-117s hit Sector and Intercept Operations Centers (in some cases again), com-

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[75](S/NF) Institute for Defense Analysis, "Desert Shield/Desert Storm, Suppression of Enemy Air Defenses," Phase I Report, IDA Document D-1076, p I-3.

[76]By and large in the first several days the Navy fired its HARMs at pre-briefed targets in a preemptive mode. It is much harder to correlate preemptive firings with specific emitters going off the air.

[77]Starr, "Special Study: History of the 35th Tactical Fighter Wing (Provisional): Operations Desert Shield and Desert Storm," p 179.

mand and control centers, and leadership targets.[78] Like the first wave, this one also had a high rate of mission success with pilots reporting ten hits out of sixteen bombs dropped.[79] The targets also involved a significant number of command and control nodes in the air defense system.

While we do not have a detailed picture of what was happening within the Iraqi system, there was clearly considerable confusion and misinformation; undoubtedly, the Iraqis found it difficult to grasp what exactly had happened over the past several hours.[80] To add to their confusion, the second F-117 strike came immediately after what had seemed to be a massive strike against Baghdad- one that had only fired missiles at SAM sites; the drones had dropped no bombs, and now with no apparent aircraft overhead, bombs were once again falling on the KARI's control centers.

Unfortunately, because of bad weather over their targets, the third wave of F-117s on the first night had less success; its pilots reported only five hits out of sixteen bombs dropped. For the short run, its misses were less important because the targets were mostly chemical and biological bunkers.[81] But the cause of the misses, bad weather obscuring the targets, presaged the weather problems that plagued the unfolding of the strategic campaign. At the same time that the F-117s attacked the chemical/ biological bunkers, four F-111Fs struck the bunkers at Salman Pak. Again, not as many bunkers were damaged as had been planned.

While SEAD packages beat up the air defenses around Baghdad, B-52s and British GR-1 Tornados struck at the forward operating bases located

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[78](S) Master Attack Plan, "The First 24 Hours," 16 Jan 1991; GWAPS Missions Database.

[79]SMSgt Harold P. Myers, "Nighthawks over Iraq: A Chronology of the F-117A Stealth Fighter in Operations Desert Shield and Desert Storm," p 8.

[80]An indication of this is the extraordinarily high number of aircraft that the Iraqis claimed their defenses had shot down in the first night's action, some of which were probably drones (TALDs and BQM-74s).

[81]Myers, "Nighthawks over Iraq: A Chronology of the F-117A Stealth Fighter in Operations Desert Shield and Desert Storm," p 9. The hour chosen was one in which the breaking of these bunkers, if they contained anthrax spores, would do the least damage to the surrounding population.

near the Saudi frontier.[82] The fear here was that the Iraqis might move their fighter aircraft forward and then launch a strike against an AWACS or tanker, thereby disrupting the flow of operations. On the next morning, bomb damage assessment (BDA) provided mixed evidence regarding how much physical damage these strikes had inflicted.[83] Nevertheless, they achieved their larger purpose because the Iraqis never again attempted to use the forward operating locations.

During the course of the night, a number of other missions went after Iraqi airfields, while Coalition fighter aircraft covered the movement of allied aircraft into and out of the country. RAF GR-1 Tornados employed JP233 scatterable mines and cratering bomblets to restrict Iraqi use of several critical airfields. JP233 required the Tornados to overfly the targeted runways and taxiways at extremely low altitudes and maintain straight-and-level flight while the submunitions were being dispensed. One RAF pilot remembered his mission during the first night in the following terms:

> We flew our familiar parallel track formation at 200 ft auto TF with pairs at two-four miles width and forty seconds between following aircraft, to allow freedom of movement for any aircraft that might be threatened en-route. At about forty miles from the target I commented to my backseater on the heavy AAA in the two o'clock when we turned at point J where we changed from parallel track to twenty second trail and since Jane's, All The World Fireworks Displays, was now in the twelve o'clock, it became apparent to both of us that the AAA was, in fact, emanating from our target . . . deep joy! We got speed up above 500 kts and I took the auto pilot out and manually TFR'd whilst I watched the bomblets of the front four-ship explode from right to left in front of me in amongst the firework display. Thirty seconds later we then attacked at about 520 kts and 180 ft radar altitude, through what seemed to be a solid red and white wall of tracer. My backseater confessed to me later that, rather than look out at the tracers, he chose to concentrate very hard on his radar display upon which the double wire airfield perimeter fence, common to all Iraqi airfields, stood out like the proverbial dog's balls and made a superb aiming offset. It was

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[82](S) Master Attack Plan, "First 24 Hours," 16 Jan 1991.

[83]Capt William Bruner, who was in the Black Hole at the time, felt these strikes had largely failed in a physical sense (conversation, 8 Apr 1992). Lt Col Richard King, who was involved in BDA (bomb-damage assessment) in Washington DC, recalls that runways at several bases were cratered (written annotations to draft of this chapter, Feb 1993).

> obvious that the US formations that had attacked before us had stimulated the defenses into action. The barrage was fully developed by the time we arrived eight minutes after the first bomb drop. None of it seemed aimed at us since it was all pointed more or less vertically upwards but it was nevertheless a fearsome sight. We heaved a great sigh of relief when all the aircraft checked in off target.[84]

For the first night, the RAF lost no aircraft despite their extreme exposure to enemy flak with their low level mission profiles.

As soon as the conventional force packages began moving into Iraq, F-15Cs and F-14s had established CAPs near the airfields that represented particularly serious threats to the attackers. The planners' belief was that if Coalition air superiority fighters struck hard and fast at Iraqi aircraft attempting to launch, they would deter the enemy from even flying.[85] The conception proved correct; shoot downs of Iraqi aircraft in the immediate vicinity of their own airfields did not encourage others to fly.[86]

In almost every respect, the first night's work represented an enormous success. A crucial indicator was the fact that when it was over, Coalition air forces had lost only a single F/A-18 in the SEAD package against Baghdad. At the time, it was believed that its loss resulted from a SAM, but it now appears that a MiG-25 may have scored a victory (if so, it would represent the only air-to-air kill the Iraqis got during the entire war).[87] Considering that Horner, Glosson, and others had expected far heavier losses on the first night (estimates had ranged as high as twenty to twenty-five aircraft), the loss of a single aircraft appeared

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[84](S) Flt Lt Bruce MacDonald, "Tornado GR-1 Low Level Operations," Appendix 16 to Annex C to 1730.13.7/AF0AT/S-078/92, 20 Feb 1992, NATO.

[85]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992.

[86]Glosson's conception was solidly supported by SPEAR's analysis of Iraqi capabilities. See (S) SPEAR, "Iraqi Threat to US Forces," p 3-63.

[87]Discussion with Cmdr Mark Fitzgerald, SPEAR, Naval Intelligence Command, 15 May 1992. During the Gulf War, Fitzgerald was on the *Kennedy* and led the first A-7 package into Iraq on the opening night of the war. He saw a MiG-25 pass overhead in afterburner and headed toward the F/A-18s. Lacking any solid evidence of SAM activity in the vicinity of the F/A-18 lost on the first night, Fitzgerald believes that the Hornet most probably fell to the MiG.

miraculously low.[88] There had even been fears about a possible mid-air collision between allied aircraft–even one involving a tanker.[89] The apparent results of the night's bombing and missile attacks also met expectations, especially in comparison with the experiences of previous wars. The first two waves of F-117s had achieved stunning successes in the teeth of enemy defenses: twenty-three hits out of thirty-three bombs dropped. One of those reported as having missed, the attack on the H-3 sector center, in fact appears to have done its job, since the Iraqis failed to use the center during the rest of the war.[90]

The damage to the enemy's systems had been significant; how significant is difficult to separate from that inflicted by subsequent attacks over the succeeding forty-eight hours.[91] But the first night attacks had substantially degraded enemy air defenses. KARI no longer operated as an integrated system.[92] Many Iraqi radars and SAM sites no longer functioned. On 18 January, intelligence sources reported that much of Baghdad no longer had electricity.[93] Of the Sector Operations Centers, F-117s claimed hits on all except H-3, and that one no longer functioned. Laser-guided bombs had also hit many Intercept Operations Centers, and even

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[88]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992. Horner in particular had cautioned Deptula against believing that the plan would function as smoothly as it had been laid out; but even Deptula found the success of the first night beyond his expectations. Intvw, Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1992.

[89]Intvw, Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1992.

[90]Testimony of Lt Col Robert Eskridge, former member of the Black Hole, 16 Sep 1992.

[91]Without Iraqi documents, it is impossible to calculate the actual damage as "documented" historical truth. What matters most in terms of this study was the continued success of Coalition air operations in attacking targets throughout Iraq for the remainder of the war without significant losses. In fact, even with full and complete access to Iraqi documents, this historian doubts whether one could arrive at a hard judgement, for example, on the individual contributions of F-117 attacks on communication nodes and command and control centers, the damage to the electrical network due to TLAMs, or the level of success achieved by the SEAD attacks of the first night; because the pieces of the first night's raids were so closely interrelated their accomplishments were too interwoven for individual contributions to be readily quantifiable in isolation.

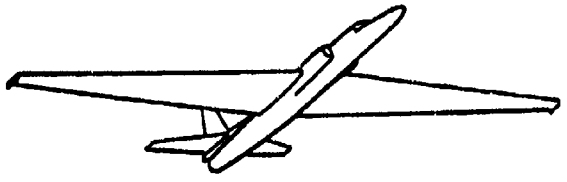
[92]This is not to claim that the enemy air defenses no longer retained substantial lethality. As the Third Day's attack on Baghdad discovered, the enemy on occasion could react with some considerable effectiveness.

[93]Desert Storm Master Chronology, electronic file, 28 May 1992.

if those sites still operated, their effectiveness no longer matched their original capabilities. Nevertheless, in the first day's euphoria, Horner interjected a note of hard-headed realism that proved to be astonishingly close to the mark. At the 1700 staff meeting on 17 January, he warned: "We are at Day One of a thirty- to forty-day war."[94]

The First Day

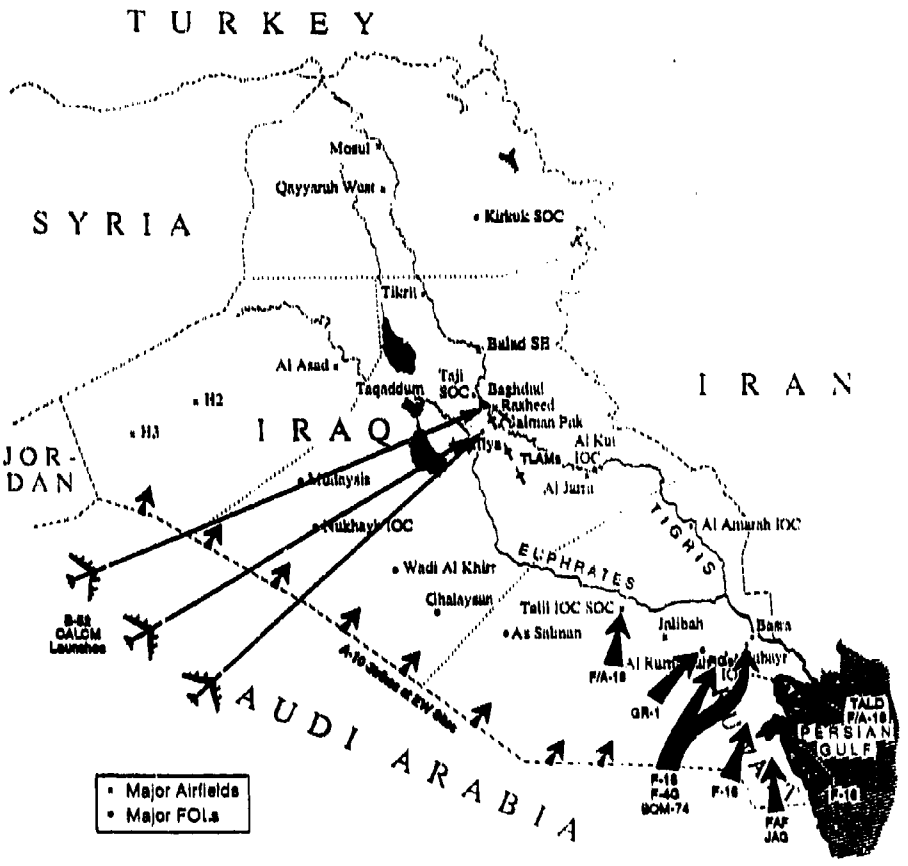
Dawn brought no relief to the Iraqis: the pounding that had begun in the night continued right through to the war's end. [For maps depicting the air operations on the rest of the first day see Maps 19, 20, and 21]. Between 0830 and 1200, after exhausting flights from Barksdale AFB, Louisiana, seven B-52s arrived at launch positions in Saudi Arabia and fired thirty-five CALCMs (Conventional Air Launched Cruise Missile) at targets throughout Iraq.[95] One missile crashed into Saudi Arabia shortly after launch; at least twenty-eight hit their targets, while a further three may have impacted in the target area. The attack by CALCMs on the Al Musayyib Thermal Power Plant suggests both the accuracy of the weapons system and the problems with bomb-damage assessment that would soon plague the air campaign:



[94](S) TSgt Barton's notes of the TACC, 1700 Brfg, 17 Jan 1991, GWAPS, NA 200.

[95]The first B-52 had taken off from Barksdale AFB at 0636 on 16 Jan for the flight to Iraq: Richard P. Hallion, *Storm Over Iraq, Air Power and the Gulf War* (Washington, 1992) p 163.

Map 19
Day One (0600 to 1300L)



[DELETED].[96]

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[96][DELETED]

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Map 20
Day One (1300 to 1830)

The B-52 strike underlines the effort required to support the first day's missions. The Barksdale bombers needed no fewer than thirty-eight KC-135 tanker sorties from Lajes in the Azores and nineteen KC-10 sorties out of Spain.[97] Of eight targets attacked, SAC intelligence

[97] *Ibid*, p 35.

Map 21
Day One (1830, 17 Jan to 0300L, 18 Jan)

estimated that six ceased functioning, one was damaged, and one was missed by the missiles.[98]

Throughout the day, packages of Coalition aircraft moved through Iraqi airspace to strike assorted targets. A-10s attacked the enemy's early

[98] *Ibid*, pp 39-40.

warning sites along the frontier; here the aim was to eliminate the ends of the tentacles, so that the enemy would lose his sense as to what was coming. A-10s also struck enemy ground forces throughout the triborder area. F-16s struck the Republican Guard several times during the day, the first of many visits. Throughout the day, heavy Navy and Air Force SEAD packages went after Iraqi air defenses, both control centers and SAM sites. Overall the weight of Coalition air attacks fell most heavily on the enemy air defenses. [See Table 2]

Table 2
Daylight Attacks on 17 January 1991

Target Category	Type and Number of a/c	Percentage
Airfields	4 GR-1, 4 A-7, 56 F-16	30.5%
Oil	20 F-16	9.5%
Telecomms/C[3]	12 F-16, 5 B-52	8%
Strategic Air Defenses	24 A-10, 24 F/A-18	23%
Electricity	3 B-52	1.4%
Scuds	16 F-16	7.6%
SAMs	36 F-16, 6 F/A-18	20%[99]
	Total Aircraft: 210	

[99](S) Master Attack Plan, "First 24 Hours," 16 Jan 1991.

Meanwhile, Tomahawk missiles continued hitting targets in the Baghdad area; here the intent was to keep pressure on the capital twenty-four hours a day. Since the F-117s only operated at night, the missiles offered a means of striking the Iraqi capital during daylight.[100] Undoubtedly, the impact of six Tomahawks hitting the Iraqi Ministry of Defense between 1010 and 1017 did little to improve morale of those in the building or neighborhood.[101] The close groupings of the missile attacks on particular targets must have added to the Iraqi sense of helplessness; the fact that they could often see the missiles in flight, but could do little in response, could not have improved the defender's psychological state.

Late in the day, a particularly heavy strike of thirty-two F-16s occurred against the airfield at Al Taqaddum and the Habbaniya Petroleum Storage Facility. The planners gave the remaining Iraqi defenses considerable respect. Four EF-111s provided jamming support; eight F-4G Weasels brought their HARMs to use against operating SAM sites.

Smoke pours from a burning petroleum refinery hit by Allied bombs.

[100]Intvw, Lt Col David Deptula with GWAPS personnel, 21 Dec 1992.

[101]GWAPS Database, TOTs acquired from the Center for Naval Analysis.

while sixteen F-15Cs provided top cover.[102] The fact that no fewer than twenty-eight support aircraft shielded the thirty-two strike aircraft from the enemy defenses and fighters suggests the extent to which stealth extended Coalition air capacity to attack targets deep inside the enemy's defensive system. In comparison, the F-117s that had executed the first strikes on *downtown Baghdad* had needed no SEAD or fighter support to attack their targets--against a fully functioning defense system. The fact that the F-16s did not possess precision-guided munition capabilities and therefore lacked the ability to hit their targets with the lethality of the F-117s further underscores the difference.

The first day's effort ended with heavy attacks in early evening. Seven B-52s struck the Tawakalna Division of the Republican Guard; F-111Fs, supported by EF-111s, attacked Saddam Hussein's residence in his home town of Tikrit, north of Baghdad.[103] But the main show in the early night hours of 18/19 January centered on F-117s and Navy and Marine attacks against the air defense systems in eastern and western Iraq. Unfortunately, due to weather problems, the last F-117 strike of Day 1 barely achieved 50 percent hits (ten hits and eight misses); a number of other targets were no drop because of weather.[104] At 2200, eighteen Marine F/A-18s, ten Marine A-6s, and four RAF GR-1s attacked airfields, bridges, and petroleum facilities around Basra; a major Navy package followed the Marines into the area at the same time that sixteen F-15Es struck targets near Basra. Two separate SEAD packages supported the three strikes; in the first, four Marine EA-6Bs provided jamming, while six Marine F/A-18s fired HARMs at the remaining SAM sites. A second SEAD package consisted of four Navy EA-6s and six F/A-18s. To the west, Navy SEAD protected nine A-6s and eight RAF GR-1s in pounding the H-2 and H-3 airfields and runways.[105]

At the end of the first day's operations, the Iraqi air defense system had received a severe blow. It is impossible to estimate at what point it

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[102](S) The Master Attack Plan, "The First 24 Hours," 16 Jan 1991; and OWAPS Database.

[103](S) *Ibid.*

[104]OWAPS Database; (S) Master Attack Plan, "The First 24 Hours," 16 Jan 1991; and Myers, "Nighthawks Over Iraq: A Chronology of the F-117A Stealth Fighter in Operations Desert Shield and Desert Storm," p 9.

[105](S) Master Attack Plan, "First 24 Hours," 16 Jan 1991; and OWAPS Database.

no longer operated as an integrated system; the Iraqis themselves still probably do not know. But while in some areas the system, particularly in the Baghdad area, could operate autonomously, its sectors were under severe pressure and no longer represented an effective defensive system. As the successful operations of Coalition aircraft throughout the first day underlined, enemy air defenses could not prevent allied air power from using medium altitudes with impunity. In the end, the Coalition plane and the attacks that had resulted from them had created maximum confusion and friction within the enemy's system.

Perhaps the second greatest surprise of the first day–after the light losses suffered by Coalition air forces–was the failure of the Iraqi fighters to put up *any* significant opposition. The enemy flew 120 sorties on the first day, but many of those were not "shooter" sorties.[106] In fact, during the first *three* days of the air war, the Iraqis flew slightly more than 100 air-to-air sorties, a dismal performance in view of their numbers. As Glosson supposed, the presence of F-15s and F-14s on combat air patrol over Iraqi airfields discouraged the enemy from flying.[107] The loss of three MiG-29s, three F-1 Mirages, and two MiG-21s over the course of the first day further discouraged Iraqi pilots from engaging the allied air offensive.[108] One suspects that the Iraqis never intended to commit their aircraft to meet the first waves of air attacks; rather they intended to save their air force to support the army in the ground battle.[109] But the lack of response was indeed a surprise.

On the other side, Coalition air losses remained extraordinarily light. During daylight air attacks, the RAF lost one GR-1, while the Kuwaitis lost an A-4, both to SAMs; during evening operations, the allies lost three more aircraft, all within forty-five minutes, but in different operational

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[106]"Conduct of the Persian Gulf War: Final Report to Congress," Apr 1992, p 204.

[107]In one case the Iraqis had approximately eight aircraft cranked up and ready to go. USAF F-15s shot the first two down shortly after they became airborne; the other six aircraft then shut down. Intvw, Maj Gen Buster Glosson with CWAPS personnel, 14 Apr 1992.

[108]The MiG-29s and Mirages were shot down by F-15s; F/A-18s shot down the MiG-21s.

[109]Perhaps Saddam viewed his air force as the Germans viewed their navy in World War I–as being a major player in the postwar balance of power and therefore as being too valuable to risk losing in action.

areas. The USAF lost its first aircraft, an F-15E, the British another GR-1, and the USN its second aircraft, an A-6E, the first two to antiaircraft fire, the latter to a SAM. In all, the Iraqis managed to damage thirteen Coalition aircraft.[110]

The overall loss rate for the first day of the war was indeed astonishing, especially when one considers that Iraqi air defenses were among the best-equipped in the world. The first day's success established a number of essential preconditions for the destruction of Iraq's military power at minimum cost to Coalition forces. It was now clear that allied air power would soon enjoy air supremacy over Iraq and Kuwait; that would allow allied ground forces to redeploy at their own convenience, while the Iraqis remained entirely blind as to what was occurring. Secondly, Coalition air forces could now attack Iraqi ground forces at their leisure; there would be no need for a ground campaign until air attacks had severely attrited enemy forces. Finally, there would be sufficient time to attack those strategic targets, the destruction of which would lessen Iraq's threat to regional stability.

The Second Day

As with the first day, the Black Hole had carefully scripted what would occur on day two. The pattern of Coalition air operations again suggests an effort to spread confusion and friction throughout the enemy's command system; in other words Horner and the planners aimed to further degrade Iraqi capacity to defend themselves against the air campaign. To a great extent, the conduct of operations on day two extended the successes that air attacks had gained at the start; nevertheless, by the end of the day, weather was having a severe impact on the conduct of the campaign.

Nor was poor weather the only friction that began to crop up by the second day. In planning Desert Storm, the Black Hole air planners had recognized that once the campaign got past the scripted first two days bomb damage assessment (BDA) from intelligence would quickly become important for evaluating previous strikes, deciding which targets to strike in succeeding days, retargeting when necessary, and uncovering new targets as the war unfolded. Unfortunately, for much of the air campaign, BDA did not arrive from the formal intelligence channels in a timely manner, and the

[110]GWARS Database, 25 Jun 1992.

air planners in Riyadh found themselves increasingly forced to obtain BDA from alternative sources.[111] Those sources included Glosson's special relation with Admiral McConnell in Washington, the use of video recordings from aircraft like the F-117 and F-111F that could provide imagery of their own strikes, the Black Hole's ad hoc relationship with Checkmate, and informal relationships with operationally oriented organizations such as the Navy's SPEAR (Strike Projection Evaluation and Anti-Air Warfare Research) in Suitland, Maryland.

This report cannot give a detailed examination of the BDA problems that emerged during Desert Storm between the commanders, their operational planners, and the formal intelligence organizations. Suffice it to say that there were problems,[112] and that the blame for these problems did not lie exclusively on the intelligence side of the house.[113] (The reader interested in more insight into BDA problems should consult Chapter Four of the Summary report.)

As with the previous day's operations, the second day began with F-117 attacks. [For a depiction of air attacks on Day Two, see Maps 22, 23, and 24.] The planners paid special attention to air defense controlling centers (SOCs and IOCs); again their emphasis was on disruption rather than on sheer physical destruction. Some considerable retargeting took

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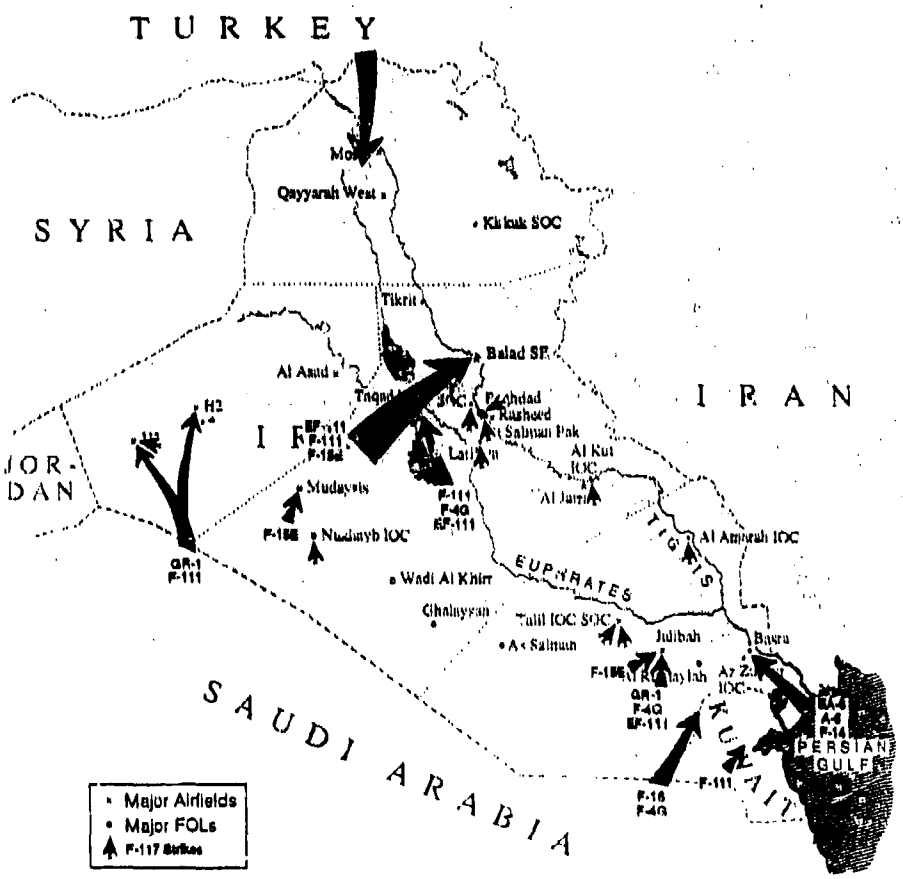
[111]The postwar criticism by such figures as Generals Schwarzkopf and Horner underlines that there were some considerable problems. In turn, their criticism is backed up by the logs in the TACC, the notes taken by air force historians in the TACC throughout the war, and by personal journals kept by crucial players such as Glosson and Deptula.

[112]Horner's frustrations at intelligence at times spilled over into the TACC Log. On 30 January he noted: "Target–SA-2 missiles–will be hit by Scud hunters in the east if not required for a higher priority target–Target is ___ This sentence is incomplete because the ops intel interface is also incomplete!" TACC, CC/DO, Current Ops Log, 30 Jan, GWAPS, NA 215.

[113]On the extraordinary difficulties involved in having operations and intelligence work together successfully one might best consult F.H. Hinsley, *British Intelligence in the Second World War*, three volumes (London, 1979, 1981, and 1984-88). It took the British nearly half the war to get their intelligence-operations working successfully and they were confronting a situation that threatened directly the very survival of the nation.

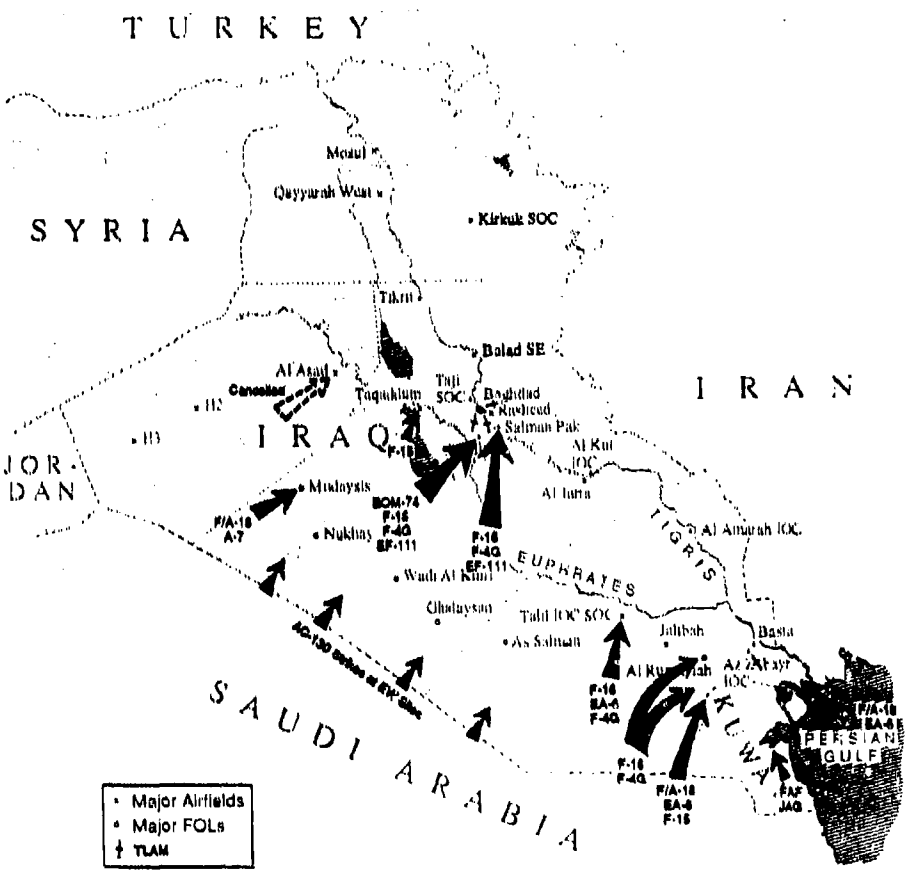
Map 22
Day Two (0300 to 0800L)



place in the case of the chemical and biological warfare bunkers because so many had escaped damage due to the bad weather that had plagued F-117 strikers early on 17 January.[114] The F-117s achieved hits with thirteen out of nineteen bombs dropped, a considerable improvement over the

[114](S) Master Attack Plan, "Second 24 Hours," 18 Jan 1991.

Map 23
Day Two (0800L to 1800L)



success rate of their past two waves.[115] Along with F-117 strikes in the early morning hours, other packages struck airfields and Scud sites throughout Iraq. The major Iraqi air bases at Balad, Al Taqaddum, and

[115]Myers, "Nighthawks Over Iraq: A Chronology of the F-117A Stealth Fighter in Operations Desert Shield and Desert Storm," p 9.

Map 24
Day Two (1800L, 18 Jan to 0300, 19 Jan)

Jaliba all received extensive attention from F-111Fs and GR-1s.[116] If the Iraqis aimed to display more willingness to engage Coalition aircraft on 18 January, these strikes were meant to discourage them.

The pattern of attacks displayed some change. Believing that the first day's effort had degraded Iraqi defenses, the planners put larger packages in against the various target sets under attack. The morning's initial strike, a large package of Navy aircraft–ten A-7s, sixteen F/A-18s, and

[116](S) Master Attack Plan, "Second 24 Hours;" and GWAPS Database.

eighteen F-14s along with four GR-1s–targeted the Al Asad area at 0930, but bad weather interfered with much of the mission.[117]

At 1000 hours two large packages hit the center of Iraq on each side of Baghdad. EF-111s provided SEAD, while forty F-16s attacked munitions, Scud, and military production targets on Baghdad's west side. Shortly after, package J with forty-four F-16s struck Scud-related manufacturing and fuel targets east of Baghdad. Substantial SEAD support covered both packages to suppress Baghdad's defenses: BQM-74 drones were included in the effort, four EF-111s jammed enemy radars, and eight F-4Gs provided HARM support against those radars still brave enough to operate.[118] Finally, twenty-four USAF and four Saudi F-15Cs provided top cover for strikers and ECM aircraft.

Beginning at 0930 air attacks went against Republican Guard units located along the Kuwaiti-Iraqi frontier. The Marines led off with twenty-four F/A-18 sorties against the Republican Guard divisions– divided equally among the Tawakalna, Madinah, Hamnurabi; eight F/A-18s and four F-15Cs provided air coverage for the attackers and their ECM package of four EA-6Bs. Two hours and fifteen minutes after the last F/A-18 mission, thirty F-16s struck Tawakalna. At 1610 sixteen F-16s hit targets associated with the airfield at Al Rumayla, just north of the Kuwaiti-Iraqi frontier. As the fighter bombers worked the airfield over, thirty more F-16s again struck Tawakalna. Fifteen minutes later twenty-four F-16s hit Madinah. Significantly, as was the case with many early packages, Air Force, Navy, and Marine SEAD assets covered the strikers; in this case four F-4Gs and two Marine EA-6Bs.[119]

Two other features on the second day were the constant hammering of Iraqi positions near the border by A-10s and sustained attacks by naval air on the enemy navy and other positions in the Basra area. The former discouraged the Iraqis from unleashing a ground campaign; the latter removed the latent threat represented by Iraqi naval forces at the top of the Persian Gulf.[120] The attacks on naval targets were a major focus of

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[117]The notation in the Master Attack Plan for 18 January 1991, indicates that the package was cancelled because of weather. GWAPS Database and Navy data suggests that a portion of the mission may have struck an alternative target.

[118](S) Master Attack Plan, "Second 24 Hours," 18 Jan 1991, and GWAPS Database.

[119](S) *Ibid.*

[120](S) Master Attack Plan, "Second 24 Hours," 18 Jan 1991, and GWAPS Database.

naval air operations in the first weeks of the war; more than 1,000 strikes of naval fixed-wing aircraft hit the Iraqi navy, its bases, and often sites that could threaten Coalition maintenance operations.[121] The destruction of Iraq's naval assets eventually allowed the carriers to move up into the central portions of the Persian Gulf and thus relieve some of the need for tanker support.

The evening and night of 17/18 January proved most disappointing to the F-117s. The Master Attack Plan called for a large number of strikes on targets in the Baghdad area. Unfortunately, the weather was so bad around the capital that no F-117 dropped on its primary target, while few alternates were open. Strikes by other aircraft did go in despite weather conditions. Package T from carriers in the Red Sea struck the power plant and TV station at Hadithek in western Iraq. At 2100, three B-52s again hit the Tawakalna Division, while two four-ship formations of B-52s struck targets near Tallil between 2200 and 2230. The final action of the day saw eight F-111Fs hit bridges along the Euphrates behind the Republican Guard, while three-ship formations of B-52s dropped on the Tawakalna, Madinah, and Hammurabi.[122]

Iraqi air defenses were still capable of putting up opposition to Coalition air strikes. On an evening strike by B-52s in the KTO, one of the Weasel crews reported:

> I worked an SA-2 about twenty-five miles away. We [received] good data on our computer so we had a pretty good shot. As we fired the missile, it came off the left toward the north[; then] we got the indications on the computer that we had been launched on. I looked out of the left side of the jet and watched the first two missiles coming at us. There was a glow in the clouds and then they popped up through the clouds with a wavering orange plume. I called out to Mark (Buccigrossi [the backseater]) that they were coming up. He got them in [sight]. . . .I tried to keep my air speed up because we were at 29,000 feet. I broke into the missiles. The only way I knew the missiles were gone, I called out 'missiles are boom and boom.' [sic] I said I've got two more coming up on the right side and Mark said 'what are you going to do now?' I said, 'Get the pod and chaff going.' I kept the airspeed up. Again Mark kept his eyes on the missiles and called out

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[121](S) Frank Schwamb, et al, *Desert Storm Reconstruction Report*, Vol. II, *Strike Warfare* (Alexandria, VA, 1991), p D-2.

[122](S) Master Attack Plan, "Second 24 Hours," 18 Jan 1991, and CWAPS Database.

> the explosions on those two missiles. Then the last two I picked up on the left hand side. We had now gotten down to about 15,000 feet because of all our maneuvering. That put us right in the middle of the triple 'A'. Missiles were coming up from the left and Mark said, 'What are you going to do now?' I'm thinking to myself I can't go right because of the triple 'A' off to the west and higher than us now, but the good news was that it wasn't at us. There was still a lot of small arms firing at us. It looked like guys with a fire hose waving it around. I was able to get the airspeed up and climb out. . . .We got out of there and spent three to five minutes in after burner.[123]

An additional strategic factor to the Coalition's advantage had opened up 18 January: the Turks granted permission for USAF aircraft from Europe to begin attacking targets in northern Iraq from Incirlik. Air operations from that direction confronted the Iraqi leadership with a threat from an entirely new point on the compass. It further overloaded their air defenses and placed enemy airfields in this area within easy range of U.S. aircraft. Moreover, it robbed the Iraqis of the possibility of shifting air assets to the north to escape Coalition air attacks.

USAF aircraft operating out of Incirlik–the name for the task force was "Proven Force"–were also within easy range of the Mosul and Kirkuk airfields and other targets in northern Iraq. Unfortunately, the potential of bases in Turkey failed to pay a full set of dividends: lacking aircraft and systems capable of laser designation, Proven Force could not attack targets with the same accuracy as the F-111Fs, F-15Es, and F-117s operating out of Saudi Arabia.[124] The first strike from the north occurred on the second night when ten F-111Es dropped cluster bombs on early warning radar sites just over the border. The next day, the first F-16 daylight mission against Kirkuk was canceled because some Turkish authorities did not yet understand that their government had authorized air strikes from Turkey.[125] But the Iraqis were on notice that there were now no sanctuaries, even in northern Iraq.

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[123]Starr, "Special Study, History of the 35th Fighter Wing (Provisional): Operations Desert Shield and Desert Storm," GWAPS, NA 277, pp 156-57.

[124]Not until the end of the war did F-4s from Clark with a precision-bombing capability arrive at Incirlik. Unfortunately, their laser designation pods did not arrive until after the war.

[125](S) 7440 Composite Wing (Prov), "Bomb Damage Assessments," 18 Jan–27 Feb 1991; see also Maj Scott Norwood, "Daylight Tactical Air Operations in Northern Iraq, 17 Jan to 27 Feb 1991," GWAPS NA.

The second day's air action underlined the continuing success of efforts to degrade KARI and suppress individual elements of the Iraqi air defense system with SEAD packages. Iraqi air activity declined by about one third compared with the first day.[126] While Coalition fighters failed to shoot any Iraqis down, allied losses fell to only three aircraft: a Navy EA-6B, a Marine OV-10, and an Italian GR-1. Furthermore the Iraqis damaged only one Coalition aircraft, an F-111E.[127] Due to weather and other factors, Coalition air forces flew two hundred fewer sorties, but all in all it was a most successful day.

It was during this period that the conduct of operations solidified the inclination of Coalition air forces to fly strike missions at medium altitudes. Even before the air campaign against Iraq had begun, there had been an unspoken predisposition to fly and execute strikes above 10,000 feet. Such an approach made obvious sense because it placed Coalition aircraft above the envelope within which most Iraqi antiaircraft guns and infrared SAMs were effective. Nevertheless, this tactical approach was intuitive rather than directed. And it reflected the obvious belief that attacks on KARI and SEAD against enemy missile sites and radar would allow Coalition aircraft to operate with low losses at or above 10,000 feet.[128] Consequently, during Desert Shield most units began to train for medium altitude delivery; the Vietnam experience undoubtedly reinforced such a tactical approach. As one F-16 wing commander noted, he had emphasized to his crews during the period before 17 January that his experience in Vietnam underlined that enemy air defenses were most successful against low flying aircraft.[129]

The aircraft most wedded to low-level strikes were RAF and Saudi Tornados and B-52s. In the latter case, the mission to attack runways dictated low-level delivery. The Tornado JP-233 weapon systems had to be delivered at low altitude, and the Tornados continued dropping it until 24 January. During this period the Tornados experienced the bulk of the losses

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[126]DOD, *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, 1992), Table VI-6, p 204.

[127]GWAPS Database.

[128]Precrisis training for most NATO aircraft had stressed low-altitude delivery to minimize the MIG and SAM threats in Europe.

[129]Intvw, Col Ray Hout with GWAPS (Wayne Thompson), Shaw AFB, 9 Mar 1992. Horner's and Glosson's emphasis that no fixed target during the air campaign was worth an aircraft undoubtedly reinforced such proclivities.

they would suffer during the air campaign. By then it was obvious that most Iraqi aircraft were remaining in their shelters and that the few Iraqi fighters that rose to challenge Coalition raids were easily being shot down.[130]

The B-52s changed tactics more quickly than the Tornados and stopped low-level attacks after the first three nights. Strategic Force Planners were told that CENTAF could not afford to lose a B-52. On the second night, a B-52 had turned back in the face of heavy ground fire, and during a low-level attack on an oil refinery that night an SA-3 had damaged another B-52.[131] In general, the decision to leave low altitude seems to have been reached on a unit-by-unit basis that recognized the obvious realities of the situation.[132] Horner never ordered the departure from low altitudes, but he did suggest to the RAF on 19 January that he thought that their low-altitude losses were unnecessary.[133]

The decision not to bomb at lower altitudes carried with it a number of important consequences. On the positive side, it minimized the casualties that Coalition aircraft would take throughout the course of the air campaign; the low casualty rates played a crucial role in allowing the continuation of air operations for a period entirely determined by the needs of Coalition air and ground forces in "preparing the battlefield." On the other hand, the decision to bomb from medium altitudes did have a severe impact on the accuracy of munitions other than precision-guided in attacking fixed positions or equipment. In effect, that decision robbed platforms such as the F-16 and the F/A-18 of much of their ability to attrit enemy ground forces, while allowing those aircraft to remain invulnerable to enemy defenses.[134] This is not to say that their attacks did not play a role in the collapse of Iraqi ground forces; clearly their bombing attacks had a considerable impact on Iraqi morale. In the final analysis,

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[130]A.D. Kitcher, RAF Strike Command, Operations Research Branch, "Operation Granby: JP-233 Analysis," Nov 1991, GWAPS, NA 515B.

[131](S) SAC History, "Desert Shield/Desert Storm," SAC, 1990, pp 251-53.

[132]CENTAF's obvious concern with losses undoubtedly served to reinforce the tactical and operational chances that individual units made.

[133]CENTAF TACC Historian's notes, TSgt Barton, 20 Jan 1991, GWAPS, NA 200.

[134]In the case of the A-10, the medium altitude decision robbed its 30 mm gun of much of its accuracy. However, the Maverick missile did provide A-10s with the means to attack targets accurately from medium altitudes. The F-16s had the capability to fire Mavericks but since few of the pilots in the F-16s were qualified to use the missile system, virtually no F-16s flying from the south used Mavericks.

the decision to attack from medium altitude made both operational and tactical sense, and it certainly carried with it important implications for the post-Gulf War arena of air power employment.

Conclusion

What had the air offensive thus far achieved? Allied air attacks on the enemy's air defenses had degraded enemy capabilities to the point where the campaign could continue at acceptable levels of attrition *for as long as Coalition military and political leaders deemed necessary*. The plan to combine attacks on the enemy's air defenses, his centralized command and control system, SEAD efforts such as electronic countermeasures and HARMs, and destruction of much of Iraq's electric network had succeeded beyond the most optimistic forecasts. Moreover, allied air attacks against Iraq gained a measure of air supremacy in two days at minimum cost to attackers. An almost flawless flow of operations and the relatively low cost of these successes certainly surprised the planners.[135] To a great extent, these two days contradicted General Helmuth von Moltke's assertion that war plans do not survive first contact with the enemy.

This success did not mean that the air offensive had destroyed all the individual components of KARI or that some sectors could not operate autonomously; throughout the remainder of the war, the Iraqis would cobble together bits and pieces of their air defense systems in response to continuing attacks. The crucial point was that the Iraqis now possessed *no effective* defenses against the attacks on their civil and military infrastructures. Perhaps the most telling statistic was the fall in the activity levels for Iraqi SAM/AAA radars by more than 90 percent.[136] While the decline in early warning radar emissions was not as drastic, the crucial fact was that from the first attacks on the Iraqi integrated air defenses, Coalition air forces gained a measure of air superiority sufficient to operate in Iraqi airspace largely with impunity.

Yet, one must also note that the attacks on targets in downtown Baghdad had focused on functional effectiveness rather than physical destruction. The concept had been to inhibit and confuse the Iraqi defensive systems; and barely any attacks had occurred against Iraq's political infrastructure. For all the spectacular footage of Iraqi antiaircraft fire over the first few days of the war, F-117s had only dropped *fourteen*

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[135]Intvw, Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1991.

[136]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, p 202.

bombs on targets within the heart of the capital in the first twenty-four hours of the war and only *one* during the second twenty-four hour period.[137] Tomahawk missiles had carried considerable weight with thirty-nine impacting on targets in downtown Baghdad during the first day and eighteen missiles on the second day.[138] But the small size of the missile warhead as well as its inability to penetrate hardened targets had limited its effectiveness.

The planners had foreseen this situation. Their aim was to return to a number of critical targets that the first days attacks had only partially damaged with large conventional force packages of F-16s beginning on the third day. Such attacks would underline the regime's inability to protect itself as well as complete the destruction of a number of large, complex headquarters sites upon which the regime depended for its military and its political control of Iraq.[139]

The imponderable was whether the air attacks of the first two days had wrecked the Baghdad defensive system sufficiently to allow such packages of F-16s to fly within the capital's vicinity without suffering significant losses themselves or without placing the civilian population of the capital at needless hazard.[140] Those two basic questions would not have answers until the first large package of F-16s actually flew against the capital. If the operational approach of using F-16s against large high-value targets in the capital did not work, then the planners faced the challenge of attempting to deconstruct these significant military and political targets that harbored the control apparatus of the regime with individual F-117 sorties. And this would represent a lengthy process that

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[137]GWAPS Database. The second twenty-four hour period was considerably influenced by the weather.

[138]*Ibid.*

[139]The guidance letters put out by Glosson for D+3, D+4, and D+5 (before it was changed) explicitly directed that at least one large package of F-16s (with twenty-four plus aircraft) attack Baghdad vicinity to make the air campaign visible to the Iraqi people. US Central Command Air Force, COMUSCENTAF Air Guidance Letter, ATO Planning guidance for D+3, Buster C. Glosson, Director of Campaign Plans (no date), p 6, GWAPS, Box 3, Folder 59, Daily Planning Material.

[140]Any kind of SAM threat over the capital where the attacking aircraft were threatened by guiding SAMs would force the pilots to drop their bombs and drop tanks so that they could take effective countermeasures. Such an action would, however, place civilians on the ground in considerable hazard since the pilots would obviously have no means of controlling the fall of these objects.

would carry with it less psychological impact on the regime and demand a consistent and clear focus to the strategic air campaign.

What did these successes over the first two days mean in terms of the strategic and operational balance of power? On the Iraqi side, the intensity of the offensive as well as the level of damage that the attackers inflicted undoubtedly came as a surprise. Coalition attacks on communications, electricity, and air defenses had sowed confusion within a tightly controlled system. The loss of electrical power forced the military to utilize backup power in many places. The effect of these raids magnified the confusion, uncertainty, and frictions attendant on waging of war. Moreover, the nature of Saddam's tyranny probably exacerbated the frictions resulting from Coalition air attacks.

[DELETED].[141]

There were a number of ironies in the above assessments of the military situation. From the allied perspective, events would soon bear out Horner's pessimism that things never go flawlessly in war. Extraordinarily bad weather, the on-going diversion of some assets to the Scud problem--forced by political considerations--as well as the other uncertainties of "real war" would exercise great strain on the conduct of the "strategic" air campaign. On the other side, the storm systems that dominated the weather in the Persian Gulf throughout this period seemingly gave credence to Saddam's belief that he could wait out the air campaign for the ground war without suffering catastrophic damage. Where he miscalculated was in the duration, accuracy, and intensity with which Coalition air forces could wage the air campaign even in the face of considerable difficulties and frictions.

[141]This reconstruction of Saddam's strategic assessment is based on the CIA briefing given at CWAPS on 25 Jun 1992.

4

Friction and the Conduct of Operations 18 January to Al Firdos

Allied aircrews had executed the first two days of attacks against Iraq in almost flawless fashion. Air power had shut down much of Iraq's electric system; its air defenses, where still operational, were largely ineffective and intimidated; and Coalition air losses had been extraordinarily low. Stealth aircraft had attacked the heart of enemy air defenses from the first moments of the war; a carefully planned SEAD campaign had severely damaged many radar sites and jammed the remainder successfully. Not surprisingly, planners and commanders greeted the successes of the first days with euphoria. The American public, led to expect heavy losses by the "experts" were equally enthusiastic. Unfortunately, the air campaign now ran into some substantial difficulties and frictions. In retrospect, many of these frictions lay beyond the control of planners and leaders; some might have been foreseen, at least in outline; but most reflected the uncertainties that distinguish "real war from war on paper."[1]

This chapter will discuss the ongoing operational air campaign within the framework of these frictions: the extraordinarily bad weather, the political impact of Scud attacks on Israel and Saudi Arabia, and the difficulties in putting together coherent operational plans and orders within short periods and under great pressure on a sustained basis instead of a single plan for the initial two days of operation refined over a long period of time.[2] These frictions came together on day three of the air war. For that reason we will begin with a detailed examination of operations on 19

[1]Clausewitz, *On War*, p 119.

[2]The history of the 614th Tactical Fighter Squadron suggests some of the difficulties that just one friction could cause; on the second day the squadron struck the airfield at Al Rumayla. The squadron historian then notes: "The damage to the airfield could not be assessed for approximately two weeks due to the overcast skies, but in the meantime, the airfield was hit quite a few more times by additional packages." 401st Tactical Fighter Wing, "614th Tactical Fighter Squadron, Desert Shield/Desert Storm."

January 1991. Thereafter this chapter will concentrate on more general topics that reflect the general pattern of operations through 13 February.

The Third Day

On day three, friction began to affect the air campaign. The difficulties underlined that the first days' success did not indicate that the rest of the war would proceed flawlessly. In an oral interview after the war, Horner suggested that he had not allowed his planners in the Black Hole to proceed beyond Day Two in their laydown of air operations.[3] This certainly followed Moltke's advice that war plans do not survive first contact with the enemy; in fact, the Black Hole had prudently worked up an outline for the third day's master attack plan before the war began.

But a number of imponderables confronted planners in their thinking before the war about the third day's operations. By that point, Coalition air forces would have flown several thousand sorties against Iraq and its military forces: what level of success would SEAD and attacks against strategic targets have enjoyed? What would Bomb Damage Assessment (BDA) show? How effective would enemy air defenses prove? There were consequently a number of issues that the conduct of operations and the flow of intelligence would have to resolve before planners could make final decisions on the targets for the third day.

The planning system would rest on a three-day cycle; the first day would involve casting the Master Attack Plan, during which planners, utilizing up-to-date BDA, would integrate strategic and other targets with re-attacks and available platforms.[4] Then on the second day, the Air Tasking Orders (ATO) cell would take the plan and coordinate the details, such as call signs, IFF (identification) codes, comjam procedures, and tanker tracks, into an Air Tasking Order. On the third day, the air units would execute the plan under the direction of the current operations portion of the TACC (Tactical Air Control Center).

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[3](S) Intvw, R. Davis, P. Jamison and E. Barlow, AF History Program with Lt Gen Horner, Shaw AFB, SC, 4 Mar 1992.

[4]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992; Intvw, Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1991.

Unfortunately, the complexities involved in such a cycle were not clear before the war. Not surprisingly, planners in the Black Hole underestimated the time required to complete the Master Attack Plan under wartime conditions. In the event they did not complete the Master Attack Plan for day three until 2000 on *18 January*. The euphoria of the first day may have also added to the problem of getting down to work on the third day's plan. To add to planning troubles, timely bomb-damage assessment simply failed to emerge from the intelligence system.[5] As work proceeded on the Master Attack Plan, the building of the third day's Air Tasking Order had to begin; here, the Tactical Air Control Center (TACC) was not yet ready to handle the coordinations involved in working up the Air Tasking Order under the demands of wartime conditions and the severe constraints of time. None of this is surprising; under the actual conditions and pressures of war, human systems and organizations rarely work at optimal levels, especially at the beginning. It takes them time to adapt; and indeed the system did adapt.

In the end, CENTAF's Director of Operations (DO), Maj. Gen. John Corder, finally threw up his hands and ordered both Black Hole and the Air Tasking Order cell to give the TACC what they had.[6] The result was less than satisfactory.[7] As Corder suggested after the war, it took nearly six days for the Black Hole and the Air Tasking Order cell to work into a cycle in which the Master Attack Plan flowed smoothly into an Air Tasking Order.[8]

The cancellations over the next week support Corder's assessment. Over the first two days of operations, the number of cancellations were under fifty for each day; on the third day the number of cancellations rose to 456 and on the fourth reached 431. The sixth day would see 331

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[5]Weather as well as a lack of the right kinds of airborne reconnaissance platforms were major contributing factors.

[6]Intvw, Maj Gen John Corder with GWAPS personnel, 18 May 1992, GWAPS, NA 361.

[7]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992; Intvw, Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1991.

[8]Intvw, Maj Gen John Corder with GWAPS personnel, 18 May 1992 GWAPS, NA 361. The after action report of the 50th Tactical Fighter Wing supports Corder's contention: 50th Tactical Fighter Wing, "Desert Shield/Desert Storm," GWAPS, NA 379

sorties cancelled.[9] Not until 23 January (the seventh day of the war) did the process of translating the Master Attack Plan into an executable Air Tasking Order function with some coherence. On that day, the cancellations fell to manageable levels–105 cancellations and on the next day to thirty-one.[10] Some of these were admittedly due to weather, but others were the result of the failure of tankers or other aircraft to show up at the right time, or other causes.

These Air Tasking Order difficulties translated directly into the operational world. As an F-16 pilot recorded about a mission flown on day four:

> I came off the target with lead and number four in sight, jinked to get my egress steerpoint, checked for number four again–he was gone. Checked for lead again–he was gone, so I came out a singleton between a four ship of F-4G Weasels–not fun! And now the real fun begins. There were no fragged tankers for us! There are planes all over the sky bootlegging tankers. We get enough fuel to divert but decide to dial-up-a-tanker and beg for fuel to get home. And now it's pitch black with some weather.[11]

Similarly, a large package schedule to attack the Al Taji Rocket Production Facility near Baghdad on the morning of the third day cancelled because there was no Weasel support available.[12]

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[9](S) GWAPS Database, "USAF Sorties by Day: Scheduled, Added on, Flown and Cancelled." Despite problems with the weather, the exceedingly high number of cancellations suggests difficulties in the Master Attack Plan–ATO process and that those problems were causing considerable problems in the coordination of tankers, SEAD assets, CAP sorties, and maintenance. There would be equally bad periods of weather later in the war, and those periods would drive up the number of cancellations, but never did the number approach the numbers on the third and fourth days of the war. Only on 30 January would the number of sorties reach over three hundred (310) during the rest of the war.

[10]*Ibid.* The daily cancellations for this period were:

19 January: 456	22 January: 331
20 January: 431	23 January: 105
21 January: 256	24 January: 31

[11]Capt Mike Boera, 10th Tactical Fighter Squadron, 50th Tactical Fighter Wing, "Desert Shield/Desert Storm," p H-15.

[12]401st Fighter Wing (Provisional), "614th Tactical Fighter Squadron, Lucky Devils, Desert Shield/Desert Storm, 29 Aug 1990–29 Mar 1991," GWAPS, no page numbers.

Along with the problems of working into a coherent planning cycle, the weather turned nasty. A series of lows began moving through the theater and directly affected the ability of Allied aircraft to strike targets in Iraq. There were some periods of good weather; often good weather and bad weather alternated over the period of a day, but weather now became a major factor in the conduct of operations.[13] The sortie cancellations on 20 January underline the impact that weather could have on operations. On that day, there were 300 sortie cancellations due to weather alone.[14]

Bad weather had already affected F-117 operations on the night of 18/19 January when roughly two of every three planned strikes either missed or could not be dropped due to weather.[15] While the F-117 "no drops" and misses attributed to weather improved to one out of two on the night of 19/20 January, half the planned effort from the F-117s against strategic targets was still frustrated by weather in the target areas. These initial difficulties were a harbinger of weather problems that would persist throughout the campaign. Black Hold planners would soon begin scheduling precision strikes in areas such as Baghdad according to the weather fronts as they moved through the theater of operations. Nonetheless, significant losses of F-117 strikes to weather would recur in early February on ATO Days 17 and 18, and ATO Days 40 and 41, during the ground campaign, would see the F-117s nearly grounded by weather.[16]

While weather impacted other air operations on 19 January, a significant number of strikes did go in against targets–either through breaks in the clouds or by dropping by use of radar, generally an inaccurate means

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[13]Kenneth R. Walters, Maj Kathleen M. Traxler, Michael T. Gifford, Capt Richard D. Arnold, TSgt Richard C. Bonam, and TSgt Kenneth R. Gibson, "Gulf War Weather," Mar 1992, USAF Environmental Technical Applications Center.

[14]Notes from the TACC, taken by TSgt Barton, 21 Jan 1991, 1700 Brfg, GWAPS, NA 215.

[15]GWAPS Missions Database, Manual Strike Counts done by Task Force Six (see Effectiveness report, Appendix 1).

[16]GWAPS Missions Database, Manual Strike Counts done by Task Force Six (see Effectiveness report, Appendix 1). On ATO Day 40, the F-117s did not fly at all; the following day the weather was still so bad that F-117 pilots only managed a half dozen strikes. See GWAPS Missions Database, Manual Strike Counts done by Task Force Six.

of weapons delivery. But throughout the day, weather cancelled force packages and affected the tactics and accuracy of those who did bomb.

The third day kicked off with F-15Es striking Scud and air defense targets. [For targets on Day 3 see Maps 25, 26, 27, 28] The next large package, F-16s, targeted the Madinah and Hammurabi Republican Guard divisions, but cancelled because of weather. At 0500 Package C was to strike Tikrit South and the Scud depot at Qubaysah, but air and ground aborts for maintenance again washed out much of the mission.[17] At the same time, the Navy was having no better luck in southeastern Iraq; the carriers cancelled Package D, which had been scheduled to strike the naval base at Umm Qasr.[18]

The major morning efforts came between 0600 and 0730. At 0600 four B-52s pounded the Madinah Division with a second wake-up call; half an hour later, thirty F-16s were to hit Hammurabi and Tawakalna. Fourteen F-16s cancelled, setting a pattern that continued over the next several hours.[19] Suggesting the difficulties in the Air Tasking Order process, the planners had scheduled two large strike packages to hit Baghdad from 0700 to 0730. By putting so many aircraft together in one strike, planners hoped to minimize coordination of SEAD and tankers and at the same time keep sortie utilization rates up.

Besides scheduling difficulties, there was some overconfidence among commanders and aircrews after the successes of the first two days. One senior officer in the Black Hole exclaimed over the possibility of "darkening the skies over downtown Baghdad." But overconfidence was not only in the Black Hole; the F-16 wings proved receptive to the idea of using their aircraft to go downtown as well, as their F-105 and F-4 predecessors had gone against North Vietnamese defenses in the Red River Valley. In fairness, two large SEAD packages had struck Baghdad's defenses in the first two days, while a number of conventional strike

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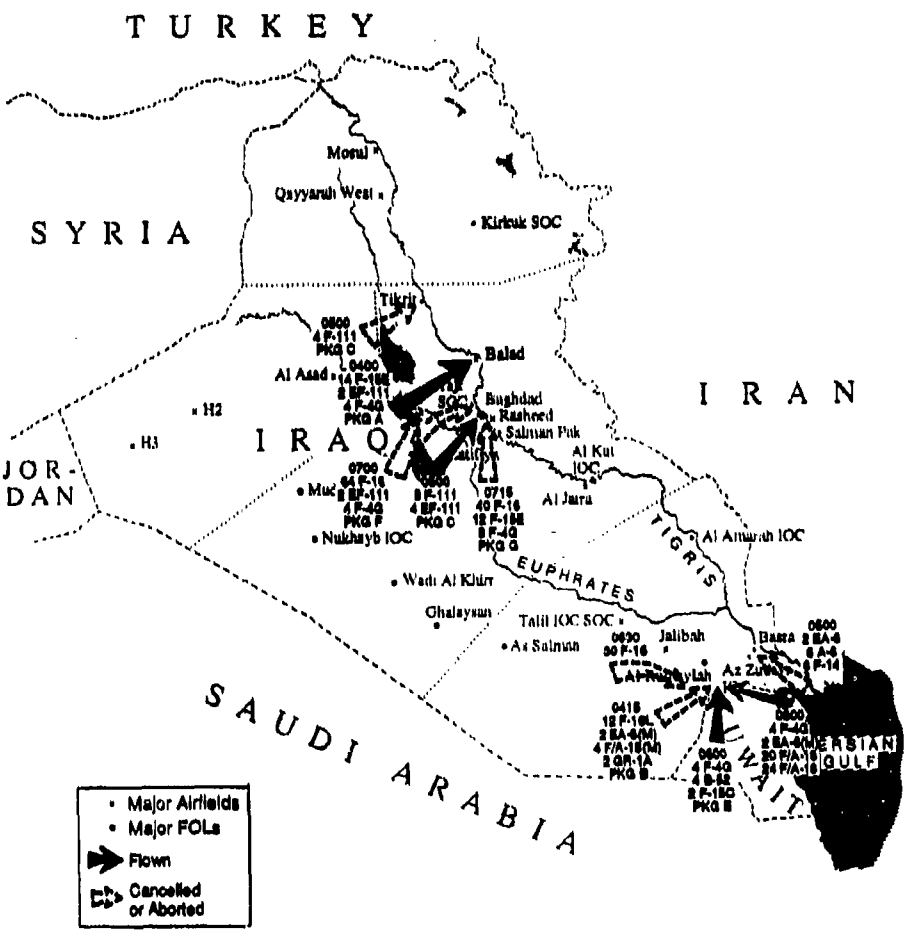
[17]GWAPS Database.

[18](S) Master Attack Plan, Third 24 Hours, 18 Jan 1991 and GWAPS Database.

[19](S) *Ibid.*

packages had probed right up to the capital's suburbs. Thus far, the enemy had inflicted only minimal damage on the attackers. Consequently, there was reason to believe that attacks had already attrited enemy defenses to the breaking point.

Map 25
19 January (0300 to 0800)



There was also a tactical reason for planning large F-16 strikes against a number of targets in the Baghdad area. Large structures such as the Ministry of Defense or the Air Defense Operations Center would require a considerable number of F-117 and Tomahawk missile attacks to destroy them completely. Whatever the inaccuracies of the F-16 plat-

Map 26
19 January (0830 to 1700)

form, the size of such structures provided area targets where pinpoint accuracy was less of an issue than in most cases. The destruction of several of the Iraqi government's larger buildings in Baghdad would obviously have had psychological effects on both government and people.

Map 27
19 January (1700 to 2000)

Moreover, the attacks would underline that American air power could reach anywhere in Iraq without serious loss.[20]

Map 28
2000, 19 January to 0300, 20 January

[20]Conversation with Lt Col David Deptula by phone, 22 Sep 1992.

The morning efforts against the Iraqi capital were only the first of several such efforts planned for 19 January. The first package was to strike Al Taqaddum air base and the Habbaniya chemical warfare production centers west of Baghdad at 0700. Supported by two EF-111s, four F-4Gs, and sixteen F-15Cs, forty-eight F-16s were to attack these targets.[21] Fifteen minutes later, a second large package of forty F-16s was to strike targets in Baghdad: among others, the headquarters of the Internal Security Agency, Military Intelligence, Air Force, and Ba'th Party.[22] The second strike would receive support from eight F-4Gs, while twelve F-15Cs ran interference against Iraqi fighters. To underscore Coalition air superiority, the last aircraft in each group of eight F-16s was supposed to carry leaflet bombs to cover downtown Baghdad with Coalition propaganda.[23] A third strike of sixteen F-16s would then pound Taji at 0745 to complete early morning attacks on the capital. In fact, virtually none of these sorties flew because of weather, tanker, or scheduling difficulties–or a combination of these factors.[24] Only one package of eight F-16 struck a target.[25] In its case, the Weasels failed to show, and therefore it went after the alternate, Salman North, just over the frontier, instead of Taji.[26]

Meanwhile, heavy attacks began on the Republican Guard, attacks that lasted all day. At 0600 four B-52s struck the Madinah Division; two hours later twelve Marine F/A-18s struck both Madinah and Hammurabi Divisions. Four F-4Gs, two Marine EA-6Bs, and four Marine F/A-18 antiradiation missile shooters suppressed enemy air defenses, while four F/A-18s provided air cover.[27] The near one-to-one relationship between support aircraft and bomb droppers for a target in the Kuwaiti Theater of Operations (KTO) stands in sharp contrast to the relatively weaker SEAD

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[21](S) Master Attack Plan, Third 24 Hours, 18 Jan 1991; and GWAPS Database.

[22]GWAPS Database of sorties flown and targets attacked.

[23](S) Master Attack Plan, Third 24 Hours, 18 Jan 1992, p 3.

[24]GWAPS Database.

[25]*Ibid.*

[26]401st Tactical Fighter Wing, "614th Tactical Fighter Squadron, Desert Shield/Desert Storm," GWAPS, no page numbers.

[27]*Ibid*; GWAPS Database.

support packages that were to accompany missions into central Iraq during the day.

At 0900 three more B-52s struck the Hammurabi Division. Further flights of B-52s hit the Republican Guard four more times during the day. Finally, starting at 0730 and continuing every half hour until 0830, large packages (upwards of ten) of F-16s pounded Madinah and Tawakalna. Throughout the remaining daylight hours into evening, F-16s continued working over the Republican Guard. The attention that the Iraqi elite force received reflected Schwarzkopf's priorities rather than those of his corps and division commanders. However, it is well to remember that air planners and commanders (as well as policy makers in Washington) had seen these units as political and strategic targets as much as military targets.[28]

But Baghdad and surrounding areas were *the* day's primary targets. At 1200 a major Navy strike package of aircraft from *Kennedy* and *America* hit Scud production and fuel sites west of the capital. Again Navy aircraft received heavy coverage from SEAD assets: five EA-6s, six F/A-18s, and three A-7s suppressed enemy air defenses, all in support of eight A-7 and ten A-6 strikers.[29] The heavy support reflected a stronger emphasis on SEAD sorties in the Navy's strike community–a considerably heavier emphasis than in the Air Force's tactical Air Forces (with the possible exception of units in Europe).

Three hours later, a package of forty F-16s, covered by eight F-4Gs and two EF-111s, was to hit targets in Baghdad. The Master Attack Plan called for sixteen F-16s to strike the Military Intelligence Headquarters, while eight would hit the Ministry of Information.[30] It is not clear why, but between the Master Attack Plan and the actual conduct of the mission, the package shifted to attack Scud sites around H-3 airfield.[31] Since Horner and Schwarzkopf were already under great pressure due to the Scud men-

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[28]*Ibid.*

[29]CNA Database; (S) Master Attack Plan, Third 24 Hours, 18 Jan 1991.

[30](S) Master Attack Plan, Third 24 Hours, 18 Jan 1991, and GWAPS Database.

[31]GWAPS Database.

ace to Israel, it is possible that they diverted the mission–particularly since one more major package was still to come to strike Baghdad.

The first two attacks on Baghdad were to have formed the prelude to one of the more interesting episodes in the war: Package Q. This attack was the largest of the war and did in fact represent an attempt to strike a powerful blow to enemy defenses. Nevertheless, the raid illustrates how a number of small incidents–or frictions–none of which by themselves necessarily serious, can contribute to a less than satisfactory outcome: in this case the loss of two F-16s.

The Master Attack Plan called for seventy-two F-16s to attack targets lying on an axis from southeast to northwest across Baghdad in the heart of Iraqi defenses. The package commander and most of the aircraft came from the 388th Tactical Fighter Wing (Provisional), but some aircraft came from the 401st Fighter Wing. In the last chapter we described how Package Q moved out from its bases to link up with tankers on tracks running up to the border. Shortly after 1300, the first aircraft began to roll and the complex ballet to assemble the package began. Each section within the package had received a mission number and call sign. Each mission cell would consist of up to eight aircraft, but smaller numbers of aircraft could make up a mission cell, depending on the target. All of the various pieces need careful coordination in order for the operation to function effectively.

Unfortunately, full coordination and planning did not take place for this mission. The Air Tasking Order reached mission commanders so late that some of those who led missions on 19 January received a brief outline of the day's mission upon landing after an exhausting day's flight on 18 January.[32] When mission commanders from the 401st began coordinating their portion of the mission on the morning of 19 January, they discovered certain crucial changes had taken place during the night. Their original target–as with much of the rest of the attack–had been the nuclear research

[32]Intvw, Maj John Nichols with GWAPS personnel, 20 Jul 1992. Maj Nichols was the mission commander of the last group of aircraft to attack Baghdad in Package Q.

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facility southeast of Baghdad. But overnight, the Air Tasking Order had changed their target to three major sites in downtown Baghdad.[33]

A major employment problem in the revised tasking was the fact that F-16s would begin striking targets in southeast Baghdad and then work their way through increasingly alerted defenses to the heart of the enemy capital.[34] Such an approach would maximize the exposure of the F-16 train to enemy air defenses; however, it was too late to change the order in which the mission subsets would attack targets.[35] So little time existed between the arrival of the Air Tasking Order and launch time that neither the package commander nor his mission commanders could change the order of the attack.[36] In fact, it is not clear how it was determined that the package would attack targets from southeast to northwest--outside of the fact that that was the fashion in which the Master Attack Plan had listed the targets.[37] There was time to coordinate the raid with the units at other bases, but that time was hardly optimum.

For the crews, the mission appeared risky, but within safety margins; their feeling was that earlier SEAD packages had attrited enemy capabilities and that the SEAD allocated would be sufficient to suppress the remaining defenses. Because of distances and fuel consumption, the F-4Gs could carry only two HARMs; moreover they would not have much time in the target area because of their high fuel usage. The F-16s were also heavily loaded, carrying two Mark-84s, two external fuel tanks, two air-to-air missiles, ninety bundles of chaff, and fifteen flares.[38]

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[33]401st Tactical Fighter Wing, "614th Tactical Fighter Squadron, Desert Shield/Desert Storm," CWAPS, no page numbers.

[34]This discussion of the events on the third day draws heavily on the oral testimony of two of its participants, Maj John Nichols and the Wing Commander, Col Jerry Nelson, who flew as a regular wingman on this mission, as well as the history of the 401st Tactical Fighter Wing (Provisional).

[35]Nevertheless, it is worth noting that those planning the mission "did believe that while the support package was a bit thin, it would suffice." Intvw, Maj John Nichols with CWAPS personnel, 20 Jul 1992.

[36]Much of the Air Tasking Order appears to have been passed to the units by phone. No complete ATO for the third day exists in the CWAPS files.

[37](S) Master Attack Plan, Third 24 Hours, 18 Jan 1991.

[38](S) *Ibid.*

Link-up and refueling with the tankers ran into problems. There was bad weather along the tanker tracks, and the tankers approached the release point too early. Consequently, they throttled back to minimum speed, which in turn seriously affected the accompanying fighters. The F-16s were soon close to stalling out, and some had to light afterburners just to stay airborne; four fighters coming off the last tanker fell so far behind that their mission commander ordered them to return to base.[39]

Fortunately, as the package reached Iraqi airspace, it broke out into the open. But Iraqi gunners greeted the Americans with a couple of high-altitude shots in the middle of several formations. Not surprisingly, there were difficulties in communicating among mission groups in the package; the mission commander of the flight attacking downtown Baghdad estimated that he received approximately 80 percent of the calls. Adding to the excitement of the flak exploding below, the Iraqis threw 100-mm shells into the formations. From the moment the package approached Baghdad's air defenses, the Weasels engaged enemy SAM sites. However, there was a problem with the Weasels allocated to the mission; either because of fuel, timing, or the decision of the package commander, not all appear to have made it to Baghdad;[40] moreover, some Weasels did not fire all their HARMs, which suggests that they had to leave because of fuel problems.[41]

Approaching their targets, the "downtown" aircraft (flying F-16s with newer model engines) passed F-16s on the way to, rolling in on, and leaving targets–all in a hostile environment. As Maj. John Nichols rolled in to strike his target, the Iraqi Air Force Headquarters, he heard the Weasels call that they were leaving. Unfortunately, cloud cover obscured the target; Nichols rolled off to turn to an alternate target, an oil refinery which was under attack by a portion of his formation.[42]

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[39](S) *Ibid.*

[40]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992.

[41]GWAPS Database. The database indicates that the Weasels only fired six HARMs; the leader of the Baghdad mission reports that it was not until after the Weasels had called in that they were leaving that the Iraqis began guiding their missiles from the ground. Intvw, Maj John Nichols with GWAPS personnel, 20 Jul 1992.

[42]GWAPS Database.

Up to this point, the Iraqis had fired most of their SAMs ballistically. Within a short time of the Weasel call that they were leaving, SAMs directly engaged Nichols' flight. Many SAMs were now guided and most of his flight had to take evasive action, which included "last ditch maneuvers" such as jettisoning fuel tanks and bombs. Approximately half of the flight struck the oil refinery; others were en route to alternate targets when SAMs engaged and forced them to jettison ordnance. SAMs hit one F-16 just as the last bombs were striking the oil refinery. As the flight egressed Baghdad, evading SAMs, another missile impacted near another F-16. Both aircraft were lost, but their pilots did survive the war. In all, the participants in the wild ride over the capital counted twenty SAMs in the air; one pilot dodged no fewer than six.[43]

A mission report from the 388th Tactical Fighter Wing whose aircraft attacked the nuclear facilities south east of Baghdad suggests the fierceness of the Iraqi response:

[DELETED].[44]

The unit history of the 614th Fighter Squadron (of the 401st Fighter Wing) also records the intensity of the enemy's response:

[DELETED].[45]

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[43] *Ibid.*

[44] Mission Report, 388th TFW Provisional, To: CENTAF/IN, 191936Z Jan 1991.

[45] "401st Tactical Fighter Wing," 614th Tactical Fighter Squadron, Desert Shield/Desert Storm, GWAPS, no page numbers.

The excitement for the survivors did not end when they left Baghdad. To bring an end to their day, a couple of MiG-29s started closing toward the rear of the F-16s as they exited the capital's environs; the F-15 top cover had apparently left with the Weasels. Nevertheless, all the F-16s had to do was turn on the MiGs, and the Iraqis ran. By the time that the F-16s approached the border some were almost out of fuel. One fighter would have crashed short of Coalition territory had not a KC-135 tanker from the Kansas National Guard crossed over into enemy territory. When the F-16 began refueling in Iraqi territory, it had only 800 pounds of fuel on board–in the words of the wing commander, flying as a wingman, "an eye-watering situation."[46]

Obviously, no one factor caused the loss of two F-16s and the possible loss of others. Rather a series of frictions–the lateness of the Air Tasking Order, not enough coordination time, a tactical approach that provided the Iraqis considerable warning, fuel problems for the Weasels and other aircraft, bad weather, insufficient attrition of the defenses–combined to create a dangerous situation, one ultimately catastrophic for two aircraft.[47]

F-117s replaced the conventional aircraft package in heavily defended areas.

[46]Telephone conversation with Col Jerry Nelson, 2 Sep 1992.

[47]Luckily the pilots were able to eject successfully, although the Iraqis captured both.

There were a number of crucial lessons from Package Q. The most obvious was that enemy defenses in Baghdad remained lethal; consequently, it was not worth the risk to send conventional packages into the heart of those defenses, especially when F-117s could strike such targets with little risk. This was entirely the result of its stealthy qualities, which its precision-guided munition capabilities magnified. Consequently, enemy defenses never put F-117s in the position where they had to jettison bombs over populated areas, and the chances of civilian casualties that would allow Saddam to manipulate the American media were considerably lessened.

There was, however, a crucial operational turn that the mission's failure caused. Glosson and his planners had hoped that destruction or at least degradation of Baghdad's air defenses would allow them to run large packages of F-16s into the capitol's environs during the daytime. Their targets, as on the morning of day three, would have been the larger command headquarters and symbols of the regime, such as those of the Ba'th Party, Republican Guard, and Military Intelligence. Most of these structures were so big that F-16s, even though less accurate, could hit such targets with a fair probability of success. As symbols of the regime, the destruction of such headquarters would have major political and military effects.[48]

The difficulties, however, into which Package Q ran, as well as the potential of inadvertent bomb release by aircraft under SAM attack, caused Horner and his planners to decide against sending any more F-16 packages against downtown Baghdad.[49] What speaks well for the American leadership in this air war was the fact that it did not repeat Package Q to prove some doctrinal beliefs of the high command at the expense of aircrew lives.[50] American air commanders adapted to the situation as it was. There would be no more conventional packages into the heart of

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[48]Conversation with Lt Col David Deptula, 31 Jul 1992.

[49]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 9 Apr 1992; and intvw Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1991.

[50]This had certainly *not* been the case in World War II or in Vietnam when senior air commanders had persisted in faulty operational approaches and tactics to the cost of large numbers of aircrew.

Iraqi defenses.[51] Moreover, F-16 packages would remain smaller–thus more manageable and easier to coordinate and fly–for the remainder of the war.[52]

Neither the difficulties encountered by the F-16s nor the problems that F-117s experienced on the third day stopped the continuing attacks on other portions of Iraq and occupied Kuwait. B-52s hit the Hammurabi Division three more times, as well as the Bayji oil refinery. They also launched a heavy attack on manufacturing sites in the Tikrit area. The Hammurabi Division also received a major strike by F-15Es, while the Navy attacked the bridges behind Saddam's elite force. Both chemical and ammunition storage areas also received extensive attention from Navy and F-111 packages. Finally, RAF and Saudi Tornados continued the pressure on Iraqi airfields throughout the day, while French and British Jaguars and Kuwaiti A-4s struck Iraqi forces in and around Kuwait City.[53]

Over the course of the third day Coalition air forces continued their domination of the skies over Iraq. F-15Cs from the 33d Tactical Fighter Wing accounted for all the kills: two MiG-29s, two MiG-25s, and two Mirage F-1s fell to their missiles.[54] By now a clear pattern was emerging in terms of the relatively few air-to-air engagements taking place. Iraqi pilots generally failed to respond to radar lock-ons and displayed almost no capacity or willingness to maneuver between the time that Coalition aircraft locked on to them and the time that a missile impacted. In two cases they ran into the ground before the missile hit, hardly suggestive of combat effectiveness or good training.[55]

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[51]One more mission of F-16s would go against the Iraqi defenses in Baghdad on the next day, but that would be the last F-16 strike against the capital during the war.

[52]On 20 January Gen Glosson told his chief planner, Lt Col David Deptula, that there would be no more packages greater than twenty-five aircraft: Deptula, personal notes, entry for 20 Jan 1991.

[53](S) Master Attack Plan, Third 24 Hours, 18 Jan 1992 and GWAPS Database.

[54]Thomas P. Christie, Gary C. Comfort, and Richard E. Guild, "Desert Shield/Desert Storm Air-to-Air Performance Study," Institute for Defense Analysis, Apr 1992.

[55]"33d Tactical Fighter Wing Air-to-Air Engagements through 21 February 1991. See the SPEAR evaluation of Iraqi pilot performance in the war with Iran which almost exactly foreshadows how their pilots would or would not react in the air superiority arena. SPEAR, "Iraqi Threat to U.S. Forces," p 3-63 to 3-64.

Nevertheless, the continued existence of Iraqi combat aircraft in hardened shelters throughout Iraq did worry intelligence analysts that Saddam would launch his air force on a massive suicide mission, reminiscent of the 1968 Tet offensive.[56] We will soon address how the planners responded to this fear and helped the Iraqis pay the first installment on future reparation payments to Iran.

On the other side, Coalition air losses did rise. In particular GR-1 Tornados had a bad day on 19 January. The British and the Saudis each lost two; these aircraft were still using low attack profiles, which maximized exposure to Iraqi flak and IR SAMs. Besides two F-16s lost against Baghdad, the USAF lost an F-15E to SAMs and an F-4G to fuel problems (possibly due to battle damage).[57] Given the number of sorties flown, these losses were well below prewar expectations and were more than sustainable.

The Air Campaign, 20 January to Al Firdos

The remainder of this chapter aims to provide a more general sense of operations than our detailed examination of the first three days. Consequently, we will now turn to a topical approach of specific issues that impacted on or guided the conduct of air operations.

The first specific problem area was obviously the hunt for the Scuds, their launching sites, and support structure, undoubtedly the most frustrating and least satisfactory aspect of the air campaign. This section has singled out the Scud story for examination in isolation. The rest of the chapter will consider shifts in priorities as well as continued efforts to destroy the Iraqi Air Force, the impact of weather on operations, and arguments as to when the air effort should move to preparing the battlefield for the ground war.

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[56]Intvw, Col John Warden with GWAPS personnel (Williamson Murray, Barry Watts, and Thomas Keaney), 21 Feb 1992.

[57]GWAPS Database.

The Great Scud Chase

Of all the aspects in the air campaign, the effectiveness of air operations in suppressing Iraq's Scud missiles remains the most unclear. As one recent report indicated well after the war: "To date, we have yet to confirm an Iraqi mobile SRBM [short-range ballistic missile] launcher kill resulting from U.S. aircraft attacks. . . ."[58] Without access to Iraqi (or for that matter Israeli documents) we cannot estimate crucial factors such as: How many missiles might the Iraqis have launched if the air campaign had not interfered, or interfered less successfully with their efforts? How many missiles and mobile launchers did air attacks destroy or damage? What constraints did air power impose on Scud launches? How likely was it that the Israelis might respond to the Scud bombardment and what effect might such an intervention have had on the Coalition, particularly its Arab members? The answers to such questions, of course, cannot become clearer until we have Iraqi documents and those of the concerned powers. But the Scud campaign did play an important role in the conduct of the Coalition's air campaign.

At the strategic level, one deals with the greatest imponderable of all: what impact would an Israeli retaliatory strike have had on the Coalition, particularly its Arab members? This author suspects that within the framework of the focus against Iraq and provided that such strikes remained limited and did not involve heavy casualties, the Coalition would have held. Immediately after the war, Schwarzkopf, however, felt otherwise, telling David Frost: "there was no question about the fact that, had Israel entered the fray [in response to the first Scud attacks], I don't think we could have held [the Coalition] all together."[59] Further exacerbating fears about Scuds was a belief that their use might involve chemicals to broaden the impact of missile attacks.[60]

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[58]Defense Intelligence Agency, "Defense Intelligence Assessment, Mobile Short-Range Ballistic Targeting in Operation Desert Storm," OGA 1040-23-91, Dec 1991, p 9. In fairness the report does indicate that [DELETED] did not evaluate the majority of aircrew-reported kills."

[59]Schwarzkopf television Intvw with David Frost, 27 Mar 1991, p 3.

[60]On 2 September CENTAF's Draft OPORD underlined as a "planning constraint" the likelihood that "Iraq will attempt to employ chemical weapons against the U.S. and friendly regional states, including Israel, if the opportunity arises." (S) COMUSCENTAF Draft OPORD, Offensive Campaign–Phase I, 2 Sep 1990, p 2. The October SNIE on Iraqi military capabilities concluded that "Iraqi tactical use of chemical weapons is virtually

Horner was more optimistic in interviews after the war. His sources in the Arab world suggested that Israeli strikes in response to Iraqi strikes would not have bothered the leadership of most of the Coalition's Arab members.[61] But Horner did worry that the movement of Israeli aircraft through Saudi airspace might lead to an air-to-air confrontation with U.S. aircraft, while an Israeli move through Jordanian airspace might bring that country into the conflict on the side of Iraq.[62]

Whatever the fears about Israeli response, there was little doubt that attacks on Arab territory *whatever the provocation* would have serious political consequences. The larger point, however, is that, whatever tactical and operational difficulties resulted from the hunt for Scuds, the effort against the missiles, combined with the perceived success of the Patriot in defending against them, achieved the strategic objective of enabling the Israelis to stay out of the conflict. And, it is on the strategic level that military organizations, nation states, and Coalitions win wars.[63]

The Iraqis had purchased large numbers of Scuds from the Soviets in the 1980s, and late in the Iran-Iraq War they fired some 190 missiles, which had been modified to provide ranges of 600 kilometers, at Iranian cities in an attempt to break their opponent's morale.[64] Even under the best of conditions, however, the Iraqi version of the Scud, the Al-Hussein, had a circular error of probability of more than 2,000 meters and carried less than 180 kilograms of high explosives. Consequently, they did not represent a significant improvement over German V-2s of World War II fame. They were not, then, a weapon possessing much military utility, but they did represent a distinct political and psychological threat.

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certain if Iraq suffers serious battlefield defeats" and even suggested the possibility of "Iraqi chemical attacks if Baghdad believes a Coalition attack is imminent." (C/NF) "Iraq as a Military Adversary," pp iv and 16.

[61]Horner's greater optimism after the war was undoubtedly framed by the fact that the Iraqis had failed to shake the Coalition.

[62]Oral History Interview of Lt Gen Charles A. Horner by Perry Jamison, Rich Davis, and Barry Barlow, 4 Mar 1992, HQ Ninth Air Force, Shaw AFB, South Carolina, p 40.

[63]Alan R. Millett and Williamson Murray, "The Lessons of War," *The National Interest*, Winter 1988/1989.

[64](S) Thomas P. Christie and William J. Barlow. "Desert Storm Scud Campaign," Institute for Defense Analysis, IDA Paper P-2661, p I-13.

The missile threat itself broke down into two distinct aspects. U.S. intelligence had discovered the locations of Iraqi fixed-launch sites constructed over the previous several years. Of sixty-four individual such positions in western Iraq, U.S. intelligence identified those which had launchers and those still under construction without launchers.[65] All such sites received heavy attention in the war's opening days.

Unfortunately, the Iraqis also possessed a number of mobile missile launchers. By early January 1991, intelligence estimates of mobile launchers had climbed into the high twenties.[66] In addition, the Iraqis had purchased a number of Scud decoys from the East Germans and had then manufactured their own local copies.[67] As one of the senior officials in DIA admitted after the war, there was "no accurate accounting of numbers of mobile launchers or where they were based [or] hiding."[68] Postwar intelligence indicates that the Iraqis had approximately thirty-six mobile launchers.[69] By December 1990 overhead imagery had made clear that the Iraqis had dispersed these missile launchers to unknown locations.[70] U.S. intelligence could estimate the general positions of missile firing baskets, all approximately 600 kilometers (324 nautical miles) from targets in Israel and Saudi Arabia.[71]

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[65]SRBM Fact/Information Sheet; Briefing, "Offensive Air Campaign," 20 Dec 1990.

[66]Conversation with Capt William Bruner, who tracked Scuds in the Black Hole during Desert Storm.

[67](S) Thomas P. Christie and William Barlow, "Desert Storm Scud Campaign," Institute for Defense Analysis, IDA Paper P-2661, p I-13.

[68]Intvw, Rear Adm J. "Mike" McConnell with Diane T. Putney, Center for Air Force History and Ronald H. Cole, JCS Historical Division, 14 Feb 1992, GWAPS NA 261.

[69]DIA, "Mobile Short-Range Ballistic Missile Targeting in Operation DESERT STORM," p 9

[70]DIA analysts who have gone back over the evidence believe that the Iraqis sent some of their mobile launchers into the field as early as August 1990. GWAPS discussion with DIA analysts 30 Sep 1992.

[71](S) DIA, "Iraqi Mobile SRBM Developments," DDX-1040-18-90, p 1-3.

But finding and then destroying the missile launchers and transporters remained a problem that was not solved in the months before Desert Storm.

[DELETED]

Worries in Washington concerning the political and diplomatic fallout from Scud attacks had been considerable from the beginning.[72] In fact, the Scuds represented an area where some genuine divergence of views occurred between Washington and operational commanders in the Gulf. Most senior air commanders had believed that the Scuds did not represent a particularly credible *military* threat. As Horner noted, the Scud was "a lousy weapon."[73]

[DELETED].[74] In the summary slides to a 20 December briefing for Cheney, Powell, and Wolfowitz, Horner predicted that the air campaign would "preclude" Iraqi missile attacks.[75] Apparently Horner did indicate that while he believed that Coalition air power would destroy fixed sites, mobile missile launchers represented a different order of difficulty, and that some would escape destruction.[76] Nevertheless, the records suggest that planners and commanders in the Gulf neglected to push preparations for an aggressive anti-Scud campaign to the full extent because they regarded Scuds as a weapon of little *military* consequence. In fairness, it was not yet clear, and would not be clear until the war, how successful

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[72]Paul Wolfowitz, Robert Kimmit, Dennis B. Ross, and John H. Kelley, in "The Gulf War Conference," pp 258, 262, and 267.

[73]Lt Gen Chuck Horner, "Speech at the Dadaelian Dinner," 11 Sep 1991, p 5. The circular error of probability for the Al Hussein (indicated above) certainly suggests the weaknesses of Iraqi Scuds as military weapons. Nevertheless it is worth noting that a Scud almost hit the *Tarawa* while it was tied up at an ammunition loading dock during the war.

[74][DELETED]

[75]Brfg, "Offensive Air Campaign," 20 Dec 1990.

[76]In a March 1992 interview Horner recounted about the 20 December briefing: "I'm not as politically sensitive as I should be. [Cheney] is going in[to] detail, 'How are you going to get the Scuds?' I show him [that] we are going to put two laser-guided bombs in every one of the fixed Scud sites the first opening moments of the war. BOOM, BOOM, BOOM. I mean how high can you get?!! With regard to the mobile, I show him where all the things were [that we were] hitting, but I just said, 'You can't get them all!'" Intvw, Lt Gen Charles A. Horner, p 42.

the Iraqis would be in eluding Coalition aircraft with their mobile missile launchers.

In the end, air planners settled on a strategy against Scud sites that targeted fixed sites in the opening days of the war, devoted a large number of sorties in the opening days to attacks on the manufacturing centers for the missiles and their fuel, and launched a significant number of sorties to those areas where the Iraqis would likely deploy their mobile launchers. The effort did not represent an attempt at eye wash, but it did miss how sensitive Coalition political leaders would prove to a continuing succession of Iraqi missile launches.

Fortunately, there were limitations that affected Iraq's ability to fire its missiles at Saudi Arabia and Israel. Until August 1990, the great threat to Iraq was Iran. Consequently, while the Iraqis had made some preparations to fire Scuds at Israel–underlined by Saddam's ferocious speeches threatening to deluge Israel with fire–most of the Scud storage facilities were probably not located in western Iraq.[77] Most likely, what the Iraqis had managed to prepare were a number of protected holding pens for mobile launchers and their missiles. Such sites were carefully prepared along the highways running through the launch baskets in western Iraq so that they would be difficult to find and hit from the air.

In any event, there were limits on the numbers of Scuds that Iraq could fire at any one time. Moreover, moving Scuds into firing positions down the Euphrates and Tigris valleys, an area covered with villages and vegetation, was easier than across the open deserts to western Iraq. Very possibly, that explains why the Iraqis fired more Scuds at the Saudis than at the Israelis, although the latter were undoubtedly the target of preference. Finally, at the end of the war the Iraqis began to fire missiles at King Khalid Military City from Baghdad.

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[77]This represents a supposition on the part of the author on the basis that the flat, unmarked terrain of western Iraq could only hide smaller storage sites for the missiles about to be launched against Israel. However, there was a limit to the number of mobile launchers that Iraq possessed and the evidence from the war indicates that in relatively short order, the Iraqis were moving Scuds out of their storage areas in central Iraq to the launch areas. The fact that they were able to move those missiles to their launch areas despite the considerable interest of Coalition air power in all movement demonstrates the elusiveness of mobile missiles as well as the effectiveness of Iraqi efforts to avoid detection.

The Iraqis initiated their reply to Coalition air attacks with a barrage of Scuds aimed at Israel. Between 0259 and 0327 on the morning of 18 January (Baghdad time), they fired eight Scuds at the Israelis.[78] The missiles landed higgledy-piggledy without causing much damage, but fears that these weapons contained chemical or nerve agents magnified their psychological impact.

The effect of Scuds on the air campaign was immediate. Notes taken in the TACC the next morning suggest the pressure from Washington:

> 0825: Gen Glosson on the phone in Black Hole: We will spend the remainder of the day targeting Scud sites. Imagery shows we had not destroyed all that we had thought. I don't know what's going on. The alert birds (ground) will be sent up and they will just go back and forth to the tankers until we get them. . . .
>
> [DELETED]
>
> 0938: Gen Glosson: CINC is getting a lot of calls from Washington about the Scuds.
>
> 0948: Second bunch of A-10s found seven MELs [mobile launchers]; destroyed two. We are sending more A-10s. First site given was wrong. Actual site in SW corner of Iraq. These are supposed to be targeted at Riyadh.
>
> 0952: Gen Glosson: We have found nine of their twenty-seven TELs in the open. We need to go get them. . . .
>
> 1040: Crigger to Horner: A-10s are being sent to the seven TELs. Also the F-15s are on the way. . . .
>
> Horner: They (F-15s) should be there by now. Doesn't care if they get there all at the same time. Want those Scuds gone.[79]

From the first, political pressure from Washington was enormous.[80] To a certain extent, the airmen were caught by overly optimistic estimates

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[78](S) Christie and Barlow, "Desert Storm Scud Campaign," Appendix A, Defense Support Program Scud Launch Log, p A-1.

[79]TACC NCO Log, Notes by TSgt Barton, 18 Jan 1991.

[80][DELETED]

of the prewar period.[81] Nevertheless, despite pressures from above, Horner kept his eye on the larger strategic aims lying behind the air campaign. On 18 January, he commented to the morning stand up:

> Last night we had a very busy night because of the Scud launches. The Scuds will continue to be a problem, not militarily, but politically. Consequently, we need to turn our attention toward timely detection and destruction of Scuds, so that we don't allow him to pull our minds off our primary job: that's taking down his military machine and getting him out of Kuwait.[82]

Unfortunately, there were no easy methods for finding and destroying mobile missile launchers, especially at night. Air attacks in the first several days appears to have removed the fixed sites as possible launching pads.[83] The first week, however, was a particularly difficult time: four more missiles in the early morning hour of 19 January; then eight at Saudi Arabia on the 20th; seven at the Saudis on the night of 21/22 January; one at Israel early on the night of 22/23 January; four at Saudi Arabia (all at 2254 local) and one at Israel (2300) on the evening of the 23rd; eight at Israel on the evening of the 25th and three at Saudi Arabia over the night of the 25/26; and four at Israel and one at Saudi Arabia on the night of the 26th/27th.[84]

Iraqi firings during this period do suggest a pattern: heavy firing at Israel on the 18th, 19th, 25th, and 26/27th; heavy firing at Saudi Arabia on the 21/22nd, 22/23rd, and 25/26th. Thereafter, there was a fall off that lasted the remainder of the war; with the exception of a few days, the Iraqis were barely able to fire one shot a day; on many days they did not manage to get off any shots. Nevertheless, during the first ten days, when the Iraqis fired an average of five shots per day, there were periods

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[81]In fairness to them it was impossible to estimate what the effectiveness of new technologies might be in locating mobile targets in a wide open area such as western Iraq.

[82]HQUSCENTAF, Office of History, "Daily Comments of Lt Gen Horner," 20 Mar 1991, Horner file in CWAPS.

[83]The Iraqis did not make any attempts to launch from the fixed Scud sites during Desert Storm. Whether they decided to forego their use prior to 17 January 1991, or were prevented from doing so by Coalition air strikes remains a matter of speculation.

[84](S) Christie and Barlow, "Desert Storm Scud Campaign," Appendix A, Table A-1.

when activity dropped to zero; that fact alone suggests that from the beginning they were having considerable trouble in getting missiles out of their main storage areas.

Nevertheless, even this relatively low level of firings caused serious perturbations within the American leadership. The Army rushed out Patriot batteries to Israel. The military effectiveness of those batteries defending Israel (and Saudi Arabia) is a moot point. What was crucial is that they provided political and strategic reassurance to the civilian populations of Israel and Saudi Arabia; they underlined that U.S. forces were engaged in a significant effort to provide protection from Scuds. The far higher casualty rate that the Scuds caused in the Iran-Iraq War suggests that the Patriots did manage to provide a significant measure of protection during the Gulf War.[85] But the essential point was the political impact that the Patriots achieved in terms of civilian morale.

The main pressure came on the air commanders.[86] Horner and Glosson had to focus resources on trying to suppress and destroy Iraqi Scuds and their launchers. The platform that ended up being most affected by this requirement was the F-15E. The sensors on these aircraft included both LANTIRN and a synthetic aperture radar. An ideal choice for going after elusive mobile targets at night, the F-15Es soon became heavily engaged in the "Scud Hunt." The abundance of air assets forced a heavy reliance on scheduling in advance. Consequently, there were

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[85]In the exchange of missiles between Iran and Iraq that took place in the winter and spring of early 1988, the Iraqis fired approximately 190 extended-range Scuds at Tehran and several other Iranian cities. They caused 2,000 deaths and a considerable number of injured. Approximately half that number of Scuds were fired during the Gulf war at targets in Israel and Saudi Arabia, but the number of casualties, civilian and military were considerably under that number. That certainly suggests that the Patriots had a considerable impact on the effects that the Scuds were able to achieve; unopposed, the Scuds might have achieved far higher casualty figures with serious political implications. Hiro, *The Longest War*, p 200.

[86]For example on 30 January Horner noted in the Current Ops Log: "CINC Meeting tonight–please keep info moving upchannel to CENTCOM–They get Mucho Heato from D.C. When they don't feed the info monster every three-four hours–Good news is wanted but beware once you start sating [sic] the monster becomes ever hungrier." TACC, CC/DO, Current Ops Log, 30 Jan 1701Z, GWAPS, NA 215.

times when Scud targets appeared vulnerable, but strikers were not always available.[87]

Planners had recognized before the war that mobile Scuds would represent a significant nuisance. However, they calculated that alert aircraft, A-10s and F-15Es, would suffice to suppress most of Iraq's launch capabilities. That, of course, was not the case. The first diversion of Coalition assets came with efforts to use AC-130 gun ships against mobile missiles, but the near loss of one of those aircraft in the high threat environment of western Iraq ended that approach.[88]

It was soon clear that only aircraft flying on station over the launch sites could attack the mobile launch platforms before they escaped.[89] Moreover, the suppression effort required significant air assets to shut down road traffic in western Iraq by day and night–a tall order indeed. As a result, anti-Scud efforts evolved into two approaches: the first to interdict missiles coming from storage sites to launch baskets; and the second to suppress launch activity by making the Scud crews believe that the accomplishment of their mission was a dangerous task indeed. On 20 January Horner and Corder underlined the importance of the Scud search by creating a "Scud Chasing Log" in the TACC to track anything and everything that had to do with mobile missile launchers.[90]

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[87]The NCO recorder in the TACC noted on 31 January: "With all of the aircraft in theater, I found it difficult to believe that we were actually 'short' [of available aircraft to strike Scud sites]. We do, however, have that problem. With the number of packages and individual missions scheduled in the ATO, there are, in fact, very few unscheduled aircraft available!" TSgt Barton's notes of conversations in the TACC,

[88]To evade an Iraqi missile fired at it, the AC-130 pulled so many Gs that it had to be returned to the United States for a major overhaul. "AC-130 Gunship Desert Storm Mission Summary," attch to 16SOS/CC to the Office of the Secretary of the Air Force, 14 May 1992.

[89]But even then they could have a difficult time. On 9 February the Current Ops Log reported: "Scud launch–Israel. Two F-15Es were on station and saw the launch but were unable to find the launcher. Two F-15Es on target immediately–two additional F-15Es closed within five minutes. No luck." TACC, CC/DO, Current Ops Log, 09 0036Z Feb, GWAPS, NA 215.

[90](S) Christie and Barlow, "Desert Storm Scud Campaign," Appendix C reproduce the TACC Scud Log.

By the end of the first week, the Scud campaign showed focus and a measure of success, but it required a diversion of resources from the rest of the air campaign. The effort over the night of 23/24 January, for example, suggests the extent of resource diversion. From 1800 on the 23rd to 0800 on the 24th, four F-15Es remained on airborne alert fifteen to twenty minutes from western Scud launch baskets. If after four hours there were no launches or no reported activity, the F-15Es then struck Scud-related targets; at the same time four new F-15Es arrived on station. At all times during this period, eight F-15Es stood alert to replace airborne aircraft should they attack suspected Scud targets.[91]

At the same time in the east, four F-16s with LANTIRN navigation pods maintained the same airborne alert over eastern launch baskets. Eight F-16s backed up the airborne aircraft, while the airborne F-16 attacked preset targets after four hours. Meanwhile, twenty-four hours a day, two A-10s worked over each Scud Box area, while twelve A-10s stood ground alert with one hour reaction time.[92] In fact, the Iraqi launches against Saudi Arabia appear to have caused about as considerable a diversion of air resources as the attacks on Israel.

In addition, there were number of preplanned missions against Scud targets and support facilities. At 2015 on the 23rd, twenty F-111Fs, supported by four F-4Gs, two EF-111s, and eight F-15Cs, struck suspected Scud sites and shelters at Qalat Salih airfield. At 0400 on the 24th, twenty F-111Fs, with a support package similar to that of the earlier F-111F strike, hit the H-2 airfield shelters. One hour later, eight GR-1s, supported by a Navy ECM package of one EA-6B and two F-14s attacked the H-3 army barracks. Finally, late in the afternoon of the 24th, sixteen A-7s, supported by ten F-14s and two EA-6Bs, hit the lines of communications running into the H-1 airfield.[93] [DELETED].[94]

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[91](S) Christie and Barlow, "Desert Storm Scud Campaign," Table III-3.

[92](S) *Ibid.*

[93](S) *Ibid.*

[94]USASOC HISTORY: "Army Special Operations in Operations Desert Shield/Desert Storm, attch to letter from Richard W. Stewart, Command Historian to HQ, USSOCOM, 22 Apr 1991.

Three days later, the CENTAF Director of Operations, Maj. Gen. John Corder, detailed the effort against the Scuds in the TACC log. His report formed the basis for a later paper for Powell on the air resources devoted to suppressing the Scud menace. Horner commented at the end of Corder's notes: "victory & frustration–issue never in doubt, but a high price to pay to kill a pain in the ass."[95]

How effective were such efforts? It is hard to say in a tactical sense; the evidence of how many mobile Scuds and their launchers Coalition air attacks destroyed or damaged remains spotty. It does appear that a number of tanker trucks on the way to Jordan or Basra paid a severe price for having infrared signatures resembling mobile launchers; some Bedouins also may have paid a similar price for having elongated, heated tents in the desert blackness that looked like canvas-draped Scuds. In the end, the best one can say is that some mobile launchers may have been destroyed. Although Iraqi launch rates of modified Scuds–particularly of coordinated salvos–dropped over the course of the campaign, and while mobile Scud operations were subjected to increasing pressures and disruption, most (and possibly all) of the roughly 100 mobile launchers reported destroyed by Coalition aircraft and special operation forces now appear to have been either decoys, other vehicles such as tanker trucks, or other objects unfortunate enough to provide "Scud-like" signatures.[96]

By the end of January, the number of Scud launches had dropped dramatically. Over the last thirty days of the war, the Iraqis barely launched one missile per day. By 28 January, Horner at least was feeling confident enough about the Scud problem to joke in the TACC log: "28 [Jan] 1845Z–one Scud shot down another of our Patriots. . . .Have not had a successful Patriot launch to Iraq yet."[97]

By the end of the war, the Scud hunt had absorbed nearly 20 percent of F-15E sorties, 2 percent of A-10 sorties, 4 percent of F-16 sorties, and 3 percent of F-111F sorties. In addition, a significant number of sorties by B-52s, A-6Es, A-7s, F-117s, F/A-18s and GR-1s also engaged in

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[95]TACC Log, "Scud Suppression–Tactics and Procedures as of 27 2300Z Jan 1991."

[96]See GWAPS Effectiveness report, Chapter 6.

[97]TACC, CC/DO, Current Ops Log, Horner note, 28 January, 1845Z, GWAPS, NA 215.

attacking Scud sites or production facilities.[98] Still, it is worth noting that the Iraqis were able to make a successful recovery in the last days of the war; while they never reached the number of launches of the first weeks, they were still able to cause considerable discomfort and casualties to their enemies.

The psychological impact of these missiles was considerable, not only on civilians in Israel and Saudi Arabia, but on Coalition soldiers and airmen as well. Yet, one of the greatest successes that the Scuds achieved was the degree to which they caused "worst casers" in the intelligence community to overestimate the impact of future missile attacks. A DIA report from early February warned:

[DELETED].[99]

Luckily, such pessimistic intelligence did not overly influence senior leadership in Washington.[100]

In terms of its indirect effects, the Scud was the most effective weapon in the Iraqi inventory; it drew off significant numbers of Coalition air sorties that could have found more productive utilization in other areas.[101] Nevertheless, the Coalition possessed an excess of air power

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[98]Approximately 1,500 Coalition strikes altogether were focused against Iraqi ballistic missile capabilities. Half of those strikes hit targets such as culverts, overpasses, and fixed sites; 30% went after missile and fuel production facilities. Barely 15% (approximately 215 sorties) actually reported that they had attacked mobile launchers. Roughly another 1,000 "Scud patrol" sorties were planned against mobile Scud launchers but ended up attacking other targets.

[99](C/NF) Defense Intelligence Memorandum, "Iraqi Mobile Scud Launcher Inventory and Employment Strategy," DIM 54-91, Feb 1991. GWAPS, CIM Folder #28.

[100]It is worth considering what the impact of such reports might have been on a weaker or less resolute leadership.

[101]There is a direct comparison between the effect of the Scuds in the Gulf War and the effect of the V-1 in the last years of World War II. The V-1 was a rather inexpensive weapon that possessed no great accuracy, but was nevertheless able to draw off considerable resources from both the Allied strategic bombing campaign and tactical air efforts to identify and attack the fixed sites. The British government feared–quite rightly–that the explosion of large numbers of V-1s in southern England might have a serious impact on the morale of the population and its willingness to see the war through to a successful conclusion. In the end, Allied air and ground forces mastered the threat but only after

over its requirements; it is difficult therefore to say how much more effective those sorties might have been against other targets. What is clear is that after 26 January–ten days into the war–the Iraqis had difficulty firing their missiles. In the first ten days, they fired forty-nine Scuds; in the remaining thirty days, they succeeded in launching only thirty-nine, 20 percent less over a period three times longer. However, what does suggest Iraq's capacity to adapt to Coalition air strikes was the considerable recovery of Scud firings in the last two weeks of the war. From the beginning to the end of the war, Scuds introduced a serious friction into the conduct of the air campaign–one that did not affect the final outcome, but only due to the absence of any other Iraqi successes.

There is, moreover, a larger issue: the question of might-have-beens. Except for the hit at the war's end that killed a large number of U.S. Army reservists, the Scuds achieved little damage and few deaths. Nevertheless, a Scud nearly hit the USS *Tarawa*, while that ship was tied up at the main dock at Dhahran–a dock piled high with ammunition. It does not take much imagination to visualize what an actual hit might have achieved in political and psychological terms.

Air Supremacy

For much of the first week, weather and continuing difficulties with the Air Tasking Order hampered the strategic air campaign. The Black Hole and Air Tasking Order schedulers did not get a full handle on the scheduling process until 23 January. Even then, substantial problems in scheduling and processing the Air Tasking Order remained until the end of the conflict. The constant flow of changes and new intelligence that occurred, at times even as Allied aircraft were launching, always perturbed the process. In particular, Checkmate and Admiral McConnell proved to be particularly useful conduits for getting time-critical intelligence out to Glosson and the Black Hole.[102]

Nevertheless, such interruptions in the plan's execution did not make the system run more smoothly or ease the lives of the crews and mainte-

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the expenditure of resources far in excess of what the Germans had devoted to the V-1.

[102]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992.

nance personnel. As late as the 25th, Horner was voicing displeasure with how the system was working: "I sure hope that it was well-coordinated [changes to the Air Tasking Order], because I hate to think of sending some guys up there [and] having fifty or sixty SAMs shot at him [sic] when he got jerked around with an alternate mission. . . .Yesterday we saw the air battle that almost got away from us."[103]

Overall, Horner believed that the air war was going in favor of his forces. On 23 January, he commented to the CENTAF staff at the 0730 briefing:

> Bean counters are concerned about holes in runways. They are missing the point. The point is [that] there's no power in Baghdad, no chemical attacks, and their nuclear capability is damaged. We've had [few] aircraft losses. Remember aircraft losses are wins for him. We are going to work on the Republican Guards now. We must keep the pressure on. We know the score is ninety-six to one, but we don't know what inning we're in.[104]

Horner's comments were particularly perceptive, because it remained unclear how much pressure the air campaign had imposed on the Iraqi regime. The direct results were obvious: control of the air, the shut off of electrical power throughout much of Iraq, and the damage to much of the military and communications infrastructure throughout Iraq. Nevertheless, thus far the Iraqis had shown no sign of bending, much less cracking.

As discussed above, Scuds continued to cause great concern and diversion of effort, and there was no way to judge what effect air attacks were having on Iraqi morale. Moreover, bad weather was interfering on a continuing basis with Coalition operations against strategic targets. Finally, while the "strategic" air campaign had dominated events during the first three days, external events and factors now impinged on the conduct of the campaign.

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[103]"Daily Comments of Lt Gen Horner, 25 Jan 1991, HQCENTAF, Office of History, 20 Mar 1991, Horner Files GWAPS.

[104]*Ibid*, 23 Jan 1991, 0730 Briefing.

The interference that continuing patterns of bad weather imposed is most noticeable when looking at F-117 strikes. Out of the first ten days of the war, weather affected half or more of the planned F-117 strikes on three days, one-third of them on two more days, and about one-quarter of the planned strikes on three other days. The weather on ATO Days 2 and 7 was the worst during this period; both these days saw two-thirds of the planned strikes end up as weather "no drops" or weather-induced misses.[105] After the war, Glosson admitted that by the end of January, the weather had the campaign "absolutely beat down."[106] He noted in his diary on 28 January:

> Bad weather again. Fourteen days on the calendar. . . .Due to the weather were have flown fewer than 100 sorties on Baghdad. Supposed to have flown 300. Whole pace of the campaign disastrously affected.[107]

The Euphrates Valley remained fogged in for one period of five straight days, and weather conditions forced diversion of precision sorties to targets outside of Baghdad. By 27 January Schwarzkopf was pushing Horner and Glosson to move the campaign's focus to Phase III, preparation of the battlefield for the coming ground campaign. But by that point, instead of having achieved ten days of target destruction in the strategic bombing campaign, weather had affected operations to such an extent, that the campaign had only reached levels of destruction planners had believed they would achieve the first four to five days of the war.[108]

Besides weather, other factors imposed friction on the air campaign. Coalition air commanders had expected more of Iraq's air-to-air fighters to come up and fight. While the Iraqis had flown approximately thirty-five shooter sorties per day in the conflict's first week, Coalition air-to-air kills virtually ceased after the third day.[109] The Iraqis were not only

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[105]GWAPS Database; Manual counts, Appendix 1, Effectiveness report.

[106]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992.

[107]*Ibid*; Gen Glosson showed this particular entry to the interviewers from GWAPS.

[108]*Ibid*; also Intvw, Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1992.

[109]DOD, *Conduct of the Persian War: Final Report to Congress*, Table VI-6, pp 204 and 216.

refusing to fight, but were in fact running at first sign of Coalition aircraft.

While this lack of serious opposition in the air eased the conduct of day-to-day operations, it presented the Coalition with a latent threat.[110] The Iraqis still possessed much of their air force and air capabilities sheltered in hardened shelters. Moreover, the media was not slow to comment on how few Iraqi aircraft the Coalition had shot down thus far in the war. Finally, fears surfaced that the Iraqis might launch an all out air assault to achieve the equivalent of the Tet offensive in January 1968.[111]

Since the Iraqi Air Force would not fight, Horner and Glosson determined to go after it in its lair. The Iraqis had built nearly 600 shelters on various airfields. Some of these, such as the super-hardened shelters at Balad SE and Al Asad, were bunkers with sufficient strength to take over-pressures even from nuclear weapons.

On 21 January, F-111Fs began attacking these shelters; on the next night F-117s joined the effort. The attackers dropped 2,000-pound, laser-guided bombs. While the initial intent was to start with the main

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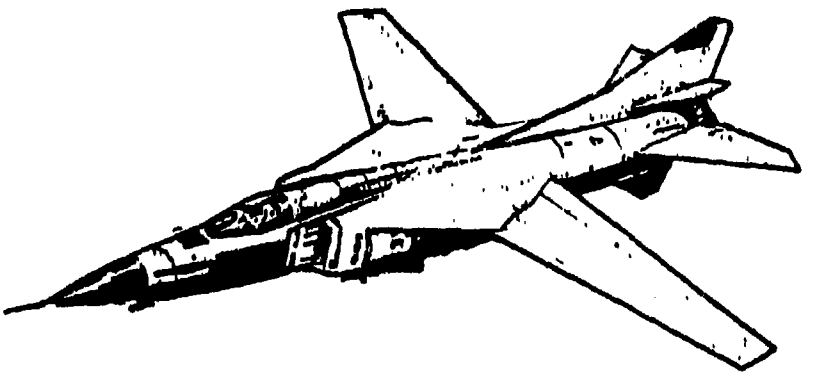
[110]The lack of reaction by the Iraqi Air Force did cause some considerable uneasiness among Coalition aircrews, particularly the F-111F drivers. They reported on several occasions being intercepted by Iraqi aircraft that approached them and even illuminated them with searchlights without ever firing. The TACC log reports a ballad about "Baghdad Billy" that runs as follows: "I'm an F-111 Jock, and I'm here to tell/of Baghdad Billy, and his jet from hell./We were well protected, with Eagles in tight/ but that didn't stop, the man with the light./ RJ, AWACS,–they didn't see/ As Baghdad Billy, snuck up on me./ Then I found a spotlight shining at my six/ and my whoozoo said, hoolyy shit./ I popped off some chaff and I popped a flare/ but that Iraqi bandit, he didn't care./ I had tracers on my left, and tracers on my right/ with a load of bombs, I had to run from the fight./ I rolled my Vark over and took her down/ into the darkness and finally lost the clown./ When I landed back at Taif and gave this rap/ CENTAF said, I was full of crap./ I'm here to tell you, the Gods' honest truth/ that Iraqi bandit, he ain't no spoof./ You don't have to worry, there is no way/ you'll see Baghdad Billy if you fly in the day./ But listen to me son, for I am right/ watch out for Baghdad Billy if you fly at night!!!" There was never any evidence that the Iraqis ever intercepted an F-111 flying at night, much less managed to shine a spotlight on it. Nevertheless, the story has a tragic ending, because an F-111 appears to have flown into the ground attempting to escape from a nonexistent Iraqi aircraft. TACC, CC/DO, Current Ops Log, 9 Feb 1991, GWAPS, 215, and Intvw, Maj Gen Buster Glosson with GWAPS Personnel, 14 Apr 1992.

[111]Intvw, Col John Warden with GWAPS personnel, 21 Feb 1992.

operating bases in central Iraq, weather ended up focusing the bulk of the early effort on secondary fields in southern Iraq. As a result, estimating the number of Iraqi aircraft destroyed inside shelters became difficult. Nevertheless, video imagery of attacks on hardened aircraft shelters at Balad SE on 23 January showed hits against several shelters being followed by spectacular secondary explosions.[112] Regardless of the number of aircraft destroyed inside hardened shelters, the Iraqis were soon in danger of running out of shelters. In the end, the air attacks against the Iraqi Air Force's hardened shelters would destroy 375 of 594 (63 percent).[113]

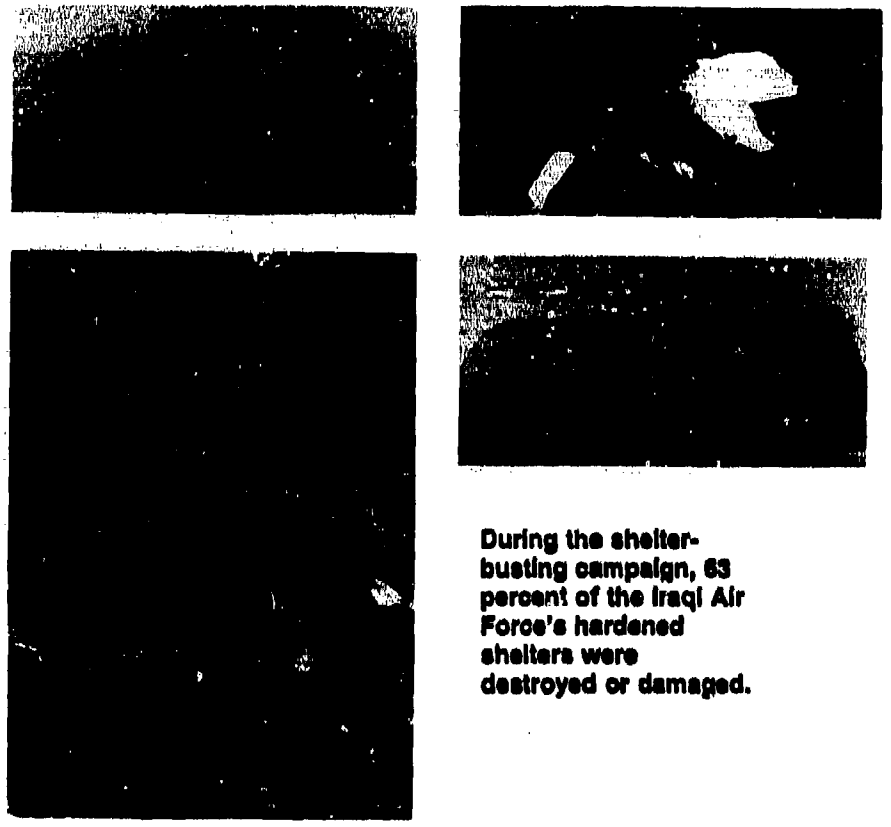
Faced with the possibility that the entire air force might be lost, the Iraqis opted to fly what aircraft they could to Iran.[114] The move caught the Coalition by surprise. In fairness, the flight to Iran was a desperate move–in effect the Iraqis were making the first reparation payment to the Iranians for the Iran-Iraq war. The flight to Iran provided Coalition fighter pilots with increasing opportunities to add to the box score



[112]VCR film of F-117 and F-111 strikes, GWAPS files.

[113]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, p 154.

[114]At the beginning of the war with Iran when his air force had performed equally badly, Saddam had ordered it to fly its aircraft out to Kuwait, Jordan, and Saudi Arabia. But then at least he had a few friends.



During the shelter-busting campaign, 63 percent of the Iraqi Air Force's hardened shelters were destroyed or damaged.

of air-to-air engagements. In reaction to the flight of Iraqi aircraft to Iran, Glosson established CAP (combat air patrol) missions of F-15s and F-14s deep in Iraq as a barrier to the escape of enemy aircraft. In fact, some Iraqi pilots were so inadequately trained that they crashed their aircraft for lack of fuel in the journey to Iran. Thus, the shelter-busting campaign finished the Iraqi Air Force as a possible combat factor. Some of the aircraft remaining the Iraqis had to hide among villages and historical sites; absolute air supremacy now lay in the hands of Coalition air forces.

The Course of the Strategic Campaign

How the Coalition would utilize its air supremacy was now the crucial question. The opening of the campaign had seen a carefully plotted and integrated operational approach achieve great effects at rela-

tively little cost. However, after the first two days, those planning the course of the strategic air campaign were found to react to day-to-day pressures in their effort to achieve a variety of objectives. Many of these had been clear before the war, but the full complexity of the target sets only emerged as the war unfolded. However, some of the objectives that gained prominence during the campaign were not apparent before the war; the Scuds and the attacks against hardened shelters are cases in point. Moreover, the bad weather and pressures from Washington, particularly dealing with Scuds, added to complexities confronting Horner and his subordinates.

Early on the afternoon of 26 January, Horner sat down and wrote a detailed precis of the air campaign's achievements and future direction.[115] His notes provide a useful summary of his intentions, goals, and conceptions. It is well to remember that, when Horner wrote this memorandum, the shelter-busting campaign was just under way.

The CENTAF commander began by indicating that Coalition air forces had achieved air superiority. During the first days, allied air attacks had sought to limit Iraqi air activity by reducing the number of available operating surfaces at key airfields. By this point in the war, air attacks had been carried out against the bulk of the enemy's major bases and the enemy air force bottled up on the ground; a top priority would be eliminating the Iraqi air force at its airfields.[116] Unfortunately, the Iraqis

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[115]At the 1700 Staff briefing that afternoon, Horner noted to his officers, "Things appear to be going well. Had a good day today, weather has been good. We're getting some good results. If I had to summarize how we're doing, I'd say despite some pretty bad weather, probably four days of weather losses, we are doing well. But it does not mean that we will not be striking targets throughout Iraq. We will. But the goals of taking down the IADS; the goal of neutralizing his air force; the goal of severely crippling his ability to produce weapons such as biological, chemical, and nuclear [have been largely achieved]. Horner File: Daily Comments of Lt Gen Horner, HQUSCENTAF, 26 Jan 1991, 1700 Brief, Office of History, 20 March 1991. The chief planner in the Black Hole noted on 28 January: "Results to date–No electricity, water in Baghdad–No allied air losses last forty-eight hours–No Iraqi air activity last twenty-four hours–leadership driven underground–NBC capability set back ten to fifteen years–oil refining capability reduced 70% to 80%–100% electricity out in Baghdad–no water–50% out nationwide" (Deptula, Personal Notes). The Black Hole kept a running status board that was mounted on the planning map of Iraq. The board kept track of the status of each target set.

[116]TACC, CC/DO, Current Ops Log, "Air Ops Summary of Air War, written by Lt Gen Horner after 8 1/2 days of Combat, 26 1100Z 91," GWAPS, NA 215.

had committed few aircraft, so that Coalition fighters had achieved a relatively small number of shoot downs. In all, Horner felt that he needed between 160 and 210 sorties to finish off the enemy base system and thus, the Iraqi Air Force. As for remaining Iraqi air defenses, he noted that Salman Pak was the only remaining intercept operations center that still functioned. Coalition aircraft would deal with the SAM threat by a combination of suppression–i.e., HARMs and ECM—and destruction: bombing the sites themselves.[117]

Turning to the strategic campaign, Horner underlined the importance of continuing efforts to isolate the Iraqi leadership. Parenthetically, he noted that the Rasheed Hotel was a key node, but that there would be political costs for attacking it.[118] Interestingly, he suggested that his goal remained the creation of an environment in Iraq "where the current leadership cannot control and provide the opportunity for new leadership to emerge."[119] Here he thought that he would need approximately 210 sorties. For both NBC (nuclear, biological, and chemical) and Scud targets, Horner emphasized the destruction of current stocks, as well as production, and research and development facilities.[120]

Two other categories remained in the strategic campaign in Horner's notes: 1) electricity and petroleum (POL) and 2) military storage. In the former case, the CENTAF commander emphasized destruction of refined POL products and several major electrical plants still apparently producing electricity.[121] Horner's impression that they were still functioning at this point probably reflects bomb damage assessment problems. From the number of sorties allocated to electricity and POL (thirty to each), Horner clearly did not believe much work remained against these target sets.[122] For the military support category–which included munitions storage facilities, missile research and development and production facilities, and

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[117] *Ibid.*

[118] Coalition aircraft, of course, never attacked the Rasheed Hotel.

[119] *Ibid*, p 3.

[120] *Ibid*, p 3.

[121] In retrospect, it appears that these three plants were in fact inoperative by 26 January. Horner's impression that they were still functioning at that point probably reflects bomb-damage assessment problems.

[122] *Ibid*, p 4.

storage facilities–Horner allocated 200 sorties. Here the aim was at long-range effects beyond the tactical needs of the Gulf War.[123]

The final categories on Horner's list were the Iraqi ground forces. He hoped to isolate and destroy the Republican Guard; to achieve this goal he estimated the need for 10,000 sorties over a ten-day period. Finally, in terms of the other Iraqi ground forces in the KTO, the CENTAF commander could not come up with a total because he felt that the requirement would depend on psychological operations and how ground commanders shaped their requirements. He did estimate that CENTAF would need approximately 750 sorties per day for an indeterminate period against the ground forces in the KTO.[124]

At the end of his rough estimate of the situation, Horner calculated the number of sorties, type of platform, and time that would be needed to accomplish these tasks. For strategic targets, Horner calculated approximately 640 more F-111F and F-117 sorties over nine days to destroy the remaining strategic targets.[125] In conclusion, he summed up the overall situation. At the top of his list was the need to defend Saudi Arabia and solve the Scud problem. In terms of the strategic attacks on Iraq he suggested 1) "protect our force from air attack, [2)] keep leadership isolated/C^2 degraded, [3)] destroy NBC capability, current and future, [and 4)] service as required SAMs, IADS [integrated air defense system]." To attack the Republican Guard he would rely on "penetration and heavy bombers;" to attack the enemy's artillery, supplies, and armor in the KTO, the Coalition would use its "attack aircraft."[126] Clearly, Horner was ready to refocus the air campaign on Phase III, preparation of the battlefield.[127]

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[123] *Ibid*, p 4.

[124] *Ibid*, p 4. Despite the fact that Republican Guard units were also ground forces they had been counted from the first as a separate category because of their political importance to the stability of the regime.

[125] Horner's numbers do not add up, but he was clearly thinking on paper rather than providing a detailed analysis for either his superiors or subordinates. For that very reason this document provides a particularly useful look into his mind at this stage in the campaign.

[126] Lt Gen Chuck Horner, "Air Ops Summary," TACC Log, CC/DO. GWAPS, NA 215.

[127] As early as 18 January Horner indicated to his staff his readiness to move quickly towards preparing the way for the ground forces: "I would suspect that in the next few days we will finish up valid targets in Iraq and begin to really shift our emphasis on[to]

There are a number of interesting aspects to Horner's estimation of the tasks remaining for Coalition air power.[128] He already felt relatively near to closure on most strategic target sets. The Scuds still remained as a problem; here political pressures undoubtedly played a role in his estimate. As for Iraqi ground forces, his emphasis lay on the Republican Guard; his focus was already moving away from the strategic air campaign against Iraq. Admittedly, from the first, air and ground commanders had regarded the Republican Guard as a strategic target–the destruction of which would carry political as well as military consequences. The attack on other Iraqi ground forces was of less consequence in Horner's mind, but that largely reflected Schwarzkopf's emphasis on the Republican Guard.[129]

Over the first four weeks of the campaign, Coalition aircraft struck a wide variety of strategic targets. The focus had shifted due to a variety of factors: long-range goals for the strategic air offensive, immediate military needs, political pressures, and the CINC's strategic and operational focus. In December, the planners had chosen to attack a broad spectrum of targets from the onset of the air campaign rather than concentrate on individual target sets, because they feared the Iraqis might bail out of the war under the pressures of air attacks.[130]

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the military forces in Kuwait." GWAPS, Horner File: Daily Comments of Lt Gen Horner, HQUSCENTAF, 18 Jan 1991, 0730 Brief, Office of History, 20 Mar 1991.

[128]The persistence of these priorities is suggested by another notation in the TACC Log by Horner: "Priorit[ies]: 1. Defend from Air/Scud attack; 2. Kill Republican Guard; 3. Continue Strategic Campaign; 4. Kill Arty, Armor, Stocks, CPs in Rest of KTO; KEEP FOCUSED ON THE TARGET." TACC, CC/DO Current Ops Log, 28 Jan 1991, 0336Z, GWAPS, NA 215.

[129]We will deal with this issue in the chapter dealing with the ground campaign. Suffice it note that Schwarzkopf as the CINC would consistently demand from his air commander a very heavy emphasis on the attacks against the Republican Guard, while his ground commanders, Army as well as Marine, were requesting that air power emphasize the enemy's forces directly on their front rather than the Republican Guard. Horner and Glosson had no choice but to follow the dictates of their commander, but since there was no ground component commander (as there was for the air), the ground commanders did not participate in the final decision making processes. The unfortunate result was considerable bad feeling that the Air Force was not responding to the needs of the ground forces.

[130]Just because Saddam Hussein chose to stick the war out to the bitter end is no reason to criticize the prewar assumptions of the air commanders and planners. They had to go on the premise that the Iraqi leader would recognize the hopelessness of his nation's

Consequently, the first week of the strategic air campaign saw attacks on a broad spectrum of targets.[131] Nearly one quarter of the F-117 strikes during this period went against the Iraqi air defense system; 15 percent of the F-111 sorties also attacked portions of KARI.[132] The remaining F-117 sorties were spread fairly evenly among leadership (17 percent), command and control (14 percent), nuclear/chemical/biological (11 percent), military support (10 percent). and airfield target sets (10 percent). The F-111s, however, struck heavily against Iraqi airfields with 48 percent of their strikes; military support and Scud categories also received some attention.[133]

Over the course of the second week a distinctly different pattern emerged. CENTAF's efforts to eliminate the Iraqi Air Force now resulted in the shelter-busting campaign. More than 60 percent of the F-111F strikes attacked airfield targets, mostly shelters, while 26 percent of the F-117 sorties executed the same mission.[134] Because so many sorties hit airfields, the F-111s hit relatively few other targets–no other target category received more than 10 percent of their strikes.

The F-117s, however, expended a considerable portion of their attacks during the war's second week on nuclear/chemical/biological, military support, interdiction, and Scud targets, as well as against airfield targets.[135] Nevertheless, in combination significant numbers of F-111F and F-117 sorties went against bridges along the Euphrates. This effort

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position and decide to bail out of the war. Consequently, there was a desire to hit as many high value targets as possible across the broad spectrum of target sets, so that even if the war ended early, the air campaign would achieve at least a minimum level of damage to all the targets sets.

[131]Our discussion in succeeding paragraphs will focus on the target sets attacked by the F-117s and the F-111Fs, because those aircraft were the premier precision munition strike aircraft and because the most accurate data exists on their attacks.

[132]CWAPS Mission Database; see Effectiveness report, Appendix 1, for the by-week strike summaries of F-117 and F-111 operations. Note that the strike data cited were based on manual counts done by Task Force Six.

[133]*Ibid.*

[134]*Ibid.*

[135]The RR category had originally included just railroad targets, but had broadened out during the planning phases of Desert Storm to include bridges as well. One might best think of this category in terms of interdiction.

was not just interdiction–although that concept was clearly involved–but was an effort to prevent the Republican Guard from retreating across the Euphrates. Coalition leaders wanted air power to destroy them in place.[136] In the end, of course, Saddam left them there right up to the start of the ground war.

By the war's second week, the impact of the attacks on KARI had become clear. The Iraqi air defense system no longer functioned except fitfully. Coalition aircraft consequently ranged back and forth across the full extent of the country at medium altitude with slight risk. In the end, as their shelters went up in clouds of cement dust–often with aircraft inside–the Iraqis could only fly their aircraft to seizure by a none-too-friendly Iranian regime. By the second week, Glosson was ordering tankers to fly into Iraq to fuel F-117 strikes against targets in the Mosul area, as sure a proof of air supremacy as one could wish.[137]

Nevertheless, during the second week of the war, Saddam undertook his second political initiative–the Scuds being the first–in reply to the pounding that Iraq and its military were undergoing from the Coalition: he ordered Iraqi commanders in Kuwait to open up the oil pipeline from the Kuwaiti oil fields–one that normally filled tankers lying off shore–and flood the Gulf. President Bush accurately characterized Saddam's actions as "environmental terrorism."[138]

Almost immediately, Horner and Glosson had their planners look into halting the flow by using precision-guided bombs against the shut off valves and pumping stations. They soon determined that a few GBU-15s would solve the problem. However, at that point Schwarzkopf intervened to prevent the mission. It appears that the Kuwaitis wanted to accomplish

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[136]Intvw, Lt Col David Deptula with GWAPS personnel, 20-21 Dec 1991.

[137]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992.

[138]*U.S. News and World Report, Triumph Without Victory, The Unreported History of the Persian Gulf War* (New York, 1992), p 262. Saddam's purpose appears to have been a desire to enlist the Western media in a campaign against the war because of the environmental damage that it was causing to the Gulf region. To a great extent, he succeeded as Western reporters flocked to the oil soaked beaches and decried–quite justifiably–the damage that it was causing with some clearly implying that the war must stop before more ecological damage resulted. However, what Saddam had not calculated was the capability of Allied air power to end this mishappened effort to play on Western concerns.

the task using their own underground.[139] In the end, several days and millions of gallons later, F-111Fs ended Saddam's atrocity against nature by destroying the pumping station and severing the pipeline itself with well placed bombs.[140]

For the most part, the pattern of attacks by the F-117s and F-111Fs against strategic targets that was evident during the first two weeks persisted into the third. Attrition of aircraft shelters at Iraqi airbases continued, with the F-111Fs posting more than 200 strikes (41 percent of the F-111 total for the third week); the F-117s carried out some 50 strikes against airfield targets (18 percent of their strikes for that week).[141] The F-117s, though, did increase their effort against nuclear/chemical/biological warfare targets (more than 90 strikes totaling 32 percent of F-117 effort for the third week).[142] The other change, discussed in more detail below, that began toward the end of the third week was the shift of the F-111Fs to attacking Iraqi armor with 500-pound laser-guided bombs in the Kuwait theater of operations.

By the end of the second week, Horner and Glosson had come under increasing pressure to switch the air war away from strategic attacks against Iraq to Phase III, preparation of the battlefield in the KTO. As early as 26 January Horner suggested to the TACC his conviction that the air campaign could soon devote most of its attention to the enemy army:

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[139]Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992; intvw, GWAPS with Edward W. Graham, U.S. Ambassador to Kuwait, 14 Jul 1992.

[140]See the report in the TACC log on 28 January for the first report of the success of this mission. TACC Log, 28 Jan, GWAPS, NA 215.

[141]GWAPS Mission Database; also see the *Effectiveness* report, Appendix 1.

[142]The question which remains, in terms of level of damage that these strikes achieved, is the extent to which the destruction of buildings and bunkers achieved effective damage. One suspects that by this point in the war the Iraqis were desperately engaged in moving everything that was not cemented down to the floor out of sites that were vulnerable to attack. Certainly the report of UN inspectors who had a chance to look at nuclear facilities suggests that the Iraqis made major efforts both before and during the air campaign to limit the damage that Coalition air attacks might achieve against such targets. See in particular International Atomic Energy Agency, "Consolidated Report of the First Two IAEA Inspections under Security Council Resolution 687 (1991) of Iraqi Nuclear Capabilities," 11 Jul 1991, Rpt #S/22788 p 5; and "Report on the Seventh IAEA On-Site Inspection in Iraq under Security Council Resolution 687 (1991), 14 Nov 1991, Rpt #S/23215.

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"We are where we need to be to shift the emphasis to the Republican Guards."[143] Three days later he reemphasized his priorities:

> We're well into our attack on the Republican Guards. It is not going to be spectacular. It's going to be a lot of work. It should not be inordinately hazardous. We are not going to get a lot of feedback until suddenly they're defeated. We'll fight the weather the next couple of days, but keep the pressure on the Republican Guards. It's the target. When we have the Republican Guards in the bag, then we'll turn our attention to the ground forces in Kuwait.[144]

As early as the 27th, Schwarzkopf had directed Horner to shift his air assets except F-117s and F-111Fs to Kuwait.[145] At the end of the month, the Iraqi attack on Khafji moved the attention of senior commanders to the Kuwait theater; as the air campaign continued, ground commanders demanded that its focus move to preparing for the ground campaign. Unfortunately, there were few indicators as to what the air attacks in the KTO (Kuwaiti Theater of Operations) had achieved thus far against Iraqi ground forces, Republican Guard as well as regular army.[146] Not surprisingly, the CINC, clearly believing in the necessity for a ground campaign, pressured his air commanders to move on.

In late January, F-111F crews reported that their forward looking infrared receivers could pick up the distinct signatures of tanks and other Iraqi military equipment in the desert. This was because the metal cooled at a different rate than the sand of the surrounding desert. On 5 February with the full support of Horner and Glosson, the F-111Fs dropped eight GBU-12s, destroyed five revetted positions and claimed four tanks and

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[143]Daily Comments of Lt Gen Horner, 26 Jan 1991, 1700 Brief, HQCENTAF, Office of History, 20 Mar 1991, GWAPS, Horner File.

[144]Daily Comments of Lt Gen Horner, 29 Jan 1991, 1700 Brief, HQCENTAF, Office of History, 20 Mar 1991, GWAPS, Horner File. Here Horner was undoubtedly following the preferences of Gen Schwarzkopf.

[145]The chief planner in the Black Hole noted on the 28th: "Yesterday CINC shifted all but 111s & 117s to RG; OK but many production facilities not destroyed." Deptula personal notes.

[146]We will discuss in Chapter 6 the nature of these arguments as well as the probable impact that the air campaign was making on the Iraqi ground forces.

one artillery piece.[147] On viewing the tape, Horner noted in the TACC's Current Ops Log: "Just returned from watching video of F-111F/Pave Tack/500 laser-guided bombs blowing up tanks in Kuwait that ought to be required viewing at Army War College and A-10 Fighter Weapons School--classic of how to do the job right."[148] Horner, undoubtedly at Schwarzkopf's urging, promptly ordered the F-111Fs to shift entirely out of the strategic campaign.[149]

On 6 February, the F-111Fs embarked on what soon became termed their tank "plinking" effort.[150] There is some irony in both the focus during the war on tank "plinking" and in the debates thereafter, because the corps commanders were by and large more interested in efforts to destroy Iraqi artillery. In fairness to the F-111F attacks that now ensued, many of their attacks went in against artillery positions as well as tank units.

On the night of 6/7 February, the F-111Fs dropped more than 140 GBU-12 laser-guided bombs on dug-in Republican Guard armor and artillery. After a return to other targets on 7 February while results were assessed, the F-111Fs resumed tank plinking on the night of 8/9 February.[151] From this point until the beginning of the ground campaign on 24 February, the F-111Fs would concentrate their efforts against Iraqi ground order of battle, particularly on Republican Guard units deployed along the Iraq-Kuwait border.

The division of effort between strategic platforms in the fourth week illustrates this change in focus. Some 73 percent of the F-111s' strikes went against enemy ground forces, 6 percent to oil, and 5 percent to

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[147]TACC, Current Ops Log, 6 Feb 1991, 0730Z, GWAPS, NA 215.

[148]TACC, Current Ops Log, 7 Feb 1991, 1838Z, GWAPS, NA 215.

[149]On 9 February Glosson noted in his diary somewhat lugubriously: "Saddest day of the war: we are going to have to stop strategic air campaign before it is completed." Intvw, Maj Gen Buster Glosson with GWAPS personnel, 14 Apr 1992.

[150]Gen Schwarzkopf soon made clear that he did not like the term "tank plinking." As Horner commented after the war, however, CINCCENT's expression of disapproval at the term only insured that it would become enshrined in Air Force lingo. TACC, Current Ops Log, 8 Feb 1991, GWAPS, NA 215.

[151]GWAPS Mission Database; see *Effectiveness* report, Appendix 1.

military support.[152] The F-117s displayed no similar concentration of effort to oil, and 5 percent to military support; instead they attacked a wide variety of target sets: no less than six sets received more than 10 percent of the stealth effort for the week. What does, however, suggest the focus of the attack by both platforms was their combined effort against leadership (with 14 percent of the strikes) and command and control (with 20 percent of strikes). There was obviously a distinct effort to complete the paralysis of the Iraqi leadership that the war's opening strikes had failed to achieve.

In the early morning hours of 13 February–in fact during the last hours of Day 27 of the air campaign–two F-117s hit the Al Firdos bunker with one bomb apiece. Intelligence had identified twenty-five bunkers in Iraq that the enemy could use as critical command posts. Ten of these were inactive on 15 January and therefore not targeted. By early February, intelligence indicated that the Iraqis had activated the Al Firdos bunker for use as a command post. Within the week after identification it appeared on the Master Attack Plan.[153] *No one* in the planning cycle or in intelligence knew that the Iraqis were also using the bunker as a shelter for civilians.[154] The strategic consequences of this attack were considerable. To all intents and purposes the civilian losses ended the strategic air campaign against targets in Baghdad.

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[152]*Ibid.* All the attacks against oil targets were flown by F-111Es flying out of Turkey.

[153]Intvw with assorted members of Checkmate, the Black Hole, and others involved in the air campaign.

[154]Those who worked in the targeting process made clear to those who interviewed them for GWAPS that they would never have targeted the Al Firdos bunker had they realized that it contained women and children. One of the ironies of the stealth/pgm war was that where the Al Firdos bunker would have provided substantial protection in terms of World War II attacks or even in terms of the B-52 strikes against Hanoi, precision platforms now rendered safe most unprotected sites, but made such hardened targets as Al Firdos exceptionally dangerous to those unlucky to be inside of them. The Iraqis as usual mounted a skillful campaign of disinformation. Not surprisingly some of the press swallowed Saddam's line; the Iraqis, of course, allowed no detailed inspection of the facility until after the war was over and they had had full opportunity to fix up the site to extract the maximum propaganda value.

The targets attacked by F-117s on day twenty-seven of the air campaign around Baghdad suggest the extent that the planners were going after the leadership and political centers of the Ba'th regime:

Baghdad: Iraqi Air Force HDQS	Two hits
Baghdad Radrel Sta	One hit, one no guide
Baghdad: Ministry of Defense	Two hits
Baghdad Conference Center	Three hits, one no drop
Baghdad Auto Exch-Radrel	Two hits
Baghdad Auto TP Exch	One hit, one no guide
Baghdad Maydan TP Exch	Two hits
Iraqi Intelligence Service HQS	One hit, one no drop
Baghdad Radcom Xmtr-Rcvr	One hit, one no drop
Baghdad Intl Radcom Rcvr	One hit, one no drop
Ba'th Party HDQS	Four hits
Al Firdos District Bunker	Two hits
Bag Dir of Gen Int Sec HDQS	One hit, one no guide
Bag Dir of Mil Intel HDQS	Two hits
Iraqi Intel Ser HQ	Three hits
Baghdad Presidential Bunker	Two hits
Baghdad Auto Mpur-Radrel	No Guide[155]

The number and nature of targets in the Baghdad suggest that somewhere along the line civilian casualties were bound to occur. Unfortunately, they came in such a frightful fashion that political pressure ensured that targets in downtown Baghdad were put largely out of bounds for the remainder of the war.

The attack against Al Firdos raises an interesting point. Thus far, this report has argued that the Iraqi regime possessed great political stamina and corresponding great weaknesses in the military arena.[156] This leads to the conclusion that an air campaign against Iraq's military structure, unless followed by the complete occupation of the nation, would not have resulted in the regime's collapse.[157] To break Saddam's regime by

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[155]GWAPS Missions Database.

[156]These strengths and weaknesses are entirely interrelated.

[157]Here we have verifiable evidence, in that two years after the destruction of most of Iraq's military power and its humiliation in Kuwait, the regime is still maintaining its hold on power.

air power, an air campaign would have had to go after the political structure from the onset of war. But to do so would almost certainly have led to a series of incidents similar to Al Firdos. In the end, such an air campaign, even though targeted at breaking the Iraqi regime directly and therefore aimed more realistically at what might cause its collapse, could very well have achieved less.

13 February: Day 28 of the Air Campaign

To conclude this chapter, a summary of conventional air operations on 13 February will be given to suggest how much they had changed over the four weeks of war.[158] This day's operations came in the hours immediately following Al Firdos; the deaths at the bunker, however, had not yet affected the lay down of air operations.

As a prelude, it would be useful to describe an air-to-air mission flown on 6 February. The mission underlines the degree of air superiority that Coalition air power enjoyed by this point in the war. On that day, two F-15Cs, Xerex flight, were flying a barrier combat air patrol mission to prevent the Iraqis from slipping more aircraft away to Iran.[159] AWACS called an initial contact at sixty nautical miles (nm). The bandits consisted of two MiG-21s and two SU-25s flying to Iran at barely 300 knots at less than 1,000 feet altitude.[160] After considerable difficulties in identifying the targets, Xerex Two achieved a lock on one of the MiG-21s at twelve nm. Both he and the lead then fired AIM-7Ms, but the first flew by the MiG-21, while the motor of the second missile failed. A third AIM-7M also did not track its target. By this time the Iraqis had split into two separate flights. Xerex Two then closed to within 6,000 feet and shot both SU-25s down with AIM-9M Sidewinder, heat-seeking missiles. At the same time, Xerex One shot down the MiG-21s, also with AIM-9Ms. At no time in the engagement did the Iraqis take evasive action, and they appeared oblivious to missile attacks or the approach of F-15s to the rear of their aircraft.

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[158]We have suggested the pattern of Stealth strikes above.

[159]The account of this mission is abstracted from "Desert Storm Air to Air Engagements, 53d Fighter Squadron Air to Air Engagements," Desert Storm, 3 Mar 1992, pp 12-17.

[160]There may have been more MiG-21s or other aircraft involved, but that remains unclear.

Obviously, the Coalition had established almost complete dominance in the skies over Iraq. No longer was it necessary for air superiority fighters to accompany strike missions in the KTO. Instead, F-15Cs and F-14s maintained a number of combat air patrol positions not just on the frontier, but deep in Iraq itself. In fact F-15s were flying CAP missions north east of Baghdad, close to the Iranian border. [For the position of CAP missions in early February see Map 29.]

At the same time, SEAD missions no longer directly supported most KTO strike packages. Instead, both EF-111s and F-4G weasels flew orbits, either to jam the radars of enemy air defenses–in the case of the EF-111s–or to seek out and attack SAM sites that came up–in the case of the F-4Gs.[161] While SEAD packages still accompanied strike packages against targets in Iraq, there were few areas in Iraq outside of Baghdad where Coalition aircraft could not fly.

The first strike of 13 February came against a "killbox" in the KTO; four Navy A-6 all-weather day-night strike aircraft worked over two killboxes. [see Maps 30, 31, 32] With dawn, the pounding of the Iraqi ground forces swung into high gear. Three particular quadrants in the killboxes, AF6, AF7, and AG7 received the heaviest attention throughout the day–the first from forty A-10s, the second from sixty-eight F-16s, and the last from seventy-six F-16s. In addition, A-10s flew 222 sorties–210 of which their pilots judged successful in terms of identifying and attacking targets during the course of the day.[162]

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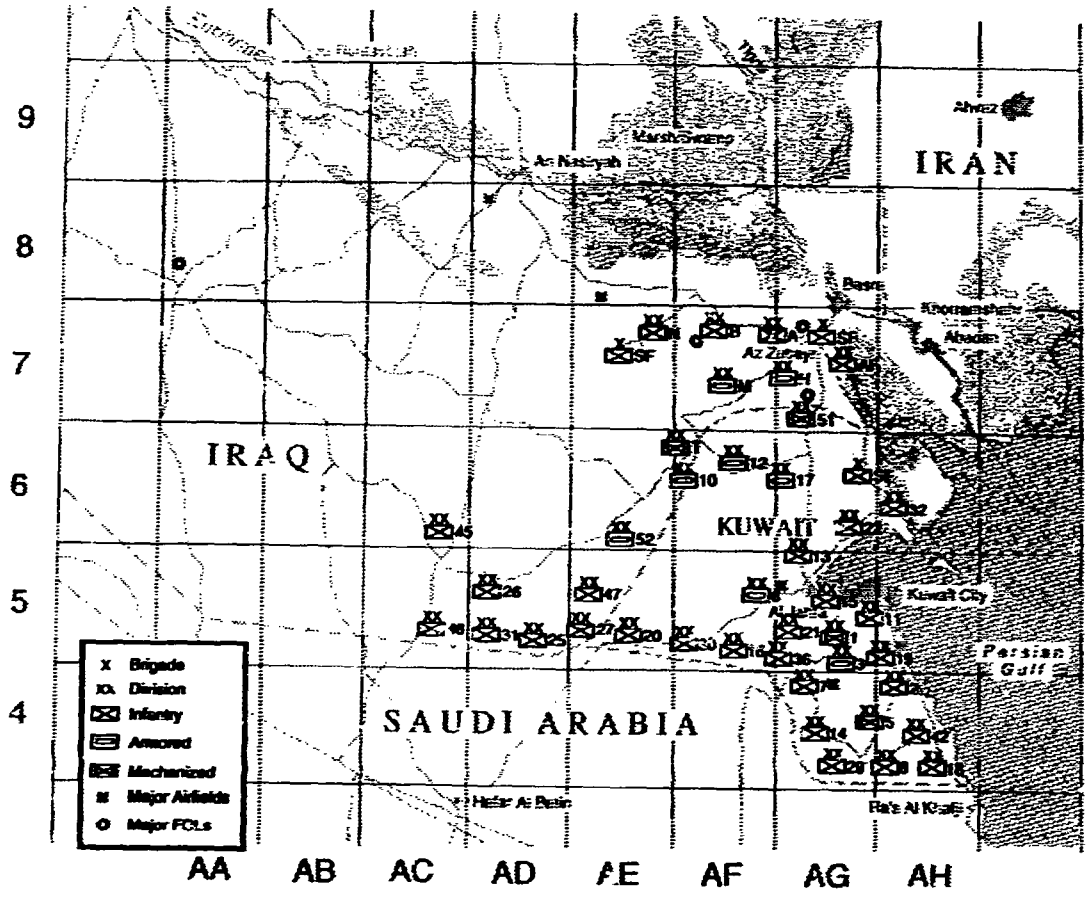
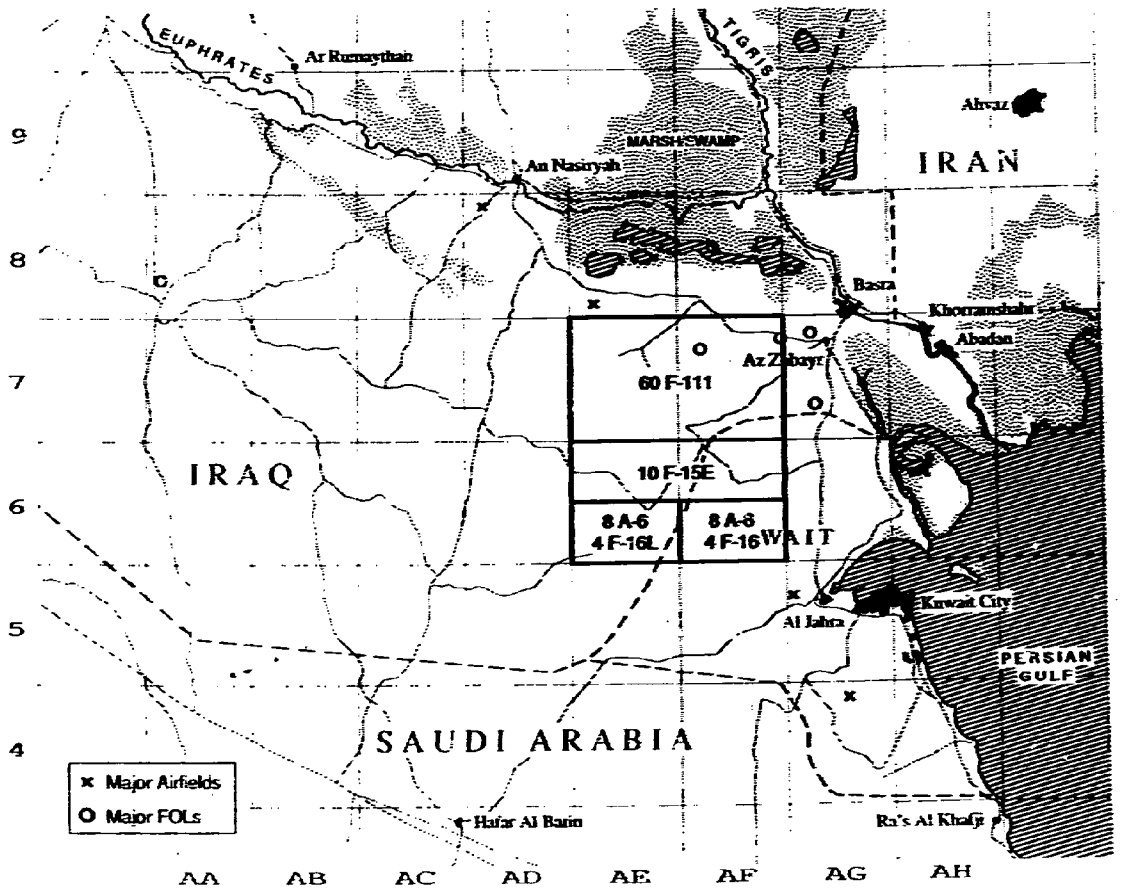
[161]The Master Attack Plan calls for round the clock coverage by EF-111s and EA-6Bs for electronic counter measures, by EC-130s, Compass Call for further ECM, and by F-4Gs to attack operating SAM sites in the KTO. SEAD support was of course available for those aircraft that had to strike targets deeper in Iraq. (S) Master Attack Plan, D+27, 13 Feb 1991, pp 1 and 5.

[162](S) Master Attack Plan, D+27, 13 Feb 1991 and GWAPS Database.

Map 29
Allied Air Operations -
Support Structure for Air Supremacy
Early February 1991



Map 30
***Iraqi* Army**
Deployment
in the KTO



Map 31
Night LGB work
13 February

At night, sixty F-111F sorties struck AF7 and AG7. Two killboxes to the south also received considerable attention from ten F-15Es, sixteen A-6s, and eight LANTIRN F-16s.[163] The emphasis on air efforts in the KTO throughout the day and night–as for much of the war–lay on the Republican Guard. Saddam's elite ground forces, chosen for their political reliability as much as for their military competence, remained in position along the Kuwait-Iraq frontier southwest of Basra. It was these boxes that received the attention of much of the air campaign for the rest of the war. In addition to these sorties, numerous other aircraft attacked targets in the KTO. Some were aircraft tasked to support Special Operations Forces, or assigned to JSTARS; some were aircraft on alert. The general picture then is of unceasing activity throughout the KTO.

The emphasis on the KTO did not mean that air operations against the rest of Iraq ceased; they continued, but at much reduced levels. A few F-16 sorties still flew against targets of opportunities in Iraq, while other attacks went against airfields and communication sites; British, Saudi, Proven Force, and Navy aircraft were particularly useful in sustaining pressure on the Iraqi airfields and Scud sites.[164] One suspects that the bombing of hardened shelters that occurred during the course of 13 February aimed as much at getting Scuds that were possibly hiding in the shelters as at finishing off the Iraqi Air Force.

Morning attacks against the Iraqi airfields like Al Asad and Taqaddum were multi-national as well as multi-service efforts. [See Maps 33 and 34 for depictions of air operations on 13 February.] At 0810, six RAF Tornados, attacked Al Asad; two Tornados provided capability to attack active SAM sites (with Alarm anti-radiation missiles), while two Navy EA-6Bs covered by two F/A-18s provided ECM. Half an hour later, RAF Buccaneers lased for four Tornados in a second attack on the same field; three EF-111s, two F-4Gs, and two F-15Cs covered the strike. At the same time (0840), two more Buccaneers lased for another four RAF Tornados in a strike against Taqaddum hardened shelters.[165]

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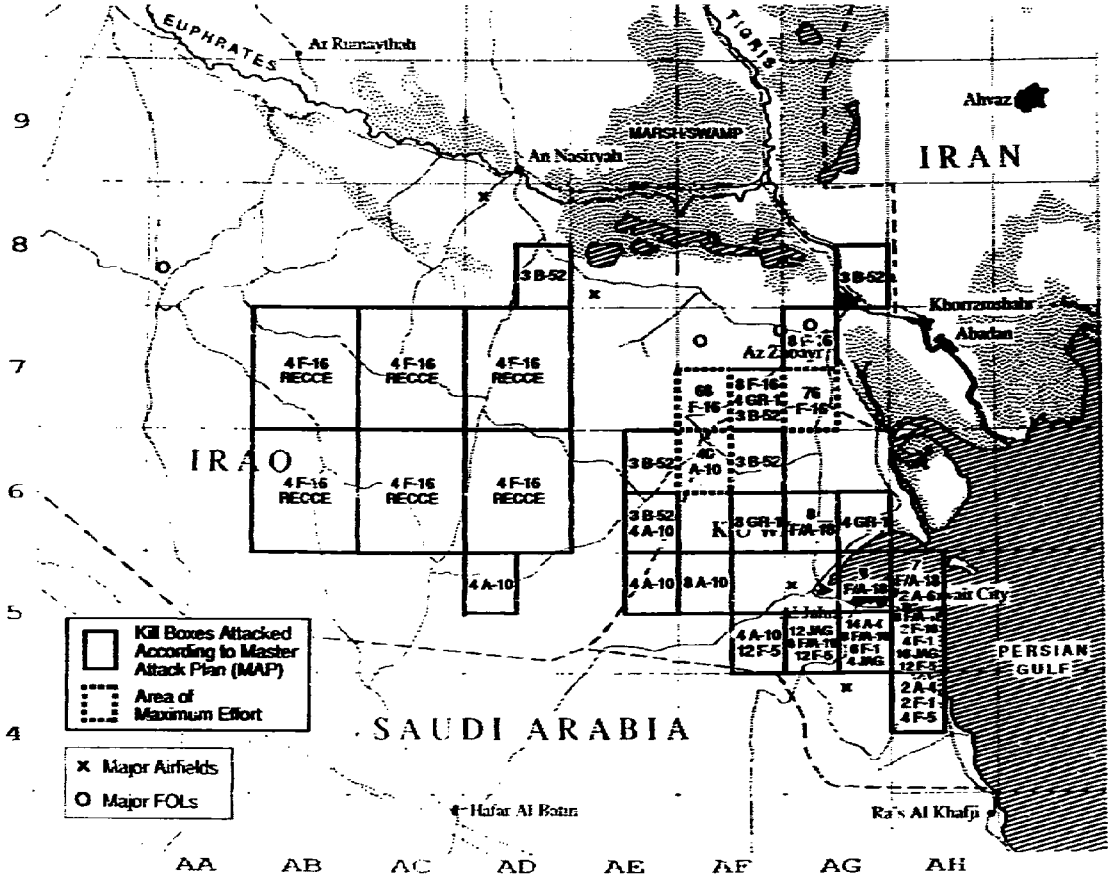
[163](S) *Ibid.*

[164](S) Master Attack Plan, D+27, 13 Feb 1991, and GWAPS Database.

[165](S) Master Attack Plan, D+27, 13 Feb 1991, and GWAPS Database.



Map 32
Non-LGB
Attacks in KTO
13 February

Map 33
13 February (0300 to 1300)

Major activity came at night: eight Tornados attacked Taqaddum in the early evening hours; F-111Fs struck the bridges just north of Basra. These attacks were the prelude to two major attacks that occurred just before midnight. A massive package of twelve B-52s, accompanied by no less than three EF-111s, four F-15Cs, and eight F-4Gs attacked the Taji Missile Repair Facility. At the same time, twelve F-111Es attacked Kirkuk from the north.[166]

[166](S) *Ibid.*

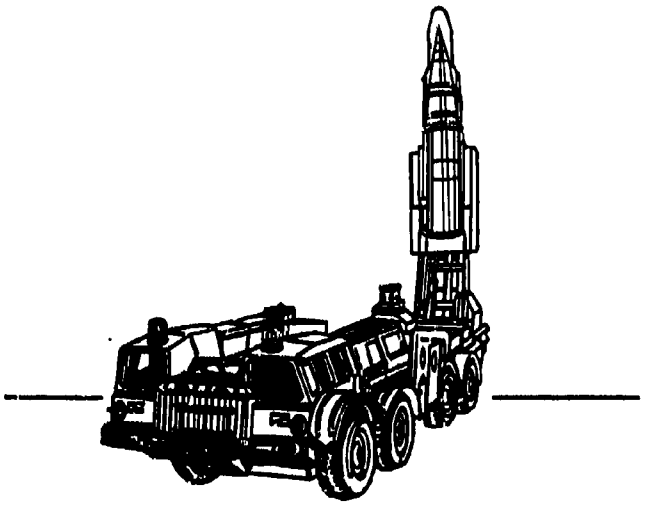
Map 34
13 February (1300 to End of Day)

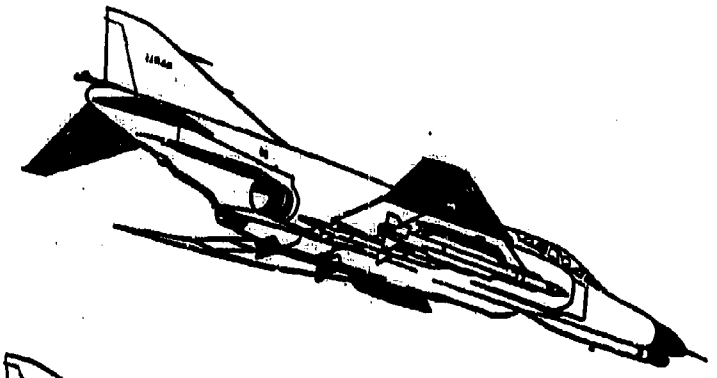
The pattern and weight of the attacks over the course of 13 February underline a number of ways in which the conduct of air operations had changed. Most notable was the general absence of interference from Iraqi defenses. Secondly, F-117s almost entirely carried the weight of the precision war against Iraqi strategic targets. The general focus of Coalition air efforts now lay within the KTO. Nevertheless, Coalition air planners had sufficient resources available so that they could keep substantial pressure on Iraq throughout the day and night.

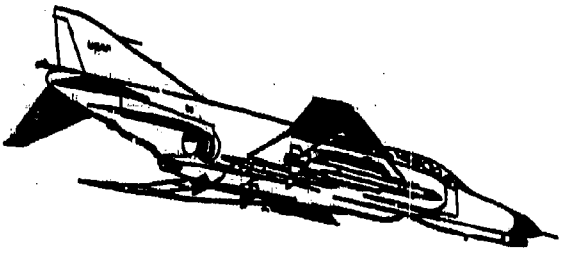
Conclusion

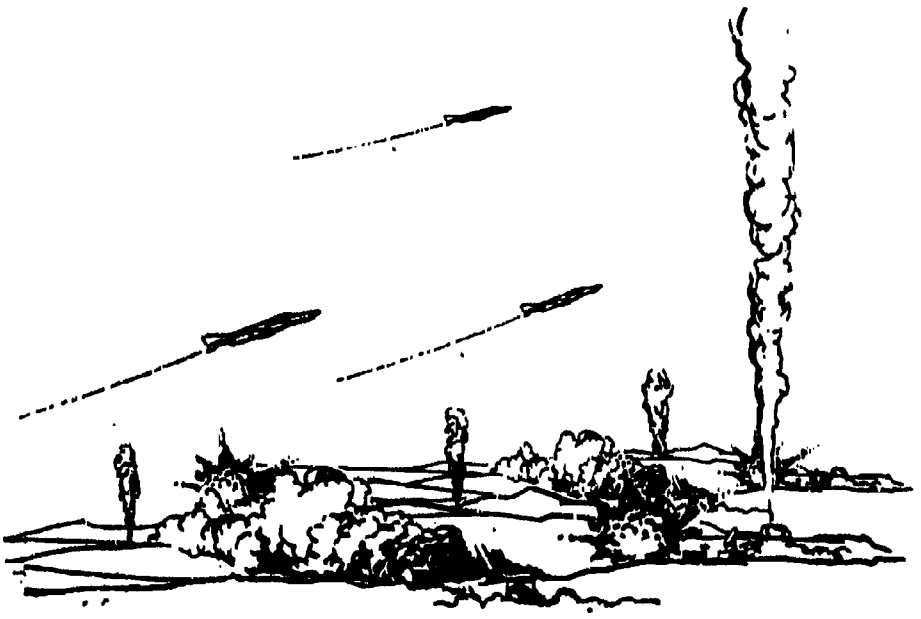
The three-and-a-half week period of air operations that followed the opening two days of the campaign suggests a number of interesting aspects. Despite the Coalition's overwhelming success at the start of the war, a number of impediments to a coherent execution of the campaign now appeared. The enemy was able to affect the Coalition's plans to a considerable extent; mobile Scuds forced Horner and his planners to bleed off resources to search for and rarely find these illusive targets. The enemy's refusal to fly and fight forced Coalition air power to strike Iraqi airfields and deconstruct the Iraqi Air Force shelter by shelter. The shelter busting campaign was successful in its aim but also pulled precision bombing assets away from the strategic campaign. Finally, the weather posed a considerable obstacle–and one that the planners had not entirely foreseen.

Such frictions in the conduct of the campaign are not surprising. The leaders of the air campaign for the most part adapted to these real conditions with considerable skill and imagination. By 13 February, they had reached the point when the air campaign was already substantially damaging the infrastructure of the Iraqi ground forces and was turning to an effort to wreck the regime's command structure. Unfortunately, the hit on the Al Firdos bunker would end that second effort; as for the first, there was nothing the Iraqis could do to prevent Coalition air from wrecking the morale and much of the equipment of their ground forces deployed in the KTO.









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Diminished Attack on the Center

During the war's last two weeks, Coalition air forces sent more than 90 percent of their strike sorties against the Iraqi army in the KTO. One night, even F-117s, which had become accustomed to working in and around Baghdad, headed into Kuwait. There they raided pumping stations that were to feed oil trenches whose flames were to thwart Coalition ground attacks. F-117s, however, did not join CENTAF's other precision bombers, F-111Fs and F-15Es, in daily attacks against tanks and other equipment of the enemy's ground forces. Schwarzkopf recognized that enough unfinished business remained in Iraq to require attention from F-117s, but the stealth bomber received little help with its precision bombing there.[1]

British Buccaneers did laser designation for Tornados dropping guided bombs in central Iraq as well as the KTO. In addition, several Tornados also carried the new Thermal Imaging and Laser Designation (TIALD) system. RAF Tornados had dropped unguided bombs in the campaign's first two weeks; in the second two weeks, they began dropping guided bombs; in the last two weeks of the war, they dropped nothing but laser-guided bombs. Their guided bombs, however, weighed only a thousand pounds each and lacked penetrating warheads which enabled American two-thousand-pound bombs to break through the reinforced concrete of Iraqi bunkers. U.S. Navy A-6s and FA-18s, flying from carriers in the Red Sea, dropped a few laser-guided bombs in central Iraq, but those Navy laser-guided bombs also lacked penetrating warheads. Navy aircraft on the Persian Gulf carriers expended all their

[1](S) On Schwarzkopf's priorities for bombing in Iraq, see msg, CINCCENT to COMUS CENTAF, subj: 72-Hour Pre-Cease-Fire Campaign guidance, 130850Z Feb 1991, CWAPS BH Deptula 19A, which is discussed later in this chapter. The F-117 raid on the oil trench system occurred on the night of 15-16 Feb 1991; see (S) Contingency Hist Rpt, 37 FW(P), 10-16 Feb 1991, AFHRA.

bombs in the KTO, and even the Red Sea force did much of its bombing there.[2]

The remaining forces available to bomb central and northern Iraq lacked precision-bombing capability. Air Force F-111Es and F-16s in Turkey had remained north of the thirty-fifth parallel during the early weeks of the war, but in the final two weeks they came south, almost reaching Baghdad. Air Force B-52s from England bombed only in northern Iraq, while B-52s based in Saudi Arabia, Diego Garcia, and Spain concentrated on the KTO with occasional runs into central Iraq. None of these forces, however, could do the precision, bunker-busting work of F-117s. As for F-117s, CENTAF could no longer send them anywhere it pleased–Baghdad targets now required approval from the theater commander and above.

Constraints and Competitive Objectives

On 13 February, a few hours after F-117s had gutted Baghdad's Al Firdos bunker, Schwarzkopf recognized that the Coalition had major press and political problems. If he had any reluctance to recognize these problems, the JCS Chairman, General Powell, called to underline both. Cable News Network television cameras had recorded Iraqi officials removing the bodies of dead women and children. The Bush administration did affirm the legitimacy of the target publicly, but there were fears that such pictures might turn many Americans against the war. Convinced that the bunker had become a communications center for an intelligence organization bombed out of its original headquarters, air planners were dismayed to learn that Iraqi families had been using the upper floor as a bomb shelter. Speculation within the American intelligence community that someone of importance in Saddam's regime may have died in the bunker did mollify unhappiness about the bunker's adverse publicity to some degree. Nevertheless, Schwarzkopf told Horner and the Black Hole that henceforth CENTAF could no longer attack targets

[2](S) Rpt, Frank Schwamb, et al, *Desert Storm Reconstruction Report, Vol II: Strike Warfare* (Washington: Center for Naval Analyses, 1991), GWAPS NA 368; (S) note for record, G. J. Onslow, RAF Strike Cmd, Op Res Br, Analysis of Attack and Reconnaissance Operations from Operation Granby, Jul 1991, GWAPS NA 515E.

in Baghdad without his approval. The Black Hole was under the impression that Schwarzkopf soon was checking all such targets with Powell.[3]

Curtailment of the air assault on Baghdad had begun in early February, when the Navy stopped launching Tomahawk cruise missiles against the capital. Since Tomahawks alone had been attacking Baghdad in daylight, their absence meant that city residents no longer had to fear attacks during normal working hours. At night their homes remained free of attack, because F-117s attacked only office buildings and bunkers. Under the circumstances of this new form of air war, the most foolish thing any Iraqi could do was leave his own house in favor of the shelter offered by a bunker. Most residents of Baghdad did not have to ponder this question, since there were only enough bunkers to house the families of the regime's elite.[4]

The Navy had used less than three hundred of approximately five hundred Tomahawks available. For the remainder of the war, Navy and Air Force planners proposed new Tomahawk missions, but Schwarzkopf refused approval for such attacks. Either January's television pictures of Tomahawks sailing through downtown Baghdad at midday had bothered someone in Washington, or their great cost and relatively small warhead made CENTCOM deem them too expensive for further use.[5]

Early in February, television cameras also publicized a British daylight strike against the bridge at Nasiriyah on the Euphrates, 150 miles southeast of Baghdad. Civilian deaths at that site may have increased Powell's reaction to F-117 night strikes against bridges in downtown Baghdad. Since communications cables ran under some of Baghdad's six bridges, air planners hoped to make communications in the capital yet more difficult by telephone as well as by car. But after strikes against

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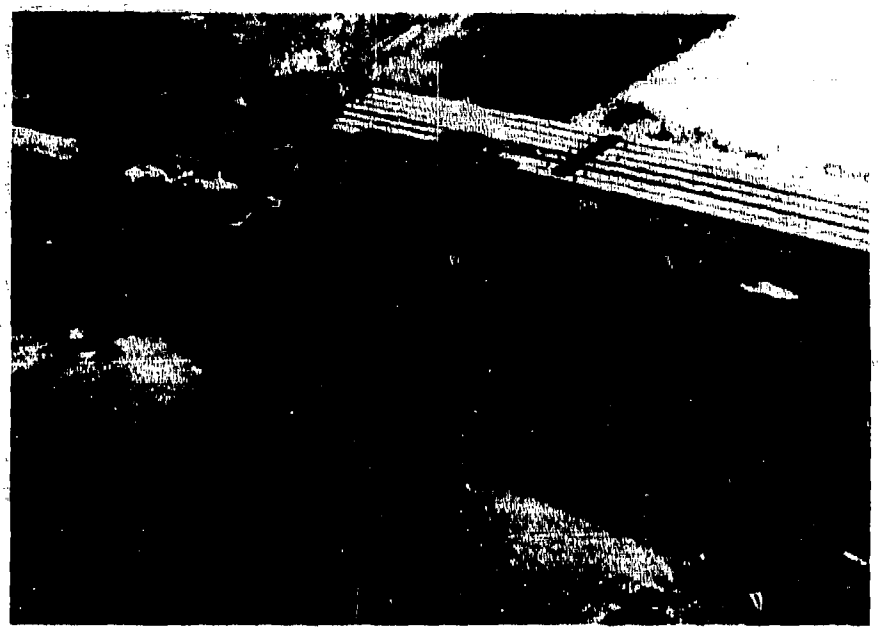
[3](S) Intvw, Wayne Thompson, GWAPS, with Lt Col David A. Deptula, Pentagon, 26 Aug 1991; (S) Intvw, Richard G. Davis, Perry Jamison and Barry Barlow, AF Hist Program, with Lt Gen Charles A. Horner, Shaw AFB, South Carolina, 4 Mar 1992; Schwarzkopf, *Hero*, p 435; (S) Intvw, Wayne Thompson with Lt Col David A. Deptula, Pentagon, 26 Aug 1991.

[4](S) Rpt, Frank Schwamb, et al, *Desert Storm Reconstruction Report, Vol II: Strike Warfare* (Washington, 1991), esp Chapter 8, GWAPS NA 368.

[5](S) *Ibid.*

four bridges during early February, Schwarzkopf told the Black Hole there would be no more bombing of Baghdad's bridges. In this context, the Al Firdos bunker strike made all targets in the capital suspect. While restrictions on some targets loosened at the end of the war, potential bomb shelters and bridges in Baghdad remained forbidden.[6]



Demolished Iraq vehicles line a roadway near a section of elevated highway in the Euprates River Valley.

If the Al Firdos and bridge affairs pushed F-117s out of Baghdad, there were other forces also pulling them to targets outside the capital.

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[6](S) Notes, Wayne Thompson, Checkmate mtg, 9 Feb 1991, GWAPS Historical Advisor's Files. According to the RAF database sent to GWAPS, the RAF attacked the bridge at Nasiriyah on 4 Feb first with guided bombs and then seconds later with unguided bombs. While visiting GWAPS in December 1992, however, researchers from the UK Ministry of Defence said that only guided bombs were used against the bridge. In any case, most of the casualties at Nasiriyah were caused by accurate bombs which struck the bridge and people crossing it. See the sortie data attached to (S) ltr, Air Vice Marshal P.T. Squires, HQ RAF Strike Command, to E. Cohen, 22 Sep 1992, GWAPS NA 515.

Realization in early February that F-111Fs and F-15Es could "plink" tanks with guided bombs sucked those precision bombers into the KTO. Precision-bombing everywhere else in Iraq now was the mission of F-117s almost alone. F-111Fs bombed outside Kuwait and southeastern Iraq on only a dozen occasions in the last two weeks of the war–about seventy-five sorties flew those missions. The largest F-111F package going north in this period consisted of twenty aircraft scheduled to bomb the conventional arms plant at Al Iskandariyah (thirty miles south of Baghdad) on the last night of the war. Bad weather kept all but one from dropping bombs, and those bombs did not guide. But a smaller package of twelve F-111Fs had enjoyed better luck against this target on 17 February, as had six B-52s on 14 February, and five F-117s on 23 February.[7]

The most important targets outside both Baghdad and the KTO were those relating to Iraq's development of nuclear, biological, and chemical (NBC) weapons. The administration in Washington wanted Iraq to emerge from the war without NBC weapons–or the capability to produce them. By mid-February, however, the Black Hole had become more interested in bombing leadership targets in Baghdad than NBC targets elsewhere. Since this renewed focus on leadership followed the weeks when aircraft shelters had been the prime target, more than a dozen suspected chemical and biological weapons storage bunkers remained to be bombed.[8]

When CENTAF intelligence's chief of targets, Lt. Col. F. L. Talbot, brought this situation to Glosson's attention on 13 February, the latter exploded: "If this is an indication that 'stress' is getting to you . . . and a break is needed–I can arrange."[9] Glosson indicated that he did not think Talbot's assessment was accurate. If it were "and you have waited until now to tell me–your departure is imminent."[10] Stress may have momentarily affected Glosson on the day his aircraft had struck the Al Firdos bunker. On that same day, Schwarzkopf announced not only that

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[7] (S) GWAPS Database; Cont Hist Rpts, 37 FW(P), 10-16 Feb 1991 and 17-23 Feb 1991, AFHRA.

[8] The focus on leadership dated from the earliest Instant Thunder planning. The renewal of this focus in mid-February 1991 can be followed in the Black Hole's daily master attack plans, GWAPS BH 1-25 through 1-32.

[9] Brig Gen Glosson's handwritten comments on memo, Lt Col F. L. Talbot, CENTAF Chief of Targets, subj: ATO Daily Prioritized Target Nominations, 13 Feb 1991.

[10] *Ibid.*

targets in Baghdad would require his approval but also that he wanted CENTAF to ensure that it had destroyed all NBC targets before the end of the war. Talbot's warning on the remaining bunkers may have seemed like piling on, and Glosson's steadily deteriorating relationship with CENTAF intelligence suffered another jolt. But in this case, Talbot had provided accurate information, as timely as it was uncomfortable. Although the Black Hole believed that Coalition aircraft had destroyed two targets on Talbot's list, Glosson's planners eventually included his other targets on a priority list for Schwarzkopf.[11]

Schwarzkopf directed Horner to plan a seventy-two-hour bombing effort against remaining NBC targets "in the event a cease-fire is declared and only seventy-two hours remain prior to implementation."[12] Since late January, Checkmate had also developed a war termination list of NBC targets and pressed their importance on Cheney as well as on the Black Hole. The Black Hole's first draft of a seventy-two-hour list included leadership targets in Baghdad, but Schwarzkopf's directive ignored that category in favor of NBC targets and other offensive capabilities such as Scuds. Although integrating Talbot's list of NBC targets, the Black Hole gave priority to research and production facilities instead of storage bunkers. While Talbot had more concern about weapons that Iraq could use against Coalition forces in this war, Schwarzkopf also wanted to eliminate Iraq's capabilities for making war in the future with such weapons.

When Bush declared a cease-fire on 27 February, he gave Coalition forces only a few hours notice. But the rapid progress of the ground offensive launched on 24 February had already given CENTAF ample warning that the war would soon end. By then, F-117s had hit NBC targets on a continually updated seventy-two-hour list for two weeks. They struck some in the final seventy-two hours, but bad weather made a surge impossible. In any case, Schwarzkopf at the end finally approved a few leadership targets in Baghdad; CENTAF grasped eagerly at an oppor-

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[11]The development of this list is discussed below. See also Lt Col Deptula's file on the "72 Hour Target List" in GWAPS BH Deptula 19A.

[12](S) Msg, CINCCENT to COMUSCENTAF, subj: 72-Hour Pre-Cease Fire Campaign guidance, 130850Z Feb 1991, GWAPS BH Deptula 19A.

tunity denied since Al Firdos had put much of downtown Baghdad off limits.[13]

Bad weather and continuing restrictions muffled the return to Baghdad. The war ended with Saddam's regime in control of Baghdad and Sunni-dominated central Iraq, if not the northern Kurdish and southern Shi'te regions. Whether bombing more office buildings or command bunkers would have made a major difference can not be known. Nor can we calculate whether more extensive bombing of NBC targets in the war's last two weeks made much difference in Iraq's long-term offensive capabilities. As usual, one of the constraints on air leaders and planners was the necessity of working within the bounds of imperfect intelligence about the enemy.

Attacking Nuclear, Biological, and Chemical Capabilities

The Black Hole headed its seventy-two-hour target list with the same target that had seemed the most important NBC target in Iraq since the onset of the crisis in August. The Baghdad Nuclear Research Center at Tuwaitha had been familiar to Americans at least since Israeli F-16s had attacked it in 1981. American F-16s struck it during the first week of the air campaign and F-117s visited it often. With approximately one hundred structures in the compound, the target warranted repeated visits. F-117s returned to this favorite target on February 18th, 19th and 23rd. While closer to Baghdad than most NBC targets, Tuwaitha was ten miles south of the city--outside the area over which Schwarzkopf controlled target selection. Weather was a problem on the 18th and only four of ten F-117s dropped on the target, most of the others diverting to alternates; the next night four of six sorties scored hits. Shortly after midnight on the 23rd, thirteen F-117s bombed Tuwaitha in good weather. At least eighteen of twenty-six bombs hit structures in the compound on the last raid against Iraq's premier nuclear target.[14]

By the end of the Gulf War, American intelligence had only begun to realize the extent of Iraq's nuclear weapons development beyond Tuwaitha. The Black Hole's final seventy-two-hour list on 28 February included seven more targets suspected of having a nuclear role. Although

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[13]See the section on attacking Saddam's regime in this chapter.

[14](S) Cont Hist Rpt, 37 FW(P), 17-23 Feb 1991, AFHRA.

U.N. inspection teams eventually found three times that many nuclear facilities after the war, American intelligence had learned enough about several of the most important in time to subject them to bombing.[15]

One of the suspected nuclear facilities was just south of Baghdad, two miles closer to the city than Tuwaitha. The Black Hole raised this facility to number two on its priority list, right after Tuwaitha. On 22 February, five F-117s put all ten bombs on target. Perfect accuracy was unusual even for F-117s, and in northern Iraq aircraft lacking precision-bombing systems attempted to attack similar targets.[16]

Suspected nuclear targets in northern Iraq were within reach of Proven Force's F-111Es and F-16s in Turkey. Indeed the most frequently bombed target in all of northern Iraq was a suspected nuclear production facility twenty-five miles northwest of Mosul; after the war this site became known to U.N. inspectors as Al Jesira. Proven Force flew no less than twenty-five strikes against Jesira, two-thirds in the war's last two weeks. Usually four F-111Es hit the facility at night, or four F-16s in daytime. F-111Es each carried four 2,000-pound bombs or fourteen 500-pound bombs, while F-16s usually carried two 2,000-pound bombs or six 500-pound bombs. The cumulative weight of strikes against Jesira was considerable and damage to the facility was severe. But since Proven Force bombs remained unguided throughout the war, ten F-117s flew into northern Iraq on the night of 15-16 February and bombed several facilities, including Jesira; of five guided bombs which fell on Jesira, however, only two hit their targets.[17]

When a pair of F-117s returned to Mosul on 22 February, their luck was even worse. They dropped four laser-guided bombs on a suspected underground nuclear facility thirty miles north of Mosul, but all four missed. That was the only strike on this facility, because Proven Force lacked laser-guided bombs with penetrating warheads. At the war's end, the suspected underground facility ranked second on CENTAF's priority list possibly requiring a strike. However, since Black Hole planners had

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[15]Rpts, UN Inspection Teams, GWAPS NA 2; (S) target list, CENTAF 72-hour, 28 Feb 1991, GWAPS SH 4-72.

[16](S) Cont Hist Rpts, 37 FW(P), 17-23 Feb 1991, AFHRA.

[17](S) Rpt, USEUCOM Bomb Damage Database, GWAPS CHST 54-1; (S) Cont Hist Rpt, 37 FW(P), 10-16 Feb 1991, AFHRA.

not yet received adequate bomb-damage assessment for the 22 February strike, they did not recommend a restrike.[18]

Six F-117s had better luck in western Iraq on 20 February; they attacked the Al Qaim uranium extraction facility near the Euphrates, where it crosses from Syria. The attacking aircraft dropped ten bombs with only two missing. This was the major F-117 mission to Qaim, and Proven Force's F-111Es and F-16s never attacked this target. But the F-111Fs of the 48th Fighter Wing continued to visit. Indeed, Qaim was the only target outside the KTO which F-111Fs attacked with any regularity during the last two weeks of the war; they conducted five separate precision strikes on Qaim, totalling twenty-three sorties. Other frequent visitors were Navy A-6s and FA-18s, which attacked Qaim from the Red Sea.[19]

Three nuclear facilities attacked during Desert Storm came to the attention of the Black Hole as rocket or missile development centers. Well before the end of the war, American intelligence revealed that the rocket facility at Tarmiya, twenty-five miles north of Baghdad, also probably performed nuclear work. A similar facility at Ash Sharqat, half way between Tikrit and Mosul, remained merely a rocket facility in American eyes; admittedly, the Iraqis may not have used it to perform the nuclear functions for which it had been designed. With less than a week left in the war, the Black Hole learned that structures adjacent to the rocket engine test facility at Musayyib, thirty-five miles southwest of Baghdad, might also be conducting nuclear work. Only after the war would the U.N. teams learn that the Iraqis had designated this facility, known as Al Atheer, to be the place where they would create their first nuclear bomb; in spring 1990, important parts of the Iraqi nuclear program had begun the move from Tuwaitha to Al Atheer.[20]

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[18](S) Target list, CENTAF 72-hour, 28 Feb 1991, GWAPS BH 4-72.

[19](S) GWAPS Database; Cont Hist Rpt, 37 FW(P), 17-23 Feb 1991, AFHRA; (S) rpt, Frank Schwamb, et al, *Desert Storm Reconstruction Report, Vol II: Strike Warfare* (Washington: Center for Naval Analyses, 1991), App C, GWAPS NA 368.

[20](S) Intvw, Wayne Thompson, GWAPS, with Lt Col David A. Deptula, Pentagon, 13 Nov 1992; rpt, International Atomic Energy Agency, Seventh Inspection in Iraq under UN Security Council Resolution 687, 14 Nov 1991, GWAPS NA 3. A target photo transmitted to the Black Hole by CENTCOM intelligence on 23 February 1991 indicated the suspected nuclear activity of the facility (later known to the UN inspection teams as Al Atheer) adjacent to the Musayyib rocket motor test facility.

Coalition aircraft bombed the three rocket-nuclear facilities as rocket facilities before their nuclear connection was suspected. Proven Force F-16s and F-111Es ran a series of six raids on Ash Sharqat in mid-February, culminating with a strike by four F-117s on 16 February. Because the attack achieved a high level of damage and because intelligence did not suspect Ash Sharqat of nuclear activities, neither Proven Force nor the F-117s troubled it again. They paid subsequent visits to Tarmiya, however. When F-117s and B-52s bombed Tarmiya on 15 February, Coalition intelligence still regarded it as a rocket facility. But when F-117s returned on 23 February, it had been upgraded to a possible nuclear facility. On the latter occasion, two of four F-117s could not bomb Tarmiya due to bad weather. The weather continued to be a problem on 25 February, when less than half of sixteen Proven Force F-16s dropped their bombs. That night Proven Force intended to make up the difference by sending a flight of four F-111Es, but again weather caused trouble; this time the entire mission was scrubbed. Tarmiya ended the war as the top target on the Black Hole's priority list.[21]

The Black Hole found the bombing of Al Atheer more satisfactory. After learning about Al Atheer's nuclear role, CENTAF had only a few days to attack it before the war ended; unfortunately, during most of that time the weather was bad. But on 25 February two F-117s put three of four bombs on the facility. Just as the war was ending the weather cleared over Musayyib, and not long after midnight on 28 February, nine F-117s attacked the rocket engine test facility and the adjacent Al Atheer nuclear facility–which the Black Hole still referred to as the Musayyib missile development facility. At least seven bombs appear to have hit Al Atheer targets, and the Black Hole judged its bombing objectives achieved for the entire Musayyib-Al Atheer complex. Had the Black Hole known more about Al Atheer's central importance in Iraq's nuclear weapons development program, the planners might not have been so comfortable with the level of damage.[22]

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[21](S) Target list, CENTAF 72-hour, 28 Feb 1991, GWAPS BH 4-72; GWAPS Database; (S) rpt, HQ USEUCOM. Proven Force BDA Database, GWAPS CHST 54-1; (S) Cont Hist Rpts, 37 FW(P), 10-16 Feb 1991, 17-23 Feb 1991, 24 Feb-2 Mar 1991, AFHRA.

[22](S) Intvw, Thompson with Deptula, 13 Nov 1992; (S) Cont Hist Rpt, 37 FW(P), 24 Feb-2 Mar 1991, AFHRA; IAEA rpt, 14 Nov 1991, GWAPS NA 3.

American intelligence's picture of the enemy's development of chemical and biological weapons was somewhat clearer (if no more certain) than the nuclear picture. Intelligence reported that the principal research and production facility for biological weapons was at Salman Pak on the Tigris, a dozen miles southeast of Baghdad. Three other biological production facilities were in the Baghdad area–two at Abu Ghurayb west of the city and one at Taji north of the city. In February, intelligence found evidence of another biological production facility at Latifiya, fifteen miles south of the capital. While it was possible that Salman Pak might also be producing chemical weapons, the principal center for that business was at Samarra, on the Tigris fifty miles north of Baghdad. Three facilities near Habbaniya (thirty-five miles west of Baghdad) provided precursor chemicals used by Samarra to produce weapons.[23]

Coalition aircraft had attacked all known biological and chemical production facilities by mid-February with considerable success. After two strikes on the suspected biological facility at Latifiya, intelligence that the Iraqis were removing crates from the ruins prompted a third strike. On 19 February, a pair of F-117s bombed this facility as part of a larger attack on the neighboring solid propellant factory; other nearby factories produced liquid propellant, Scuds and explosives. Two of four bombs guided to the biological target, and the Black Hole crossed the site off their list together with the solid propellant plant, which absorbed fourteen hits.[24]

[DELETED].[25]

Whether any biological weapons had actually been in bombed facilities is not known. The only indication that such might have been the case was an article in the Egyptian press in early February. According to this article, which stimulated a subsequent article in the Soviet

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[23]For two HQ USAF Checkmate files on chemical and biological weapons in Iraq, see GWAPS CHSH 100 and CHST 18.

[24](S) Memo, Rear Adm McConnell, DIA, to Brig Gen Leide, CENTCOM, subj: BW Activity, 20 Feb 1991, GWAPS BH Deptula 19b; (S) Cont Hist Rpt, 37 FW(P), 17-23 Feb 1991, AFHRA.

[25](S) Cont Hist Rpt, 37 FW(P), 17-23 Feb 1991, AFHRA. For Horner's Dec discussion with Cheney and Schwarzkopf, see the GWAPS Planning report.

press, an attack on a biological weapons facility near Baghdad had led to the death of fifty guards from a rapidly progressing disease that spread to Baghdad. No more, however, has been heard of this case.[26]

There was always the possibility that Iraqis would move biological and chemical weapons development and storage to other locations. CENTAF did a thorough job on the designated targets, with the major exception of eight chemical storage bunkers at Samarra.[27] To some degree this omission was a consequence of the focus on production facilities. When F-117s attacked Samarra for the last two times on 23 and 24 February, they again struck the production buildings and left storage bunkers untouched.[28]

Nevertheless, CENTAF had made a successful effort to eliminate the other suspected chemical and biological bunkers. Of thirty suspected chemical storage bunkers, air attacks hit twenty-three and destroyed seventeen. Of twenty-one suspected biological bunkers, bombers destroyed nineteen; intelligence discovered the remaining two too late to bomb. The slightly better record against biological bunkers perhaps reflected greater concern over biological weapons. There was also more reason to believe that bunkers labeled biological might actually contain most of Iraq's biological weapons.[29]

The problem with trying to identify facilities housing chemical weapons was, that the Iraqis could keep such weapons in "virtually any secure building or bunker."[30] According to experts, there were more than three thousand storage structures in Iraq and even if one limited the target set to bunkers, that left approximately eight hundred targets. [DELETED].[31]

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[26]Msg, FBIS London to FBIS Reston, subj: Fifty Die After Air Raid, 101738Z Feb 1991, GWAPS CHST 18-10.

[27]Seven of these remained intact at the end of the war.

[28](S) Rpt, DIA Final BDA Status, 14 Mar 1991, GWAPS CHST 49-1.

[29](S) *Ibid.*

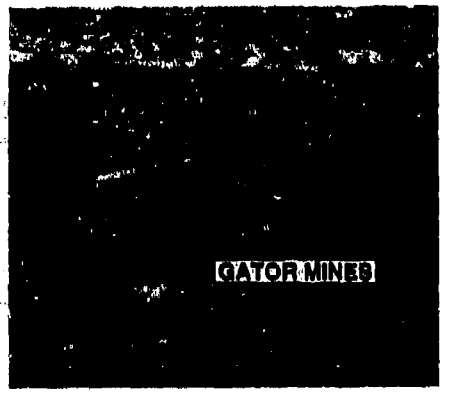
[30](S) *Ibid.*

[31](S) Imagery Analysis rpt, GWAPS CHSH 100-3.

Intelligence assessments of probable biological storage bunkers rested on only slightly firmer foundations. [DELETED].[32]

While intelligence believed that only one bunker in northern Iraq held biological weapons, the Iraqis had located eight chemical bunkers (of the thirty suspected) near the cities of Kirkuk and Qayyara. Since American planes based in Turkey lacked precision-bombing capability, they

[32](S) *Ibid*; rpt, DIA Final BDA Status, 14 Mar 1991, OWAPS CHST 49-1.



Mines with time delays were dropped near aircraft shelter areas to neutralize activity.

could do little more from medium altitude than limit access by scattering mines around the bunkers. Ten F-117s came north to destroy most of those bunkers on 11 February, the very day that dedication of the F-111Fs to "tank plinking" created a demand for Proven Force's F-111Es and F-16s to fly further south and help F-117s in central Iraq.[33]

Joint Task Force "Proven Force" and B-52s

F-117s attacked northern Iraq only occasionally. Most bombing in that region came from air force aircraft based in Turkey and England. Not surprisingly, American strike aircraft north and west of Iraq bombed targets in northern Iraq. In the case of Proven Force's eighteen F-111Es and thirty-six F-16s, located at Incirlik air base in Turkey, range limitations discouraged any inclination to use those aircraft in the KTO. Eight B-52s at RAF Fairford in England could not receive air tasking orders from Riyadh via the Computer Assisted Force Management System (CAFMS). Consequently, folding those B-52s into Saudi-based packages was too cumbersome.[34]

When Moron Air Base, Spain, got CAFMS in mid-February, the twenty-two B-52s there were able to bomb Iraqi ground forces in the KTO for the first time in the war. During the early weeks of the war Moron had only ten B-52s, all restricted to missions in northern Iraq. At the

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[33](S) Cont Hist Rpt, 37 FW(P), 10-16 Feb 1991, AFHRA.

[34](S) Hist, SAC, 1990, AFHRA.

same time that Moron got CAFMS and more bombers, the eight B-52s newly arrived at RAF Fairford in Great Britain took over Moron's old task of bombing northern Iraq. Like Moron's B-52s, the Fairford "Buffs" looked to Proven Force for targets and support packages.[35]

In addition to F-111E and F-16 strike aircraft, Proven Force had "Wild Weasels" (F-4Gs and F-16s) for SAM suppression; EF-111s for radar jamming and Compass Call EC-130s for communications jamming; RC-135s (based in Greece) for electronic intelligence; E-3s and F-15Cs for protection against Iraqi fighters; KC-135s for refueling; and helicopters to rescue downed aircrew. This composite force built its own strike packages without assistance from CENTAF. Fairford B-52s were scheduled to hit targets in northern Iraq when Proven Force's support aircraft were available. Usually a cell of four B-52s would share the support package built for nightly strikes by F-111Es. Proven Force also ran several F-16 strikes during each period of daylight, with the bigger ones employing as many as twenty F-16s.[36]

The independence of Proven Force's operations reminded some older airmen of arrangements used in attacking North Vietnam two decades earlier, when Air Force and Navy had divided the enemy's country into seven route packages--each bombed by one service or the other. Such a compromise had never satisfied believers in unity of command, including Horner and Glosson who had flown fighter bombers into North Vietnam. The single air tasking order (ATO) had aimed to avoid route packages, but CENTAF made an exception in the case of Proven Force, which belonged to United States Air Forces in Europe (USAFE). Although Proven Force aircraft came under Horner's operational control, geography dictated a de facto route package that would have been needlessly doctrinaire to oppose.[37]

While its sorties were in CENTAF's daily Master Attack Plan, Proven Force built support packages without formal coordination and issued its own ATO. Underlying this informality were frequent communications

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[35](S) *Ibid.*

[36](S) Hist, Joint Task Force Proven Force, by CMSgt Jerome L. Schroeder, and SMSgt Thomas L. Raab, HQ USAFE, Dec 1991, AFHRA.

[37](S) Intvws, Center for Air Force History, with Lt Gen Horner, 4 Mar 1992, and Maj Gen Glosson, 12 Dec 1991.

between the composite wing commander, Brig. Gen. Lee A. Downer, and two of CENTAF's air division commanders, Glosson and Profitt; the latter had been a major proponent of Proven Force before leaving Germany in December 1990 to replace Henry as Horner's electronic combat commander. So long as Proven Force stayed north of the 35th parallel, there was little need to coordinate with anyone other than the Fairford B-52s–except when F-117s attacked targets in the north.[38]

The Black Hole assigned targets to Proven Force (often targets recommended by Proven Force itself), but the latter decided when to attack and with which aircraft. These local decisions, based partly on intelligence from USAFE headquarters at Ramstein Air Base in Germany, went into CENTAF's Master Attack Plans. Since targets in northern Iraq received lower priority for imagery than those in the KTO or central Iraq, Proven Force depended heavily on its own reconnaissance aircraft for target photography. Six RF-4Cs had arrived at Incirlik on 3 February; by the end of the war, they had flown more than a hundred sorties in northern Iraq.[39]

Maj. Gen. James L. Jamerson, who commanded Proven Force, adopted an air campaign plan with phases different from those used by CENTCOM. He broke the first CENTCOM phase in two and replaced phases two and three with a phase dedicated to interdiction. Jamerson's first phase was an attack on command, control and communications nodes. His second phase involved targeting weapons production and storage, electricity, oil, airfields, and aircraft. Jamerson never got to execute his third phase, interdiction of enemy bridges and troops in northern Iraq. Horner did not want to expend much effort interdicting those Iraqi forces unless they started to move south. The Iraqis stayed put, and consequently even Republican Guard in northern Iraq passed through the air campaign mostly unscathed. Those forces then supported Saddam against civil unrest following the Gulf War.[40]

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[38](S) Intvw, GWAPS with Brig Gen Downer, Ramstein AB, Germany, 30 Apr 1992. For the Black Hole's role in Proven force targeting, see (S) planning binder, "Northern Iraqi Target Base," GWAPS BH 7-95.

[39](S) Hist, Joint Task Force Proven Force, AFHRA.

[40](S) Intvw, GWAPS with Brig Gen Downer, Ramstein AB, 30 Apr 1992; (S) Hist, Joint Task Force Proven Force, AFHRA.

As with CENTCOM's first three overlapping phases, Proven Force's first two phases merged. There was, however, something of a north to south progression in the bombing. The final southward push was in response to CENTAF's call in mid-February for help in attacking targets below the thirty-fifth parallel. Before that, however, Proven Force's lack of stealth and precision had caused Jamerson to think in terms of rolling back Iraqi defenses from north to south rather than paralyzing the enemy's defenses at the outset. For some air defense targets, like the sector operations center at Kirkuk, he needed help from CENTAF's F-117s.[41]

Proven Force's lack of precision flowed from deployment of all available precision attack aircraft in Europe to Saudi Arabia before establishment of Proven Force at the beginning of the air campaign. Although such a force had been under consideration for months, few had believed that Turkey would permit the use of Incirlik to launch air raids against Iraq. There were limits to Turkey's cooperation, but they mostly affected special operations forces under Jamerson's command; the Turks would not let him insert such forces into Iraq except to rescue downed aircrew. As a consequence, special operations forces could not provide laser designation from the ground, which in some cases would have enabled Jamerson's aircraft to drop laser-guided bombs. Jamerson did request F-4E aircraft with laser designation pods from Clark Air Base in the Philippines, but while the planes arrived before the end of the war, the pods did not.[42]

Jamerson and Downer made a number of other attempts to improve the precision of Proven Force bombing. Like CENTAF, they did not

[41](S) Rpt, 12 TFS, "Daylight Tactical Air Combat Operations in Northern Iraq," 1 Jun 1991, GWAPS NA 516; (S) Intvw, CMSgt Jerome E. Schroeder with Maj Gen James L. Jamerson, Incirlik AB, Turkey, 27 Mar 1991.

[42](S) Hist, Joint Task Force Proven Force, AFHRA.

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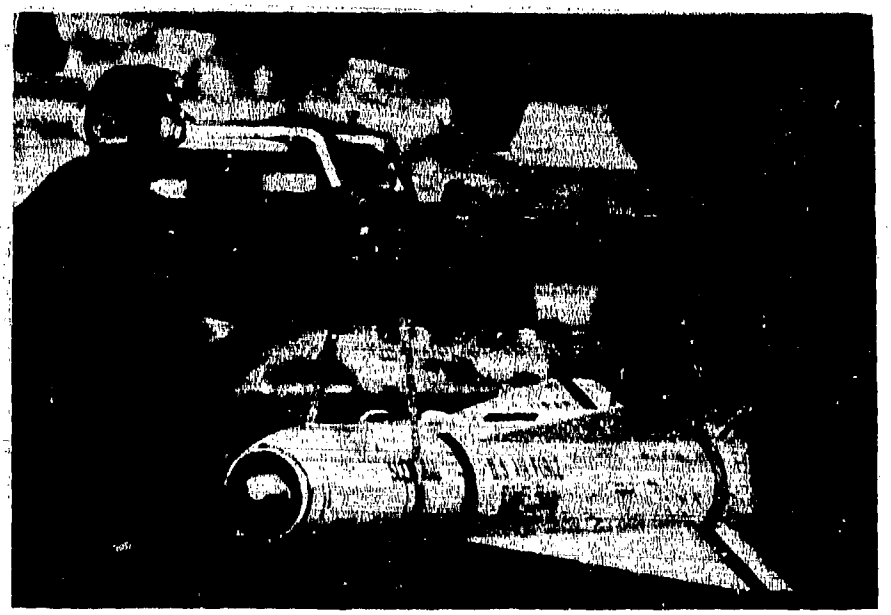
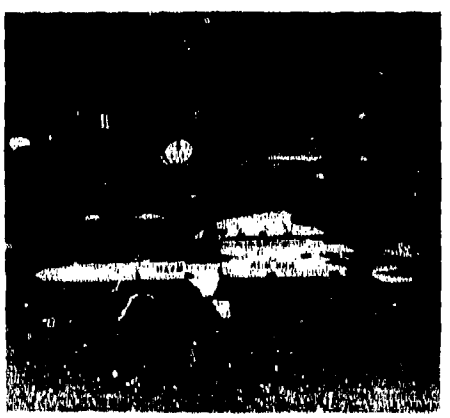
risk going to low altitude for better accuracy. But three of Downer's F-111Es used Global Positioning System receivers to improve navigation and to act as pathfinders for other F-111Es. Downer commented after the war that this increased accuracy by "a hundred per cent."[43] Still, Proven Force's only precision weapons were HARMs, Shrikes, and Mavericks carried by "Wild Weasel" F-4Gs and F-16s. Despite their small warhead





(Above) Crewmen position Maverick missile for mounting onto aircraft. (Below) Close-up of Harm missile attached to the wing pylon of an F-4G Wild Weasel aircraft.

[43](S) Intvw, CWAPS with Brig Gen Downer, Ramstein AB, 30 Apr 1992.

designed for use against tanks, Mavericks were useful against other targets besides SAM sites, including an electric power plant and an aircraft on the ground. Such targets were unusual, however, and Proven Force expended only fifty-five Mavericks.[44]

A major focus of Proven Force attacks during much of the war was the military research and development complex located near the Tigris north of Mosul. In addition to suspected nuclear production facilities already discussed, there was a missile plant, another development facility whose purpose had yet to be discovered, a SAM support facility, and a signals intercept station. Day after day, Proven Force attacked these targets around the clock in an area that pilots took to calling "Happy Valley," where unusually heavy air defenses sparkled harmlessly below them. On 13 February, for example, four F-16s dropped a total of twenty-four 500-pound bombs on the signals intercept station with four hits on the main building and several secondary explosions. Meanwhile, four other F-16s attacked the nuclear production facility with eight 2,000-pound bombs, three of which hit one building; this attack was unusually accurate. The next day, Proven Force sent eight F-16s against the nuclear production facility, followed by four F-111Es that night. Another four F-111Es led four B-52s in a raid on the missile production facility to conclude two typical days of air campaigning in "Happy Valley."[45]

While giving "Happy Valley" more attention, Proven Force got more satisfaction from its single raid on Iraq's biggest oil refinery at Bayji on the Tigris 100 miles south of Mosul. [DELETED]. Proven Force's strike did not occur until after other Coalition planes had already raided the target. Six Tomahawk cruise missiles hit Bayji on 22 January. Two weeks later, on 7, 8, and 9 February, a total of twenty-four British Tornados came just north of the thirty-fifth parallel with a hundred 1,000-pound unguided bombs and eight laser-guided bombs. On 8 February,

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[44](S) Hist, Joint Task Force Proven Force, AFHRA.

[45](S) Rpt, HQ USEUCOM, Proven Force BDA, 4 Apr 1991, GWAPS CHST 54; (S) rpt, 612 TFSq, "Daylight Tactical Air Combat Operations in Northern Iraq," Jun 1991, GWAPS NA 516.

six B-52s joined the attack and dropped nearly three hundred 750-pound bombs.[46]

Jamerson then gave the go ahead for Proven Force aircraft to join in bombing Bayji. Although previous attacks had left at least a dozen storage tanks already destroyed or burning, not to mention many pipeline cuts, Proven Force sent most of its fighters. Twenty F-16s hit the refinery on the morning of 9 February, followed by sixteen F-16s in the afternoon and six F-111Es in the evening. They dropped nearly a hundred 2,000 pound bombs with spectacular results. A big black mushroom cloud rose over burning oil tanks, and weeks passed before the smoke cleared. In addition to destroying approximately forty storage tanks, Proven Force severely damaged two cracking towers. Ever since Checkmate's original Instant Thunder plan, cracking towers had been off limits, because their destruction would make refinery repair after the war more difficult. As Downer later recalled, CENTAF told Proven Force to "knock it off" and Proven Force ceased to bomb oil targets.[47]

CENTAF's reaction could not dim Proven Force's pride in so smokey a triumph, but this kind of dramatic result was both rare and deceptive. It was likely that Iraq had enough surviving fuel and lubricants in the KTO to render Bayji unimportant for months to come. On the other hand, the suspected research and development facilities in "Happy Valley" might really have held keys to Iraq's development of special weapons, including nuclear ones. Nevertheless, it was the Bayji raids that aircrews remembered with greatest pleasure.

The Bayji raids brought Proven Force to the thirty-fifth parallel, the southern edge of its route package. A few days later, CENTAF told the Incirlik F-111Es and F-16s to attack further south to help F-117s bomb central Iraq. The principal target area that the Black Hole had in mind was the Taji military complex; that facility surrounded an airfield on the northern outskirts of Baghdad, approximately fifteen miles north of the downtown area. On the first night of the campaign, an F-117 had struck

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[46](S)Rpt, RAF sortie data, GWAPS NA 515; (S) Intvw, CMsgt Jerome E. Schroeder with Maj Gen James Jamerson, Ramstein AB, 27 Mar 1991; (S) Intvw, GWAPS with Brig Gen Downer, Ramstein AB, 30 Apr 1992.

[47](S) Intvw, GWAPS with Brig Gen Downer, Ramstein AB, 30 Apr 1992. See also (S)rpt, HQ USFUCOM, Proven Force BDA, 4 Apr 1991, GWAPS CHST 54.

the Taji air defense sector operations center there, but the number of targets there far exceeded available F-117 sorties. Hundreds of machine shops, bunkers, warehouses, and sheds were packed with military equipment in storage or under repair. Taji's components included air and ammunition depots; missile, tank, artillery and aircraft engine repair facilities; as well as barracks for three brigades. There was also a steel fabrication plant whose products intelligence believed included items used in making nuclear weapons.[48]

CENTAF's guidance for Proven Force attacks on Taji was even more basic than usual. Glosson told Downer to leave nothing at Taji standing "taller than a taxi light."[49] During the last two weeks of the war, thirteen Proven Force strike packages–totalling approximately 140 F-111E and F-16 sorties–struck these facilities. While the mission was straightforward, Proven Force now had to submit its aircraft to more detailed control by CENTAF. Not only were they operating in the middle of CENTAF's territory, but they were using CENTAF support packages. Since Proven Force could not cross Syria, their missions against targets in central Iraq were a third longer than necessary. But at less than 700 miles each way, Proven Force had less distance to cover than F-117s coming from the southern end of Saudi Arabia.[50]

Fairford B-52s could not follow Proven Force to Taji, because Fairford lacked the computer link of the Computer Aided Force Management System to the ATO system. Instead, bombing Taji became the favorite recreation for B-52s whose normal targets were Iraqi positions in the KTO. The theater-based B-52s, took the lead in forming packages with their more distant partners in Spain (nearly three thousand miles away) and Diego Garcia (more than three thousand miles away). About seventy B-52 sorties struck Taji (as many as a dozen at a time) and dropped more than 3,000 bombs. Taji was the sort of complex for which area bombing seemed particularly well suited, and while no towering cloud of black smoke rewarded the attackers, there was much destruction.[51]

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[48](S) Planning binder, "Taji Military Complex," OWAPS BH 7-92.

[49](S) Downer's recollection in intvw with OWAPS, Ramstein AB, 30 Apr 1992.

[50](S) Hist, Joint Task Force Proven Force, AFHRA; (S) rpt, HQ USEUCOM, Proven Force BDA, 4 Apr 1991, OWAPS CHST 54.

[51](S) Hist, SAC, 1990, AFHRA; (S) rpt, HQ SAC Plans and Resources, *B-52 Desert Storm Bombing Survey*, 15 Dec 1991.

Approximately twenty miles separated North Taji from Taji. Except for their military affiliation, the two places were very different and posed dissimilar targeting problems. Instead of hundreds of warehouses, North Taji had two big, tough bunkers. These command bunkers were so hard that they had thus far thwarted the F-117's best penetrating bomb, the 2,000-pound GBU-27. Even when Schwarzkopf kept F-117s from attacking leadership targets in downtown Baghdad, the North Taji bunkers remained fair game. But CENTAF did not have a weapon that could do the job.[52]

Tactical Air Command and the air staff wrestled with this problem throughout the air campaign. Possible solutions included dropping a series of as many as four 2000-pound bombs in quick succession on the same aimpoint to dig through perhaps thirty feet of concrete slabs, crushed rock and soil. This idea was never tried, but CENTAF did request immediate development of a new bomb, utilizing off-the-shelf technology. Normally a new bomb would have taken years to develop. Under the pressure of war, the U.S. weapons development community produced four GBU-28s in a month. Their bodies were at one time artillery gun barrels, and each weighed nearly 5,000 pounds. They went to Nevada for testing. The first GBU-28 missed a concrete slab but penetrated deeply into the soil. The second penetrated concrete without breaking up. The remaining two GBU-28s were flown to Taif, Saudi Arabia, and on the last night of the war a pair of F-111Fs dropped them on one of the bunkers at North Taji. GBU-28 number three buried itself harmlessly in the desert, but the fourth penetrated the bunker.[53]

More GBU-28s were in production when time ran out in Iraq. Except for the other bunker at North Taji, one at Abu Ghurayb west of Baghdad, and possibly one downtown, no Iraqi bunker was so strong that

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[52](S) Planning binder, "Taji Military Complex," GWAPS BH 7-92.

[53](S) Background paper, Capt Bernier, TAC, 9 May 1991; (S) msg, Vice Cmdr TAC to SAF/AQ, subj: Desert Storm Deep Hardened Target Penetration Test, 191803Z Feb 1991, both in GWAPS NA 334. See also (S) rpt, SAF/AQ, Deep Penetration Munitions Study, 29 Jan 1991, GWAPS CHST 16-1.

only a GBU-28 (and not a GBU-27) could penetrate it.[54] During the last week, the Abu Ghurayb bunker once again proved impervious to a GBU-27. Given the strength of these bunkers, the Black Hole had reason to think that they might hold senior Iraqi leaders, even Saddam. Although Saddam's death was a bonus hoped for rather than a necessity planned, Coalition aircraft attacked targets associated with him from the beginning to the end of the campaign.[55]

Most leadership targets were in Baghdad and off limits for at least a week after Al Firdos, but several like the bunkers at North Taji and Abu Ghurayb were outside the city. While intelligence had pinpointed a large residence at Abu Ghurayb as Saddam's, CENTAF bombed other residences whose connection with Saddam was only suspected. Late in the war, for example, F-117s bombed a suspected residence across the Tigris from the Taji complex; early in the war they bombed another one at Abu Al Jahish farther up the Tigris, five miles north of the Bayji refinery.[56]

Even more numerous and elusive than Saddam's fixed residences were his conference vehicles. In the 1980s Iraq had purchased twenty-four motor homes (or "recreational vehicles") from an American company, the Bluebird Wanderlodge Company. On at least one occasion he had put his staff on board this fleet and taken them into the desert for a conference away from normal distractions. One week into the air campaign, Saddam appeared on American television from inside one of the conference vehicles. Toward the end of the war, American intelligence discovered a Bluebird Wanderlodge at a motor pool near Qaim in western Iraq. Before dawn on 22 February, a pair of F-111Fs fresh from "plinking" tanks in the KTO, flew north to Qaim and used 500-pound laser-guided bombs to plink the Bluebird (which the Americans usually referred to as a command "Winnebago," the name of a more famous

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[54](S) The possible exception in Baghdad was the bunker under the New Presidential Palace. Steel beams in the roof of the building could knock a GBU-27 off course before it could reach the bunker, but a bomb entering through a side portico might penetrate. See memo, Checkmate to CENTAF/XX (Black Hole), subj: Baghdad New Presidential Palace, 242300Z Feb 1991, GWAPS CHST 14-35.

[55]On the relationship between CENTAF planning and the possible death of Saddam, see the GWAPS Planning report.

[56](S) Cont Hits Rpts, 37 FW(P), AFHRA.

recreational vehicle). Meanwhile, another pair of F-111Fs with 2,000-pound laser-guided bombs attacked a nearby command bunker.[57]

Whatever damage these scattered attacks on places associated with Saddam achieved, his survival as well as the survival of his regime put a premium on severing communications between the regime and its forces–particularly ground forces in the KTO and mobile Scud launchers. CENTAF planners assumed that Saddam and his senior subordinates spent most of their time in Baghdad; possibly they moved from house to house in residential neighborhoods where American bombs never fell. Although CENTAF bombed key nodes in the national telephone system at the outset of the war, the fact that the Iraqis made little use of radio communications indicated that they were probably still using land lines, however cumbersome the switching and routing of calls.[58] [deleted].[59]

Bombing the Rasheed Hotel remained out of the question, but the Black Hole continued to hope for permission to bomb other Baghdad targets. For about a week after Al Firdos, Schwarzkopf made it plain that he would not (or could not) approve most targets in downtown Baghdad. Except for a couple of strikes on the city's military airfields, F-117s attacks stayed outside the city limits. Black Hole planners even quit asking for permission to bomb downtown targets, while their Checkmate allies did what they could.[60]

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[57](S) Msgs, 48 TFW to CENTAF, subj: Misrep, mission 3467-68A, 220645Z Feb 1991; mission 3461-62A, 220650Z Feb 1991, both in GWAPS Database. See also (S/NF) memo, James K. Swanson, Defense Technology Security Administration, to Deputy Under Secretary of Defense for Trade Security Policy, 29 Jan 1991, GWAPS CHST 15-17; (S/NF) msg, ASO Robins to SSO DIA, subj: Possible Use of US Built Motorhome by Saddam Hussein and Iraqi General Staff, 270456Z Jan 1991, GWAPS CHST 15-28; (S) notes, TSgt Scott Saluda, CENTAF TACC, 22 Feb 1991, AFHRA.

[58]Such a supposition proved correct, because as soon as the war against the Coalition was over the Iraqis extensively use their radios in putting down the Shi'te and Kurdish rebellions.

[59](S) Memo, Checkmate to Black Hole (CENTAF/XX), subj: Al Kut and Al Basrah Cable Communications Nodes, 211600Z Feb 1991, GWAPS CHST 14-44; (S) memo, Checkmate to Black Hole, subj: Proposed C3 Targets, 232246Z Feb 1991, GWAPS CHST 14-38; (S) memo, Checkmate to Black Hole, subj: Eastern C3 Weakness, 262100Z Feb 1991, GWAPS CHST 14-30.

[60](S) Intvw, Wayne Thompson, GWAPS, with Lt Col David A. Deptula, Pentagon, 26 Aug 1991.

On the morning of 15 February, when Warden learned that no F-117s would attack Baghdad that night for the first time since the beginning of the war, he took his objections to Secretary of the Air Force Donald Rice; Warden also sent a subordinate to convey his complaint to Cheney's staff. Four days later, Rice brought Cheney into Checkmate for the third time since the beginning of the air campaign. Warden argued in favor of striking internal security facilities in Baghdad with F-117s and Tomahawk cruise missiles. [DELETED].[61]

Deptula then drafted a request for permission to attack six targets in Baghdad: the regional headquarters of the Iraqi Intelligence Service (possibly the new national headquarters of this service, the regime's principal agency for controlling its dissidents through informants, surveillance, and torture), the headquarters of the Special Security Service (the guardians of Iraq's leaders), that of the Ministry of Strategic Industry and Planning (responsible for nuclear, biological and chemical weapons development), the suspected new operating location of the Ministry of Defense in a building adjacent to the Ministry of Petroleum, the Republican Guard headquarters, and the headquarters of the Ministry of Military Industry. Deptula argued that destruction of these targets might "further cripple the Saddam regime such that even with cessation of hostilities he may become impotent and subject to replacement."[62]

Schwarzkopf approved the first two targets on CENTAF's list and for a time approved the Republican Guard headquarters as well. The Black Hole made the most of this opportunity by scheduling relatively heavy F-117 raids against the available targets. The Special Security Service and the Iraqi Intelligence Service regional headquarters would suffer more than the one or two bombs dropped in earlier raids. Only after the war would the U.S. learn that Iraq kept its American prisoners in the Intelligence Service's regional headquarters; fortunately, none were hurt in the attack. Schwarzkopf canceled a strike on Republican Guard headquarters after a squabble within the American intelligence community

[61](S) Thompson notes, 15, 19 and 21 Feb 1991.

[62]Draft memo, Lt Col Deptula for Lt Gen Horner to Gen Schwarzkopf, subj: Air Strategy, 21 Feb 1991, GWAPS BH Deptula 19C.

about whether that headquarters had moved or whether it had already been bombed. [DELETED].[63]

In the face of these objections to target nominations of 21 February, the Black Hole took a different approach. Instead of placing priority on the regime itself, the Black Hole recommended bombing three notorious symbols of the regime: Ba'th Party Headquarters, an enormous statue of Saddam more than 60 feet tall, and an even more enormous pair of victory arches commemorating the Iran-Iraq War; the last were massive bronze magnifications of Saddam's forearms, holding swords which crossed some 150 feet above a broad avenue. Schwarzkopf liked all three targets, and he was especially enthusiastic about bombing Saddam's statue. But targeting the statue and the arches ran into objections from army lawyers both in Riyadh and in Washington.[64]

Military lawyers performed two important services for the air campaign: they helped the campaign to conform with international law

[63](S) Thompson notes, 22-24 Feb 1991; (S) Cont Hist Rpts, 37 FW(P), 17-23 Feb 1991, 24 Feb - 2 Mar 1991, AFHRA; memo, Lt Cmdr Gonzalez to Brig Gen Glosson, subj: TLAM Tasking Against Ministry of Petroleum, 25 Feb 1991, GWAPS BH Deptula 19C.

[64]The Black Hole's target recommendations to Schwarzkopf for this period are in GWAPS BH Deptula 19C. On Schwarzkopf's views, see his *Hero*, esp pp 457 and 468. On the statue, see the Checkmate target file, GWAPS CIT 390. On the victory arches, see Samir al-Khalil, *The Monument: Art, Vulgarity and Responsibility in Iraq* (Berkeley, 1991).

and they helped to prevent excessive restrictions based upon misreadings of international law. But when Black Hole planners had proposed an attack on Saddam's monuments earlier in Desert Storm, an Air Force lawyer at Tactical Air Command headquarters had objected to bombing such targets as cultural monuments. Throughout the war, CENTAF had scrupulously avoided genuine cultural monuments like the ziggurat at Ur–even when the Iraqis parked fighter aircraft nearby to gain protection. But to regard Saddam's propaganda symbols as "cultural monuments" was akin to regarding Hitler's Nuremberg parade grounds in a similar light. CENTAF was certainly correct to believe that Saddam's propaganda symbols were legitimate targets.[65]

Military lawyers felt Saddam's propaganda symbols were protected by international law as "cultural monuments."

While Tactical Air Command's legal advice was simply wrong on this matter, Army lawyers confused matters by raising objections which had little to do with the legality of targets. They wished to minimize bombing in Baghdad to avoid further incidents like Al Firdos. They argued that a psychological target like Saddam's statue might have contributed to the Coalition air campaign early in the war, but with the conflict nearly over such attacks carried unnecessary risks. Whatever the

[65](S) Thompson notes, 9 Feb 1991.

merits of the lawyers' arguments, their special position gave legal weight to their views. When military lawyers advise against action for whatever reason, politicians and generals tend to think in terms of legality. On 25 February after approving raids on the statue and arches, Powell asked Schwarzkopf to hold up on the strikes; they were never again approved as targets.[66] After the war, Horner remained under the misconception that the strike on Saddam's statue had been prohibited by international law.[67]

An Air Force lawyer in Washington suggested that CENTAF's recommendation of Saddam's statue as a target demonstrated the need for more thorough legal screening of targets.[68] Such conclusions condoned rather than corrected the air campaign's failure to conduct psychological operations against Baghdad. While dropping leaflets in the KTO had stimulated desertions, Schwarzkopf's staff vetoed dropping leaflets on Baghdad–where they might encourage rebellion against Saddam's regime. CENTCOM's rationale was a mixture of deference to perceived Saudi uneasiness about seeking democratic upheaval in the Arab world along with the notion that encouraging the collapse of an enemy government at war was somehow illegal.[69]

CENTAF's three symbolic targets in Baghdad boiled down to one, Ba'th Party Headquarters, only lightly damaged by Tomahawk warheads on the campaign's first night and hit again by F-117s in mid-February. The Black Hole planned the biggest F-117 raid of the war against this single target, thirty-two F-117s over the night of 25-26 February. But the weather again failed to cooperate. For the first time in the war, it kept the F-117s from bombing anything for an entire night and reduced their effort on the following evening to dropping a few bombs outside Baghdad.[70]

Bad weather interfered just as the F-117 wing was transitioning into its surge schedule. In place of a normal schedule of three nighttime waves of ten sorties each, the wing had aimed to send two waves of

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[66]Schwarzkopf, *Hero*, pp 457 and 468.

[67]*Air Force Times*, 8 Mar 1991.

[68]Suggestion, JULLS 21335-07500 (00006), HQ USAF/JACM.

[69](S) Thompson notes, 24 Feb 1991.

[70](S) Cont Hist Rpt, 37 FW(P), 24 Feb - 2 Mar 1991, AFHRA.

thirty-two sorties each. That meant F-117s must fly two long six-hour sorties in a single night. The first wave had to finish its work around midnight so that the wing could turn the aircraft and send them back for a strike before dawn. In the end, it managed to fly only one of these two-wave nights before weather ended the surge.[71]

F-117s finally returned to Baghdad on the night of 27-28 February. By then the ground war's rapid progress signaled that a cease-fire could come at any time. The F-117 wing flew a three-wave schedule, with a beefed-up first wave of twenty aircraft; after announcement of the impending cease-fire, the third wave was cancelled. The Black Hole reduced the size of the raid on Ba'th Party Headquarters to conform to this schedule and to make F-117 sorties available for other pressing targets, including the suspected nuclear facility at Al Musayyib (Al Atheer) and two transport aircraft at Baghdad's Muthena Airfield (planners suspected that Saddam might try to leave Baghdad). Still, CENTAF sent sixteen F-117s which did considerable damage to the Ba'th Party Headquarters. This attack also demolished a statue in front of the building--a statue possibly of Saddam, but probably of a Ba'th Party founder. By this time, CENTAF planners were happy just to eliminate any symbol of the regime.[72]

Conclusion

The air campaign had begun only six weeks earlier in front of a worldwide television audience fascinated by the bombing of Baghdad. When the last bombs fell on one of the original Baghdad targets, the television audience had moved on to the ground war in Kuwait and southern Iraq. Coalition air forces had long since led the shift in focus to the KTO, but continued efforts in central and northern Iraq by a few aircraft, including the exceptionally capable F-117s, testified that the Coalition wanted to do more than evict Iraqi forces from Kuwait. If the attacks on Saddam's regime and its weapons of mass destruction did not achieve complete success, they at least worked toward a worthy end–an Iraq less threatening to its neighbors and the world's oil supply.

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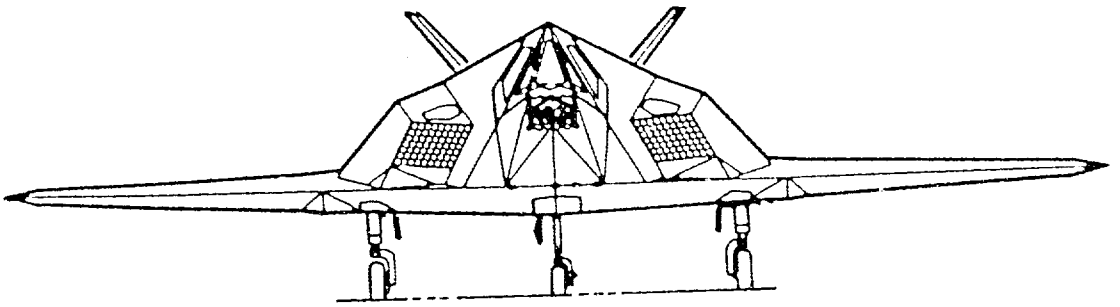
[71](S) Cont Hist Rpts, 37 FW(P), 17-23 Feb 1991, 24 Feb - 2 Mar 1991, AFHRA.

[72]The Black Hole planning sheets for the Ba'th Party Headquarters raid are in GWAPS BH Deptula 21D. Bomb-damage photos are in GWAPS CIT 291.

F-117s destroy a transport aircraft and small jet suspected to be Saddam's escape from Baghdad.



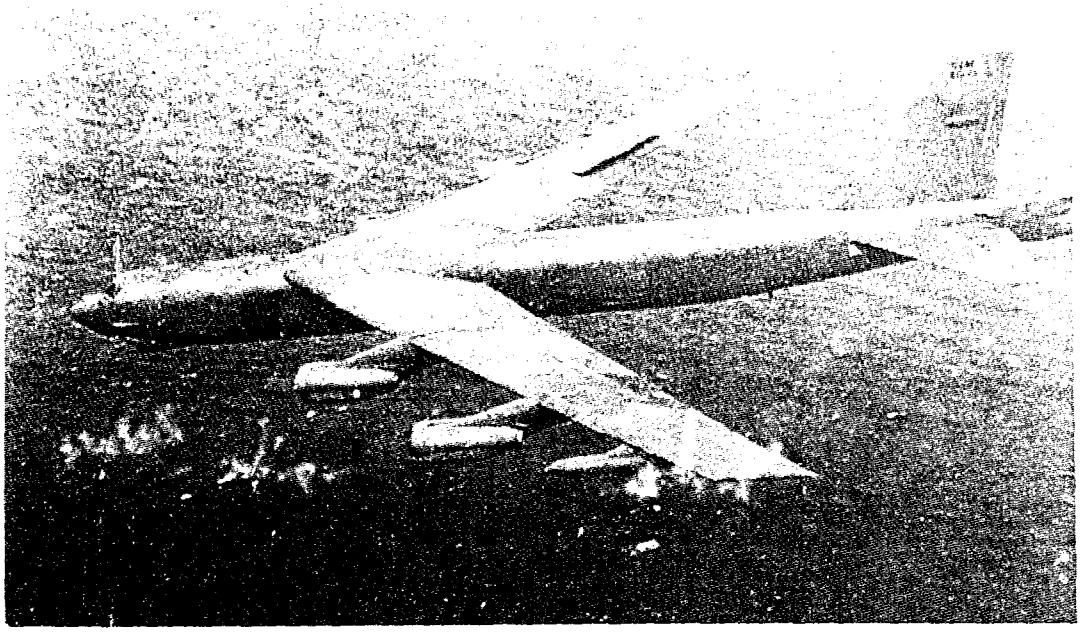
6

Air Against Iraq's Ground Forces

The most opaque and controversial portion of the air campaign against Iraq was the effort against the enemy's ground forces. That effort began on day one and continued to the end of the war. On it rested Coalition hopes that a ground campaign, if necessary, would result in few casualties. In fact, the eventual ground war resulted in Coalition casualties far below the most optimistic prewar estimates. But the question remains as to the effectiveness of air attacks against Iraqi ground forces throughout the KTO. This chapter will evaluate the conduct of Coalition air operations focused against Iraq's field army in the KTO before the ground war began. It is a story that still remains unclear, but this account hopefully will contribute to an understanding of the larger picture.

In the past, air forces have contributed significantly to destruction of enemy ground forces and to ground campaigns.[1] But never has an air force found itself in the position of "preparing the battlefield" to the extent that ground commanders counted on air power being able to achieve a 50-percent level of destruction of the enemy's equipment. What is remarkable about the prewar period is the alacrity with which senior army commanders, including Schwarzkopf, assigned air power the mission of taking Iraqi military forces down by half; what is perhaps even more surprising was the willingness of air commanders to accept this charge.

[1]The application of Allied air power against German ground forces in Normandy is a case in point. From the opening of that campaign with Allied attempts to isolate the battlefield in northwestern France by attacks on the French railroad system to the devastating attacks on German panzer and infantry forces as they escaped the Falaise pocket, air power played a crucial role in the Battle of France in summer 1944. Yet, whatever the similarities between 1944 and 1991, there is no comparison between the sustained weight of effort involved in the two campaigns; Desert Storm represented a quantum leap in technological sophistication and capability in comparison to any previous air campaign against enemy ground forces.



Although the B-52 was least precise platform of the Coalition inventory, POWs suggest it had the greatest impact on their morale.

In the end, much of the air effort centered on attacking the equipment of the Iraqi military in the KTO. Air attacks aimed at destroying or damaging measurable, quantifiable percentages of the Iraqi Army's tanks, armored personnel carriers, and artillery pieces. Ironically, however, when the war was over, many POWs would suggest that the B-52s, the most inaccurate and least precise platform in the Coalition inventory had had the greatest impact on their morale.[2]

The Iraqi Army: Dispositions and Strategy in the KTO

Earlier, this study suggested the general framework of Iraq's strategy and Saddam's assessment of his opponents.[3] For our purposes, we need to recall that framework to understand Iraqi intentions in deploying their

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[2]See among many others: (S/REL UK) Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "The Gulf War: An Iraqi General Officers' Perspective," JDC Rpt #0052, 11 March 1991.

[3]See Chapter 3.

ground forces in the KTO. The Iraqis had followed their invasion of Kuwait with a move of their Republican Guard formations up to the frontier into Saudi Arabia.[4] When this attempt to intimidate the Saudis failed, they then moved to a defensive strategy. The Republican Guard now moved back to form a theater-level reserve, and a flood of reserve infantry divisions deployed along the Kuwait-Saudi frontier.[5] The Iraqis established a three-tiered defense, similar to Soviet doctrinal conceptions and in line with their experiences in the Iran-Iraq war. Across the Kuwaiti-Saudi frontier and along the Gulf coast they deployed reserve infantry divisions dug into extensive defensive positions consisting of deep trench lines, mine fields, barbed wire, and even ditches to be fired with petroleum. [For the disposition of Iraqi forces in the KTO see Map 35.] Behind these positions lay artillery set to fire at predetermined ranges. The initial defensive forces were to tie up and attrit attacking allied forces, so that Iraqi reserves could mass for major counterattacks.[6]

Immediately behind the infantry divisions were armored and mechanized divisions of the regular army. Their mission was to launch immediate counterattacks on any breakthroughs by Coalition forces.[7] Finally, if the Coalition ground troops did claw their way through defenses and counterattacks, the Republican Guard, positioned on the Iraqi side of Kuwait's northwestern bulge, would launch a devastating counterattack. With the exception of frontline divisions, the Iraqis spread armored and mechanized counterattack forces over a wide area to make them less vulnerable to air attack; once the ground campaign began, they believed that they would have sufficient time to concentrate for the "Mother of all Battles."

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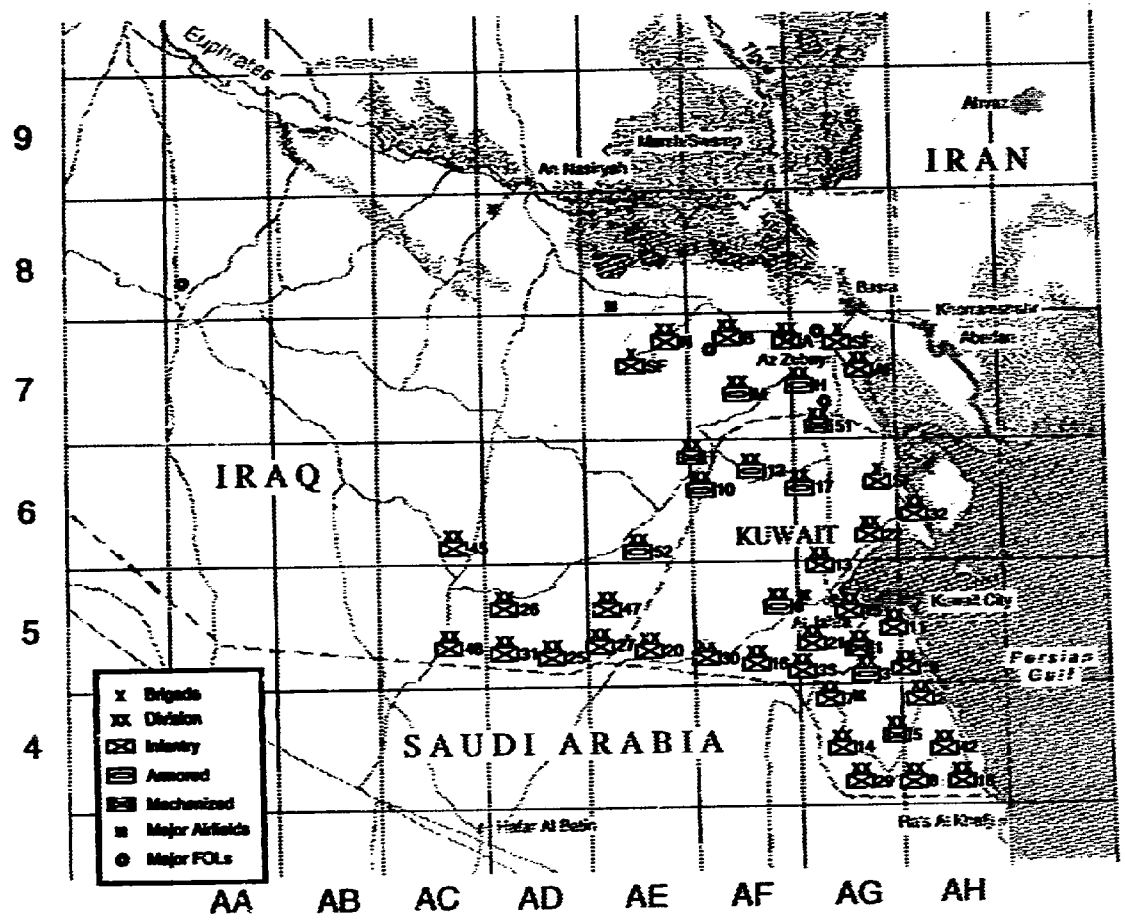
[4]Gen H. Norman Schwarzkopf, *It Doesn't Take a Hero*, with Peter Petre, (New York, 1992), p 229.

[5]*Ibid*, p 346.

[6](S) CIA Brfg, OWAPS, 25 Jun 1992.

[7][DELETED]



Map 35
Disposition of Iraqi forces in the KTO

In assessing the operational picture, the Iraqis calculated that Coalition commanders had only three options: an amphibious landing by the Marines, a drive up the Gulf coast, or an offensive from western Kuwait up the Wadi al-Batin. But they excluded a wider encircling hook from the west for a variety of apparently sensible reasons. First, they recognized the thoroughly inhospitable nature of the desert and assumed that their opponents would be equally loath to move through western Iraq. Secondly, they saw no preparations for such a move before 17 January; after that date they had other things on their mind.[8]

[DELETED].[9] [DELETED][10]

Finally, there was one other major deficiency in the Iraqi deployments. The forces in the KTO were under Baghdad's direct control and Saddam's deadening hand. Above corps level, there was no army command charged with defense of Kuwait. Hence, General Headquarters in Baghdad–firmly under Saddam's thumb–made virtually all operational decisions. Consequently, even under the best of circumstances, there would be substantial delays in transmitting orders out to the field.[11] Needless to say, the air campaign insured that these were not the best of circumstances.

It still remains unclear how much force the Iraqis deployed into the KTO. The paper strength of the Iraqi Army in the region was indeed impressive. In the KTO the Iraqis emplaced thirty-one infantry divisions, eight armored, and three mechanized divisions. Based on TO&Es (Tables of Organization and Equipment), U.S. intelligence assessed Iraqi strength at approximately 540,000 troops, 4,280 tanks, 2,870 armored personnel carriers, and 3,110 artillery tubes.[12]

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[8][DELETED]

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[10][DELETED]

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[12]Even a year after the war the Department of Defense's estimates were still in this range. Department of Defense, *Conduct of the Persian Gulf War, Final Report to Congress* (Washington, 1992), pp 113, 356.

In fact, Iraqi forces in the KTO were far weaker than these intelligence estimates. First, the reserve divisions called up in the summer never received a full complement of manpower or equipment.[13]

[DELETED].[14]

The situation got steadily worse as the conflict approached. Average frontline and second echelon divisions deployed severely underpowered; between then and the outbreak of the ground war they lost more manpower to "desertions, AWOL, and casualties."[15] The Effectiveness report of this survey estimates that the Iraqi Army in the KTO probably numbered no more than 336,000 when the war began; after the sustained bombardment of the air campaign that number appears to have declined to approximately 220,000 due to casualties and desertions.[16]

The equipment situation was hardly more impressive. In contrast to the intelligence estimates quoted above, the Iraqis possessed approximately 3,475 tanks, 3,080 armored personnel carriers and 2,475 artillery pieces in early December.[17] Most Iraqi units that deployed to the KTO were short of what their TO&E called for; [DELETED].[18] Consequently, Iraqi ground forces represented a less formidable opponent than intelligence assessments indicated. Luckily, the Iraqis themselves appear to have been equally deceived by their undeserved reputation for military competence and power.

Planning the Air War in the KTO

How to attack the concentration of Iraqi military power in the KTO was the fundamental strategic and operational problem confronting the Coalition's high command. In the beginning, air staff planners argued

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[13][DELETED]

[14][DELETED]

[15][DELETED]

[16](S) GWAPS Effectiveness report, Chapters 4 and 5.

[17]This information is based on U-2 photography, 1 December 1990 through 1 March 1991 [(S) CIA Brfg, GWAPS, 25 Jun 1992]. No evidence exists that any substantial increments of equipment arrived in the theater after the beginning of the air campaign.

[18][DELETED]

that a strategic air campaign could mitigate the need for and/or the course of ground operations against Iraq. Instant Thunder plans stressed air power's ability to attack enemy centers of gravity and its potential to break the enemy's will without prolonged ground operations.

Nevertheless, with the exception of a few on the air staff, senior military and political leaders in Washington concluded that there was a strong likelihood of a ground campaign, if war were to occur. Even more so, those in Saudi Arabia confronting Iraqi troops deployed in jump off positions recognized that enemy ground forces represented an intractable and dangerous problem. Horner and Henry had initially focused on the defensive problem of using air power to attack a major Iraqi incursion into Saudi Arabia. Both recognized that the crucial warning of an invasion would be deployment of the SA-6s from Kuwait City. Coalition air would first destroy the Kuwaiti Sector Operations Center, then the missiles, and then the armored spearheads.[19] One senses that here there would have been no effort to fly above enemy antiaircraft; instead A-10s and F-16s would have gone to low level to attack enemy armored forces as well as their soft-skinned logistical support. Air losses would have been much heavier than in Desert Storm, but Iraqi armored forces bunched in combat array would indeed have made an inviting target.

By mid-October, the air staff was itself looking closely at Phase III, preparing the battlefield.[20] Checkmate's early studies predicted that Coalition air forces could destroy 50 percent of Iraqi tanks, artillery, trucks, and troops in the KTO in twenty-three days of good weather.[21] As hostilities loomed, the ground support portion of air plans continued its growth. While some retained considerable hope that "strategic" bombing might persuade Iraq to retreat from Kuwait, a firm understanding also existed that air operations would move fairly quickly from strategic targets to Iraqi ground forces if war occurred.

With Phase I now listing the Republican Guard as a strategic target, and with Phase III, defined as "shaping the battlefield," with 600 sorties a day to the KTO–not counting A-10s, AV-8s, and B-52s–the assumption

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[19]Intvw, Maj Gen Larry Henry with GWAPS personnel, 28 Aug 1992.

[20]See the notes by Lt Col Harvey, 16 Oct 1991, GWAPS, CHP 10.

[21]Checkmate Briefings reporting the results of its computer modeling in GWAPS, CHSH 6 and 8.

was that air power could greatly reduce the combat power of the Iraqi Army, if not destroy it. Even postulating that a quarter of the planned sorties might not find their targets, CENTAF's air planners calculated that four to five days of air attacks would suffice to destroy 50 percent of the Republican Guard's armor, with 80-100 percent attrition by day nine. They applied the same criteria to attacking Iraq's regular army; ten to twelve days of air attacks would, they believed, produce 50 percent attrition. Eighteen days of air attacks would take out 80 to 100 percent of enemy forces. Consequently, concentrated, focused air power would wreck Iraqi forces in the KTO. Unfortunately, such assessments were dangerously optimistic; as we will discuss below, a number of factors combined to lower the effectiveness of air strikes against Iraqi ground forces.

By early September, with the balance between Coalition and Iraqi ground forces more favorable, Schwarzkopf turned to offensive options. By mid-month a team of SAMS (School of Advanced Military Studies, at Fort Leavenworth) graduates was in Saudi Arabia and examining ground war options.[22] Given the forces in theater, they did not have much with which to play. Their most obvious move was a combination turning movement and envelopment against the enemy's right flank that floated exposed out to the west in the desert. But even with surprise, the balance of forces would result in unacceptable risks. A relatively weak strike into the Iraqi rear with available forces might not achieve decisive victory; if it were to become hung up in the Iraqi rear, it would inevitably lose the ensuing battle of attrition. Without sustained, heavy combat power, a Coalition envelopment faced the prospect of being destroyed in detail. In the end, Army planners did move to such a scheme, but only after the President added a reinforced, heavy corps to the order of battle.[23]

Given available forces, CENTCOM planners advocated a smaller, one-corps attack; they suggested an attack straight up the middle, at mid-point along the Kuwaiti-Saudi frontier. Coalition ground forces would drive to the main road junctions north of Kuwait City. There, hopefully, they would entrap many of Iraq's infantry divisions. Nevertheless, such

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[22]Schwarzkopf, *Hero*, p 354.

[23]Details of the work of the SAMS team and the development of the ground plan are in the (S) CENTCOM J-5 After-Action Report, 21 Mar 1991, CWAPS, NA 259. See also Schwarzkopf, *Hero*, Chapter 9 for discussion of the development of the ground plan.

an offensive would attack into the heart of Iraqi defenses and face counterattacks from enemy armored formations.[24] Such an operation risked heavy casualties, as well as the threat that Iraq would emerge with much of its army intact and its prestige enhanced.

The final melding of air and ground into a campaign plan for the KTO resulted from briefings in October. On 6 October, CENTCOM planners presented their plan to Schwarzkopf: a one corps operation with the main emphasis west of Kuwait's southern "elbow." Later that week, Glosson and Maj. Gen. Johnston briefed the entire plan, all four phases, air as well as ground, in Washington. While U.S. leaders expressed confidence in air phases, Phase IV, built around a direct assault on Iraqi positions in Kuwait provoked grave concerns. Again on 22-23 October, Powell and Schwarzkopf reviewed options; the CINC detailed the two-corps envelopment plan that his staff had examined. Powell raised some logistic doubts, but Vietnam was clearly on his mind.[25] He did promise Schwarzkopf that if it proved necessary to fight, "tell me what you need to do this. The U.S. military is available to support this operation."[26]

With such support, Schwarzkopf had his planners explore in detail other alternatives; they focused on the two-corps envelopment. On 6 November, they briefed the proposed operation to Schwarzkopf; he reiterated his belief that the Republican Guard was a major target. He told his planners that the offensive must cut off and destroy them.[27] On 15 November, Glosson briefed the CENTCOM staff on air portions of the coming war (Phases I-III). Some Army officers apparently raised concerns that CENTAF had put the plan together without ground inputs, but Glosson noted that the air plan had met Schwarzkopf's guidance. He added that he would solicit Army input for Phase IV.[28]

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[24]Schwarzkopf. *Hero* pp 356-57.

[25]*Ibid*, p 366.

[26](S) CENTCOM J-5, After Action Report, 21 Mar 1991, GWAPS, NA 259.

[27](S) *Ibid.*

[28](S) *Ibid.* See below for a discussion on the difficulties that Schwarzkopf's peculiar organization of ground forces in CENTCOM would impose on army-air force relations in the coming campaign.

Planners continued their work throughout December, and new concerns surfaced. Chief among them was the process of tying the air campaign to ground operations; there were also worries about bomb-damage assessment: could CENTCOM's intelligence evaluate the combat status of Iraqi units in Kuwait? Some fixes were easy. When Army planners calculated that ground forces would need two weeks for redeployment to the west, air and ground planners quickly agreed that the air campaign would aim at cloaking this massive flank march.[29] Other problems, like bomb-damage assessment, offered no easy solutions. Schwarzkopf himself could only caution against "over-reliance on force correlations." He noted that prudent military judgment must be the final arbiter.[30]

Organizational and Employment Problems

On the organizational side of CENTCOM's preparations, there were factors that influenced the air campaign in the KTO; these remained beyond the control of Horner and his air planners. The most important may have been Schwarzkopf's decision not to name a ground component commander. There was, admittedly, an Army component commander (Lt. Gen. John Yeosock) and a Marine component commander (Lt. Gen. Walter Boomer), but no senior officer represented the ground forces in discussions between Schwarzkopf and Horner. Schwarzkopf apparently aimed at running the ground war himself, in effect becoming the ground component commander.[31]

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[29](S) *Ibid.*

[30](S) *Ibid.* In this Schwarzkopf was entirely correct.

[31]In many respects, Desert Storm presents a picture analogous to the Normandy invasion in terms of the enormous forces deployed, the complex inter-allied relations, the vast number of joint capabilities deployed and interfacing, and the political problems that had to be negotiated between the CINC and the various capitals of members of the Coalition. In 1944, Gen Eisenhower was the Supreme Allied Commander; given the complexities of his many duties and responsibilities, he appointed a ground component commander, Field Marshal Bernard Montgomery, even though that involved placing Bradley's army group directly under Montgomery's command for the first two months of the invasion.

Schwarzkopf's decision had important consequences in the Army's attitude toward the conduct of the air campaign.[32] For justifiable reasons and with his authority as CINC, Schwarzkopf determined that the air effort in the KTO would emphasize the destruction of the Republican Guard.[33] Unfortunately, he never appears to have communicated his priorities for the air campaign to field commanders. As a result, they watched the air force seemingly ignore their target nominations.[34] Moreover, for most of the war Schwarzkopf short-circuited his targeting board's recommendations, while telling Horner and Glosson directly what they should strike in the KTO. The result, unfortunately, was considerable, and needless, misunderstanding between army and air force.

There were also organizational weaknesses within the planning system. Up to December, the Black Hole had concentrated on taking Iraq apart at the highest level and at removing the Iraqi threat to peace and stability in the Middle East. The focus of that planning effort was, thus, almost exclusively on the first phase of the air campaign. In December, in his reorganization of CENTAF, Horner folded into the Black Hole, the planning group responsible for the daily flying training ATO and defensive plans to meet an Iraqi invasion. This new group, mostly drawn from the Ninth Air Force staff, became responsible for the air war against the KTO.

In no sense was this new section in the Black Hole prepared to tackle the problems involved in using air power to degrade and destroy an enemy's ground forces. In fairness, few others in the Air Force were any better prepared. Without a conceptual framework, the planners in the Black Hole's KTO cell fell back on racking up targets and reliance on numerical indices–all unclear from the evidence (BDA)–to determine the

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[32]It is worth noting that the author's discussions in early September 1991 with a number of senior officers in XVIII Airborne Corps made clear that most of those on that staff felt that Schwarzkopf's failure to name a ground component commander had had a number of serious consequences beyond air force-army cooperation. Some went so far as to argue that the failure to close off the exits to the KTO reflected Schwarzkopf's incapacity to run the war from so far in the rear and with so many distractions.

[33]Schwarzkopf's continuing and consistent emphasis on the Republican Guard as the *primary target* for the air campaign in the KTO appears across virtually all of the GWAPS interviews with the senior planners of the air war. It is also in the TACC Logs and in all of the Master Attack Plans for the war.

[34]This affected the Marines less, since they had direct access to their own air resources.

progress of the air campaign. Without any conception of using air power as a rapier to remove surgically the opponent's brain–or stomach–the only possible employment became that of a sledge hammer. In the end, Horner was indeed correct to characterize the air effort in the KTO as "pounding a tethered goat."[35]

Two other factors conspired to make the air assault in the KTO more difficult. The first was the decision to move the attack levels of Coalition aircraft to altitudes above enemy antiaircraft artillery (AAA) defenses. By so doing, especially after allied SEAD attacks gutted Iraq's SAM defenses, the Coalition could continue its air campaign with minimal losses. The political and morale gain to the allied forces was enormous.

On the other hand, bombing above AAA had a substantial negative impact on employment of most conventional nonprecision weapons. For A-10s, the higher altitude made the 30-mm gatling gun, a most effective anti-tank weapon–firing depleted uranium rounds–considerably less effective. Even more serious was the loss of accuracy that bombing at medium-level altitudes with nonprecision weapons caused a number of sophisticated platforms. Unfortunately, because of this altitude change, the nonprecision munitions expended by F-16s and F/A-18s were incapable of hitting individual pieces of equipment. Weather exacerbated the difficulty of using "dumb" bombs from medium altitudes. The percent of targets obscured by clouds increased from 1-to-2 percent to 33 percent, a more than fifteen-to-one increase.[36] When weather was bad, these aircraft had to bomb by radar. In addition, winds at altitude–sometimes in excess of 100 knots–further degraded bombing accuracy.

There was also a substantial problem in how air force planners in the Pentagon and theater had estimated air power's effectiveness in attacking Iraqi ground forces. Numerous estimates and briefings throughout the prewar period on how air power could destroy the Iraqi Army assumed that F-16s would use Maverick, anti-tank missiles, or CBU-89s against tanks and other equipment. CENTAF's mid-November "Theater Air Campaign," for example, had calculated that a four-ship of F-16s, carrying eight Mavericks or sixteen CBU-89s would destroy three tanks.[37]

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[35][DELETED]

[36]GWAPS Space report Chapter 7, p 25.

[37](S) CENTAF, "Theater Air Campaign," Brfg, Nov 1990, GWAPS, CHC 19-17.

Unfortunately, the Maverick has never been the weapon of choice by the F-16 community; few of its pilots had trained with or used the weapon in peacetime training, while cockpit instrumentation was far from optimal for the utilization of the Maverick. Consequently, hardly any F-16 sorties against the Republican Guard or Iraqi Army units used the missile. During the war, some 8,700 F-16 sorties dropped dumb bombs; fewer than 130 expended Mavericks. F-16s did deliver large numbers of CBUs and Rockeyes–some 12,500 and 3,600 respectively.[38] But the release altitudes used were typically so high–8,000-12,000 feet above the ground–that most of these munitions were not effective. For example, the canister and fuse combinations for the CBU-2/58/57 "performed poorly throughout the war with excessively high dud rates."[39] Particularly against dug-in Iraqi armor, the preferred F-16 munition was the CBU-87 combined-effects munition (CEM). But CENTAF's restrictions on the use of this munition in the middle of the war–a sensible decision in view of the heavy fighting that might have occurred during the ground war–limited its employment as well. As a result, for much of the air campaign F-16s were attacking Iraqi armor and artillery in the KTO with dumb bombs from altitudes at which they had little hope of hitting their targets–a situation not foreseen by air planners in either Washington or Riyadh.

Counting and Miscounting the Results

CENTCOM's commanders, air as well as ground, saw attrition of this force as a prerequisite for a successful ground campaign. Knocking out tanks, however, represented only one criteria. As suggested above, there were disconnects between Schwarzkopf and his ground commanders as to what they wanted air power to do. Finally, there was seen to be an almost endless argument about bomb-damage assessment–the counting of destroyed tanks, armored personnel carriers, and artillery. The result was a confusing, contentious, and seemingly unending argument over the performance of air power in, to use the army term, "preparing the battlefield."

What did Schwarzkopf expect air power to accomplish? Here the 50-percent attrition goal set for air power in operational plans raises its

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[38]GWAPS Missions Database, Apr 1993.

[39]Tactical Analysis Bulletin, 91-2, Jul 1991, p 4-13.

head. How Coalition air power would achieve the "fifty percent solution" or even what it meant, became issues still exercising inter-service relations. It is still not clear, for example, how Schwarzkopf, himself, evaluated the battle damage assessments he received. From 16 January (D-1), ARCENT's J-2 briefed the CENTCOM staff on estimates of tanks, armored personnel carriers, and artillery pieces remaining in theater. One observer noted that Schwarzkopf had elected to focus on using air power to inflict around 50-percent equipment attrition (armor, artillery, etc.) as early as August 1990; he did not concern himself with more esoteric, aggregate measures such as combat power or potential.[40] Horner, on the other hand, has stated that neither he nor Schwarzkopf placed much faith in battle damage reports of such attrition once the war started. Rather he suggests the CINC brought his own estimate of the situation to bear in calculating enemy potential; and Schwarzkopf's estimate generally placed more reliance on the *number* of air strikes against Iraqi units as the primary indicator of enemy effectiveness rather than the damage reported. For his part, Horner resolved to stay out of bomb-damage assessment (BDA) fights altogether. Since BDA against the Iraqi field army was an army concern, he expected the army to address the problem.[41]

But the lack of agreement on how to calculate BDA caused endless problems, not the least of which was the divergence between air force targeting and army BDA. Many Coalition sorties attacked truck convoys, ammunition dumps, and other targets in the enemy's supply network. How should one evaluate such sorties? What did their BDA mean in terms of a future ground war? These were vexing problems with which commanders had to wrestle but could never fully solve. Ultimately, it was the assessments imposed by Schwarzkopf that ended much of the argument on BDA.

Throughout the air campaign, the Republican Guard and its attrition remained central in Schwarzkopf's thinking. As the air war unfolded and Coalition air forces expended increasing ordnance on these divisions, BDA estimates caused increasing controversy within CENTCOM. On 29 January, Schwarzkopf noted a lack of BDA regarding these formations; he was apparently concerned that such stringent reporting criteria existed that

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[40]Col Gary Ware, GWAPS intvw (by telephone), 26 Feb 1992.

[41](S) Intvw, Perry Jamison, Rich Davis, and Barry Barlow with Lt Gen Charles E. Horner, 4 Mar 1992, Shaw Air Force Base, GWAPS, NA 322.

only vehicles on their backs like "dead cockroaches" would count as kills.[42] Two days later, in reply to this rebuke, Yeosock confirmed in a briefing to the CENTCOM staff that the Republican Guard divisions remained at 99 percent strength.[43]

The Army estimate, however, did not go unchallenged, since well over 300 sorties by F-16s and twenty-four B-52 sorties alone had attacked these units per day in the war's first two weeks.[44] CENTAF soon discovered that Yeosock's staff had only counted A-10 mission reports in calculating bomb-damage assessment. Again this reliance on hard numbers caused problems for CENTAF planners; the targeting strategy did, after all, aim at degrading enemy unit effectiveness, without necessarily always destroying enemy assets physically. Horner's air interdiction instructions, for example, issued each day as part of the "Air Guidance Letter," called on friendly forces to "delay and attrit Iraqi forces (focusing on the Republican Guard) by concentrating . . . attacks against POL supply vehicles, water supply vehicles, and other portions or other logistics supporting Iraqi forces."[45] ARCENT's system and methodology were neither prepared nor interested in evaluating the results of such sorties.

With ARCENT's numbers under close scrutiny, estimates by the national intelligence agencies complicated the situation. CIA and DIA, working independently as well as together, produced assessments differing markedly from CENTCOM's. Working strictly from national collection systems (often degraded by weather conditions in the theater and without access to video BDA films), they consistently credited Iraqi forces with greater strength and Coalition air power with less effectiveness than did estimates on the scene. Their estimates raised fears that, as in past wars, inflated BDA claims would lead to substantial miscalculations of the enemy's strength. On 12 February for example, CENTCOM reported 25

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[42]Lt Col Lewis, HQ/USAFE/XPPF, Notes: "Close Air Support in Desert Storm."

[43]*Ibid.*

[44]*Ibid.* Lewis confirmed to Lt Col Rich King via telephone that the original version of this background paper had omitted the words "per day."

[45](S) COMUSCENTAF, Air Guidance Letter, filed in "Daily Planning Materials," Box 3, Folder 3, in Black Hole materials, GWAPS.

percent of Iraq's in-theater armor as destroyed; DIA's estimate stood at 10 percent.[46]

Yet, in the final analysis, much of the bean counting entirely missed the point. The number of tanks, vehicles, trucks, and artillery pieces destroyed did *not* determine whether the Iraqi Army would fight or even how well it would fight. Its battlefield effectiveness would depend on the state of mind of Iraqi soldiers and their officers. Consequently, the impact of the air war depended, to a great extent, on psychological imponderables, and such uncertainties are not congenial to staff officers or to those statistical managers that have so bedeviled American military and intelligence agencies over the past twenty years.

Air Operations in the KTO Before the Ground War

With the onset of the air campaign, Coalition air forces also embarked on their great effort to "prepare the battlefield." Their contribution would be both direct and indirect. Schwarzkopf had forbidden any moves that might give away the deployment of Coalition ground forces out into the western deserts in preparation of what he later termed the "Hail Mary Plan."[47] The move to the west now began on 17 January. It succeeded without the Iraqis ever picking up the slightest hint of what was unfolding. Of all the air campaign's contributions to the allied victory on the ground, this was one of the most important. When the ground offensive broke on the Iraqis, it caught them completely by surprise as to direction and intent.[48]

The second major contribution was that of tactical airlift in the redeployment of XVIII Airborne Corps and VII Corps to the west. The

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[46]OWAPS Working Paper by Thomas Keaney, "Study of Two Target Sets."

[47]Generals are of course prone to overstatement, and in this case Schwarzkopf indulged himself. The movement to the west, followed by the sweeping envelopment of Iraqi forces, reflected the strengths of US and Coalition military forces: their logistical sophistication–consistently derided by the military reformers in the 1980s, their capacity to maneuver, their flexibility, and above all the advantage that air power provided, namely the ability to operate in an environment in which they never came under the observation of their opponent, much less his attack.

[48]And this was due to the fact that Coalition dispositions before the war confirmed Iraqi conceptions that an allied attack would come from the directions suggested above. After 17 January they saw nothing.

work horse in this was the C-130, performing in much the same fashion as it had in Vietnam.[49] C-130s flew most of the personnel of XVIII Airborne Corps from King Fahd to Rafha, a distance of more than 400 miles. The flow into Rafha averaged one landing every seven minutes for the first thirteen days of the move. After closing XVIII Airborne Corps, C-130s turned to building up logistic bases and hauling fuel, food, water, parts/supplies, and ammunition to places such as "Log Base Charlie," a highway strip along the Transarabian pipeline near Rafha.[50]

Similarly, C-130s played a crucial role in helping VII Corps and the Marines shuffle personnel in their redeployments after the beginning of the air campaign. Moreover, C-130s were a crucial link in the ground forces' logistic system; they moved critical parts and items out to the troops in the desert on demand. Much of the high operationally ready rates that ground forces enjoyed throughout the period of Desert Shield/Desert Storm rested on that timely delivery of parts by these transports. Finally, the C-130s moved approximately 600,000 gallons of fuel to air force forward operating locations and isolated army logistic bases.[51]

As suggested in Chapter 3, Schwarzkopf began exerting considerable pressure as early as the second week to move the air campaign's emphasis from the strategic offensive to the KTO. There was some redundancy in this pressure, because Horner was already pushing air assets into striking ground force targets. On the first days of the air war, Air Force aircraft had flown 381 interdiction/battlefield air interdiction sorties, and seventy "close air support strikes" (CAS); Marine air units added an additional forty-six interdiction sorties and twenty-eight "CAS" sorties as well.[52] Perhaps more importantly, the Master Attack Plan had targeted

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[49]The bulk of these C-130s came from Air Force regular, reserve, and national guard units, but it is worthy of note that some Navy, Marine, RAF, and even Korean C-130s participated in airlift operations within the theater.

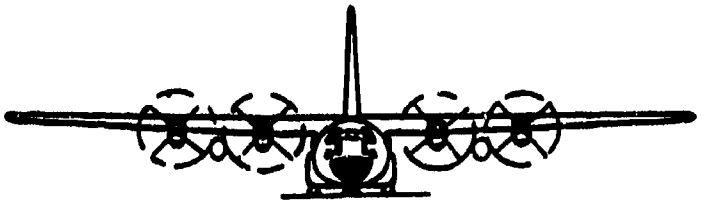
[50]Brig Gen Edwin E. Tenoso, "A COMALF Perspective," Speech at Air Force Association Session VII, St. Louis, Missouri, 2 Aug 1991.

[51]For a more detailed look at the tactical airlift within the theater see Appendix 4A of the GWAPS Logistics report.

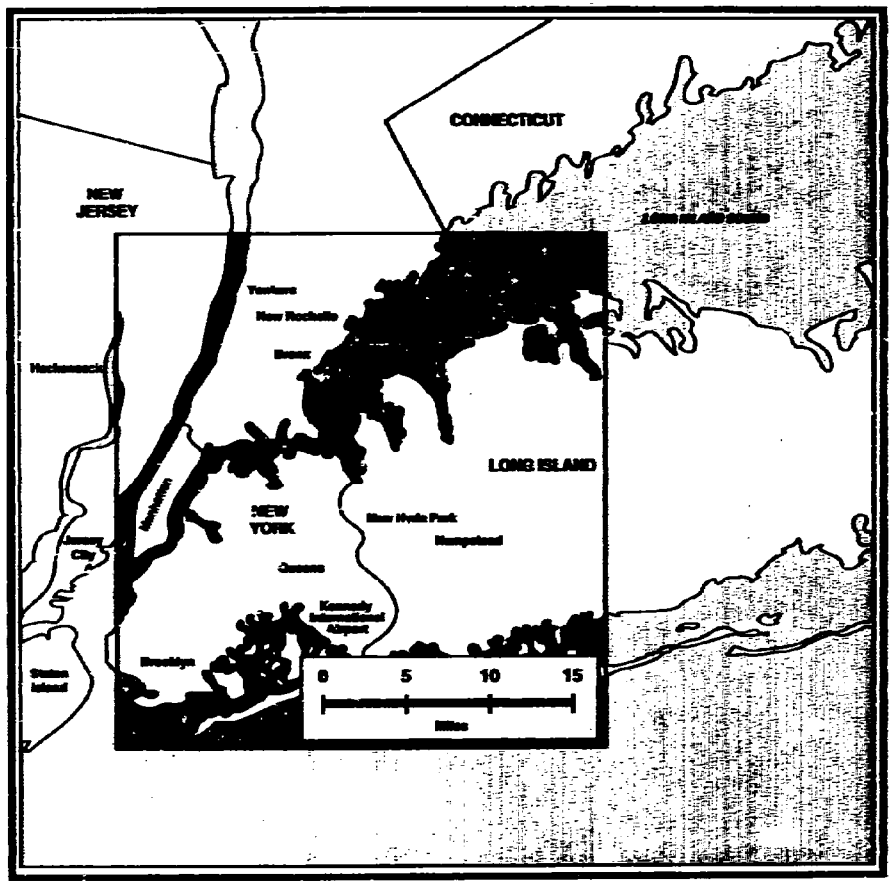
[52]GWAPS Database. The sorties that were reported as CAS during this period were so only in the definitional sense of proximity to the Iraqi-Saudi border; they did not support coalition ground forces engaged with Iraqi units.

Iraq's strategic reserve, the Republican Guard Divisions for heavy strikes. Throughout the first three days of the air war, these Republican Guard divisions, deployed primarily inside Iraq between Jaliba Air Base and the point where the Iraqi-Kuwaiti border turns south, felt the weight of Coalition air power. [See Map 35 for depiction of the deployment of Iraqi ground forces in the KTO.]

Throughout the air war against the Iraqi ground forces, the KTO cell in the Black Hole tasked allied aircraft to attack targets in "kill boxes." These boxes were in fact nothing more than grid references on maps. Each kill box was thirty miles on a side, and was divided into four quadrants, each fifteen miles on a side. To find the appropriate kill box, one need only to refer the various maps in this chapter that deal with the KTO, and then the appropriate quadrant by alphabetical designation. One would find quadrant AF6NE by looking first at the top reference grid and finding AF; then look down the side of the page for 6. Having found the kill box, NE would then designate the north east quadrant. The need for kill boxes reflected the fact that there were few, if any, visual points of reference in the desert. Without physical features, planners had to devise a method to control and focus air attacks on specific geographic areas, where intelligence had located Iraqi units. Each one of these kill boxes represents a considerable amount of real estate.[53] Map 36 indicates a kill box superimposed on a map of New York City. The extent of a kill box is 900 square miles; each quadrant 225 square miles. Unfortunately, the Iraqi Army had more than five months to dig in and camouflage its forces; on the basis of experiences in the Iran-Iraq War, it made



[53]De Saint Exupèry noted in his classic: "One fact the enemy grasped and exploited–that men fill small space in the earth's immensity." De Saint Exupèry, *Flight to Arras*, p 56.



Map 36
Kill Box Comparison in Relation to New York City
Kill Box is 900 square miles

good use of that time. The extent of the theater and the dispersal of Iraqi forces within kill boxes proved a major problem for aircraft tasked to attack targets in the KTO.

Although bad weather and the hunt for Scuds delayed Coalition air strikes on strategic targets, Schwarzkopf remained unswerving in his insistence that the Republican Guard receive a top priority. Observers in the Tactical Air Control Center record that as early as 23 January, Horner, undoubtedly reflecting CINC guidance, stressed the Republican Guard as a crucial target set.[54]

Even with the Scud hunt in full cry, Horner proclaimed "days" in "honor" of the Republican Guard Divisions: 27 January, for example, was "Hammurabi Day." In post-briefing comments on that day, Horner emphasized Schwarzkopf's resolve to destroy Saddam's elite units and repeated the CINC's intention to destroy Iraqi morale by physically annihilating one of the Republican Guard divisions.[55] According to Horner, Schwarzkopf still hoped to get Iraqi forces in Kuwait to surrender–Coalition aircraft had dropped more than one million leaflets suggesting such a course on the KTO on 19 January. But the Republican Guards were the exception: they were to die![56] Even as the Battle for Khafji was about to unfold, Horner warned his subordinates not to allow that battle to divert them from the main effort, the Republican Guard.[57]

Over the course of the first week, nearly 750 Coalition air sorties went into the KTO to attack Iraqi ground forces.[58] The major attention focused on three kill boxes close up on the Iraqi-Kuwaiti frontier. [See Map 37 for a depiction of the air effort during the first week in the KTO

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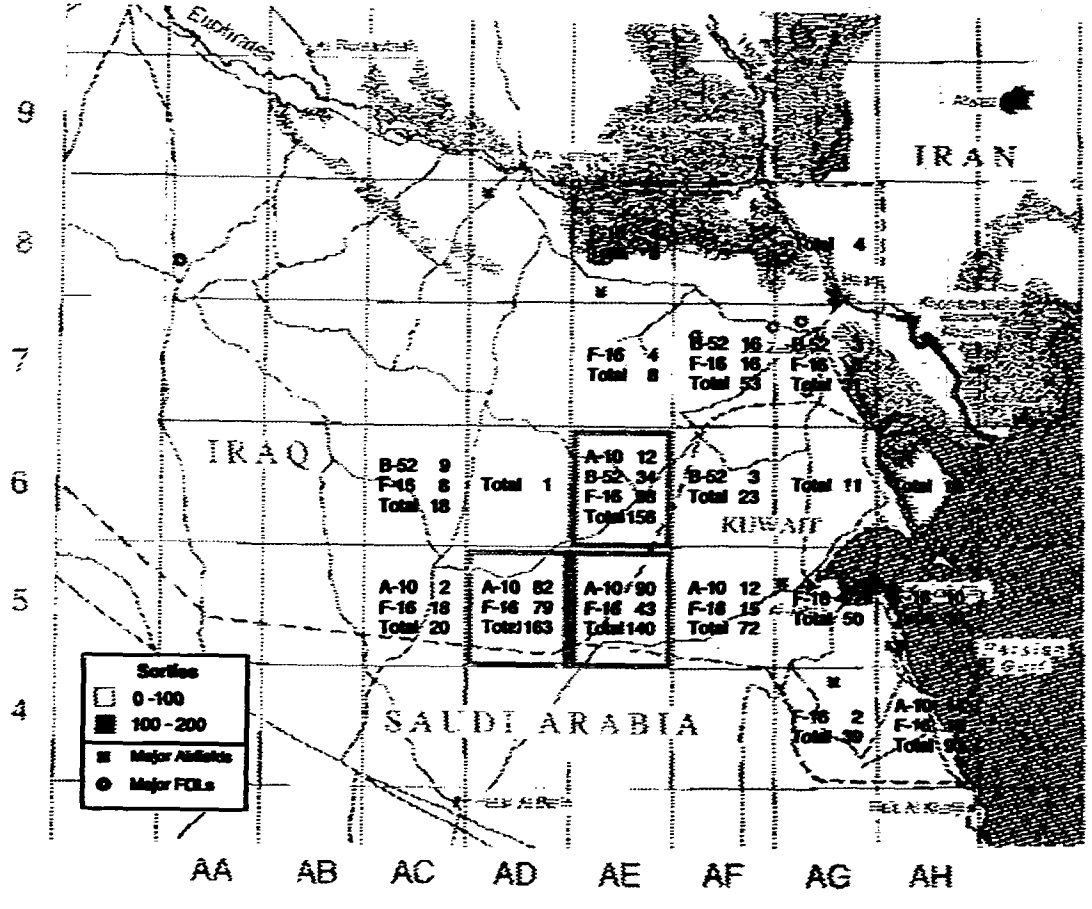
[54]Historians' Logs, TACC Notes, 23 Jan 1991, GWAPS.

[55]*Ibid*, 27 Jan 1991.

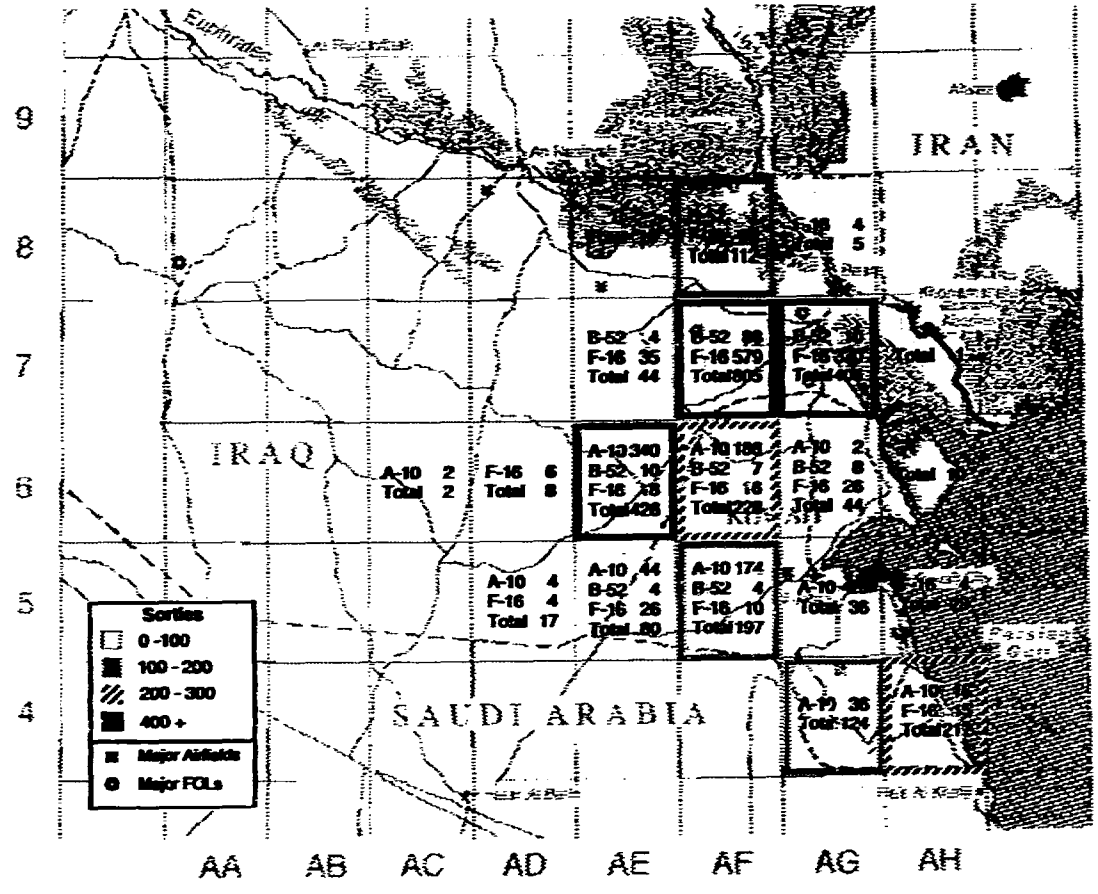
[56]*Ibid*, 27 Jan 1991. For a summary of the Leaflet drops, see USAF, "Persian Gulf War: An Air Staff Chronology," p 224. The crucial point here is that *despite the emphasis* on the Republican Guard, air attacks failed to attrit these units as heavily as was the case with those units of the Iraqi Army closer to the frontier into Saudi Arabia.

[57]*Ibid*, 27 Jan 1991.

[58]These figures are from the GWAPS Database and are based on mission reports (misreps) of sorties flown into the KTO.



Map 37
Week I
Strikes in KTO
938 Total Sorties



Map 38
Week II
Strikes in KTO
2796 Total Sorties

and Map 38 for the second week.] In the second week, there was a general sharpening of the intensity of attacks–nearly 2,800 sorties attacked the KTO–as well as a refocusing of the effort.[59] During Week Two, there was a clear emphasis on the Republican Guard: kill box AF7 containing the Madinah and part of the Hammurabi heavy divisions received no less than eighty-eight B-52 attacks and 579 F-16 strikes.[60]

How much physical damage these attacks imposed on the enemy is questionable. The majority of F-16 sorties appear to have destroyed little of the Iraqis' dug-in armor and artillery. But the real significance of such attacks, particularly B-52 strikes, was that they began a period during which the Iraqi Army *knew* that it was under sustained, unremitting attack, and that it had neither the defenses nor means of retaliation against its tormentors. Later, when F-111Fs began using GBU-12 500-pound laser-guided bombs to attack Iraqi armor, especially in Republican Guard units, the sudden vulnerability of even T-82s forced Iraqi crews to cease living in their vehicles, which meant that the readiness for battle of both crews and equipment inevitably began to break down. Combined with the psychological pressure from attacks by less accurate attacks from aircraft like F-17s and B-52s, the combat capability of even the better Iraqi units began to decline, although precisely how much was never quantified, either during or after the war.

Mounting pressure from Coalition air power on the Iraqi field army in the KTO provoked the Iraqis to respond, however, even before the so-called "tank plinking" began in early February. The Iraqis' initial response became known as the battle of Khafji. To understand this battle, one needs to estimate what was occurring "on the other side of the hill."[61] Saddam and his senior advisers appear to have believed that operationally and tactically, their forces would and could absorb a three-to-seven day air offensive, and then the ground war would begin.[62] Beginning with

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[59]GWAPS Database.

[60]GWAPS Database. See Map 38.

[61]Unfortunately, one of the great differences between the *Gulf War Air Power Survey* and the *U.S. Strategic Bombing Survey* fame is the lack of access that the former has had to the enemy's documents. Thus, any assessment for the foreseeable future will lack the assurance that historians could offer in evaluating Luftwaffe responses, for example, to allied air power–at least until Iraqi documents become open.

[62](S) CIA Brfg, GWAPS, 25 Jun 1992.

D-Day those expectations began to fail. The first several days of the air campaign did not appear to inflict irremediable harm on either Iraq or its forces in the KTO. In effect, the minimization of collateral damage by precision-guided munitions may well have misled Saddam as to what was occurring. Nevertheless, some dangerous warning signs were appearing by the second week; the first was the shelter-busting attacks on the Iraqi Air Force. Secondly, by week two it was apparent that the Scud offensive had not had the desired impact; the Israelis had stayed out of the conflict and the Coalition had hung together.[63]

The third shock, and perhaps the most devastating from an Iraqi perspective, was an emerging recognition that the Coalition air offensive was not the prelude to an immediate ground attack, but rather that it would continue for an indefinite period of time.[64] Comments by CENTCOM briefers at the end of January, as well as CNN broadcasts to the world, underlined that the air campaign would continue for the foreseeable future. There was little pressure on Coalition commanders to begin the ground offensive. That news may finally have awakened Saddam to the fact that the air offensive could be of interminable length.[65]

Moreover, by the second week, the darkness that the Coalition's air offensive had thrown over movements on its side of the frontier was also apparent to the Iraqis. In response, they now moved on the ground. Their operation had two probable aims. At a minimum, Saddam hoped that the attack would display Iraq's willingness to fight.[66] The Iraqis also probably hoped that by inflicting significant losses and/or by achieving a ground victory they would gain a significant propaganda coup. But their primary aim was to force the Coalition to initiate ground operations that would turn the war to what they believed were Iraq's greatest strengths.[67]

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[63]See Chapter 4 of this report for an analysis of the Scud attacks and their impact on the Coalition.

[64](S) CIA Brfg, GWAPS, 25 Jun 1992.

[65](S) *Ibid.*

[66][DELETED]General Sir Peter De La Billiere, *Storm Command, A Personal Account of the Gulf War* (London, 1992), p 252.

[67](S) CIA Brfg, GWAPS, 25 Jun 1992.

In general, the Iraqi attack on Khafji was a botched operation from beginning to end. The Division in the front line was to make the breakthrough, while another then exploited whatever advantage initial patrols gained.[68] [DELETED].[69] [DELETED].[70]

Three Iraqi probes from the 5th Mech moved out to make contact with their enemy; all three probes apparently got lost, but one found its way into Khafji, where Coalition forces eventually destroyed it.[71] The morale of none of the attackers was particularly high.[72]

The Coalition initially failed to pick up the significance of the probe at Khafji; the Saudis had abandoned the town at Schwarzkopf's urging because it lay within range of Iraqi artillery. The fact that it was unoccupied may explain the initial hesitation by allied commanders to the Iraqi move.[73] But the Coalition possessed such abundant air resources that continuing the "strategic" campaign, albeit on a reduced scale, hunting for Scuds, and pounding the Republican Guard left Horner with sufficient sorties to deal with this first, and as it turned out, only Iraqi attack of the war.

The Tactical Air Control Center (TACC) did not react to the first warning signs that the Iraqis were moving. That lasted only until Horner arrived on the scene. Over the night of 30 January, the TACC retasked more than 140 U.S. tactical aircraft to conduct repeated strikes against the Iraqis. Air Force and Marine aircraft pounded the Iraqi probes throughout the day and night; where they caught the enemy concentrated, these strikes were particularly effective.

One of the 5th Mechanized Division's subordinate units, a Tank Brigade, was especially hard hit; it was traversing its own mine field when

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[68]The 5th Mechanized Infantry Division was considered to be one of the better ones in the Iraqi Army. It had gained an excellent reputation during the Iran-Iraq War.

[69](S) Plan to Attack Khafji Possibly Unknown to Iraqi Troop Participants. This was part and parcel of the Iraqi approach to war.

[70](S) Exploitation Summary of Morale in Key Iraqi Units.

[71](S) CIA Brfg, GWAPS, 25 Jun 1992. Reasons for the Khafji Failure.

[72]Plan to Attack Khafji Possibly Unknown to Iraqi Troop Participants.

[73]Schwarzkopf, *Hero*, p 424.

Coalition air attacks disabled the lead tank, and thereby stalled the entire unit, strung out in column. When the slaughter was over, little remained of the brigade. One survivor, a veteran of the Iran-Iraq War, claimed that all that the brigade had endured in the ten years of the war with Iran did not equal what had happened to the unit in a quarter of an hour in the desert north of Khafji.[74] The 3d Armored Division never had a chance to concentrate, so intense were the attacks over its area of responsibility.[75] Altogether, the Iraqis appear to have lost substantial number of tanks, armored personnel carriers, and soldiers in the operation.[76]

Khafji did set up jitters on both sides of the line. Many in the TACC believed that the attack represented a feint–the prelude to larger strikes that would occur further west.[77] The Army, not surprisingly, felt that such attacks would come down the Wadi Al Batin in its area of responsibility, while the Marines were sure that it would come along the Kuwaiti-Saudi elbow.[78] But in fact, the Iraqis had received such devastating blows from the air around Khafji that they had no intention of moving again; nor did they for the rest of the air war.

At the same time that the attack occurred against Khafji, the Iraqi navy came out. Using TNC 45s armed with Exocet missiles and Soviet Osas armed with Styx missiles, the Iraqis may have had some illusions of supporting the raid on Khafji.[79] It is also possible that Iraqi naval

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[74](S) CIA Brfg, GWAPS, 25 Jun 1992.

[75]Source Debriefing.

[76](S/NF) *Air Staff Chronology*, p 281; and DOD, *Report to Congress*, vol. II, VI-125-126.

[77]There was considerable interest in the TACC Log as to whether the Republican Guard was in the process of concentrating or moving south. The most likely place for it to attack would be out of western Kuwait–hence the army worries. Several air force pilots reported seeing just such movement; their vision was undoubtedly helped by the request that they had received to look for a movement of the Republican Guard.

[78]The Marines went to a high state of alert as did the Iraqi 1st Mechanized across from them, both sides seeing the increasing alert status on the other side as a sign of impending attack. For the fears over a major Iraqi attack occurring elsewhere see the TACC log for the period 30 January - 1 February.

[79]The study on Gulf war naval activity performed by the Center for Naval Analyses suggests that the Iraqis were attempting to flee to Iran. Given what they were also doing with their air force that was a distinct possibility. (S) Jeffrey Lutz, et al, "Desert Storm,

forces, like the air force, were running for Iran. Whatever the case, Royal Navy Lynx helicopters refueling and rearming off two destroyers in the northern waters of the Gulf fired twenty-five Sea Skua missiles--of which apparently eighteen hit.[80] Not surprisingly, the United States Navy also engaged; A-6Es first picked up the movement into the Gulf. Using laser-guided bombs, the A-6s disabled three boats; throughout the day A-6s and F/A-18s struck the Iraqi boats with laser-guided bombs, cannon, and Rockeye cluster munitions. In the end, Coalition air attacks damaged eleven Iraqi vessels, two of which managed to reach Iran.[81]

In a less paranoid state than Iraq, the devastating defeat at Khafji, largely at the hands of Coalition air power, destruction of a quarter of its navy, and the continuing hammering that Iraq and its military organizations were suffering would have set off alarm bells. Certainly it should have suggested that all of Iraq's strategic and political assumptions were invalid. But in the world of Iraqi politics, one can wonder whether Saddam ever received a complete account of what was transpiring.[82] Here, as throughout the crisis and the ensuing war, the nature of the Iraqi regime ("the Republic of Fear") made it impossible for the regime and its military commanders to recognize their strategic and operational position.

Week three of the air campaign again saw a significant jump in the number of sorties attacking the KTO--to more than 3,500.[83] [For the distribution of those sorties by kill box see Map 39.] The Republican Guard positions up along the Iraqi-Kuwaiti border continued to receive substantial attention. Significantly, however, the intensity of Coalition attacks along the immediate border areas had moved up several notches. Part of this was undoubtedly the direct result of Khafji, and part resulted from jitters that the Iraqis might launch a bigger offensive while allied forces were in the middle of their deployment out to the western desert. But the weight of air effort against the KTO continued to climb as Horner shifted his resources away from the strategic campaign in central Iraq.

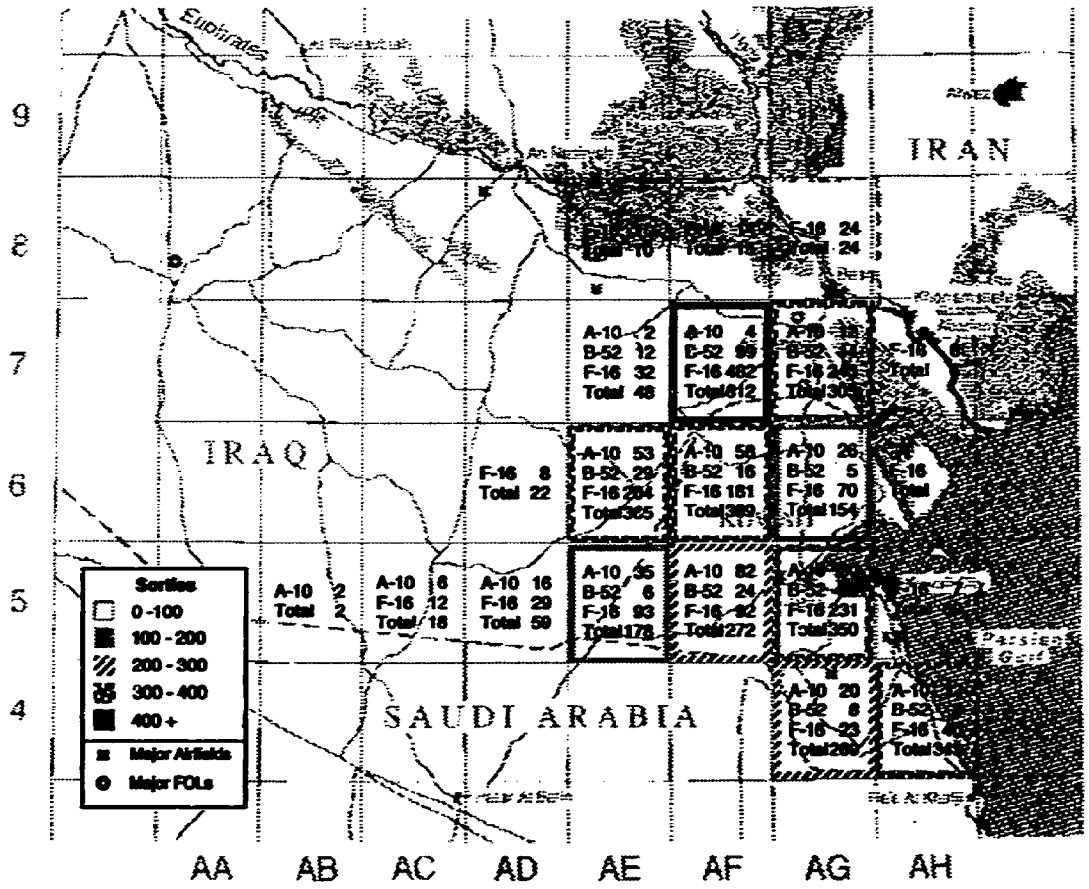
Reconstruction Report, Vol. VI: Antisurface Warfare," Center for Naval Analyses, Alexandria, VA, p 4-6.

[80]De La Billiere, *Storm Command*, p 254.

[81](S) Lutz, "Desert Storm Reconstruction Report, Vol. VI," p 4-13.

[82][DELETED]

[83]GWAPS Database.



Map 39
Week III
Strikes in KTO
3512 Total Sorties

The period of early February saw considerable adaptation to the KTO's changing tactical environment. Difficulties in target recognition in the faceless desert, even within the kill box system, led to reintroduction of "fast" forward air controllers (FACs) for F-16s, although this time called "Killer Scouts." The ATO now deployed flights into each box at designated times; upon arrival, strikers checked in with the GPS-equipped F-16 "Pointer" scouts, who worked geographic areas over time and therefore could identify targets more readily.[84] Helping the accuracy of such strikes was the fact that the decreasing effectiveness of Iraqi antiaircraft artillery allowed aircraft like the F-16s and A-10s to attack from lower altitudes.

But the crucial development in early February came with the introduction of precision-guided munition capabilities into the KTO. We have already quoted Horner's enthusiastic response after viewing the video of Pave Tack-equipped F-111Fs "plinking" tanks.[85] Allocation of one of the most capable bombing platforms in CENTAF was a surprising and innovative decision. It reflected the high priority that Horner was giving the "preparation of the battlefield" phase. Admittedly, the decision to use the entire F-111F fleet for virtually all the rest of the war to attack enemy armor and artillery removed a crucial platform from the strategic campaign. The debate may well continue between some in the Air Force and the Army about the wisdom of this decision, but it revolves around judgments as to just what were Iraq's centers of gravity. This author's opinion is that the Republican Guard represented a crucial element of support–both in political and military terms–for Saddam's regime. In that context, allocation of critical "strategic" capabilities made sense, particularly viewed within the context of the necessity for a ground war.[86]

The increasingly effective air campaign into the KTO continued apace in the fourth week of operations. [See Map 40 for depiction of

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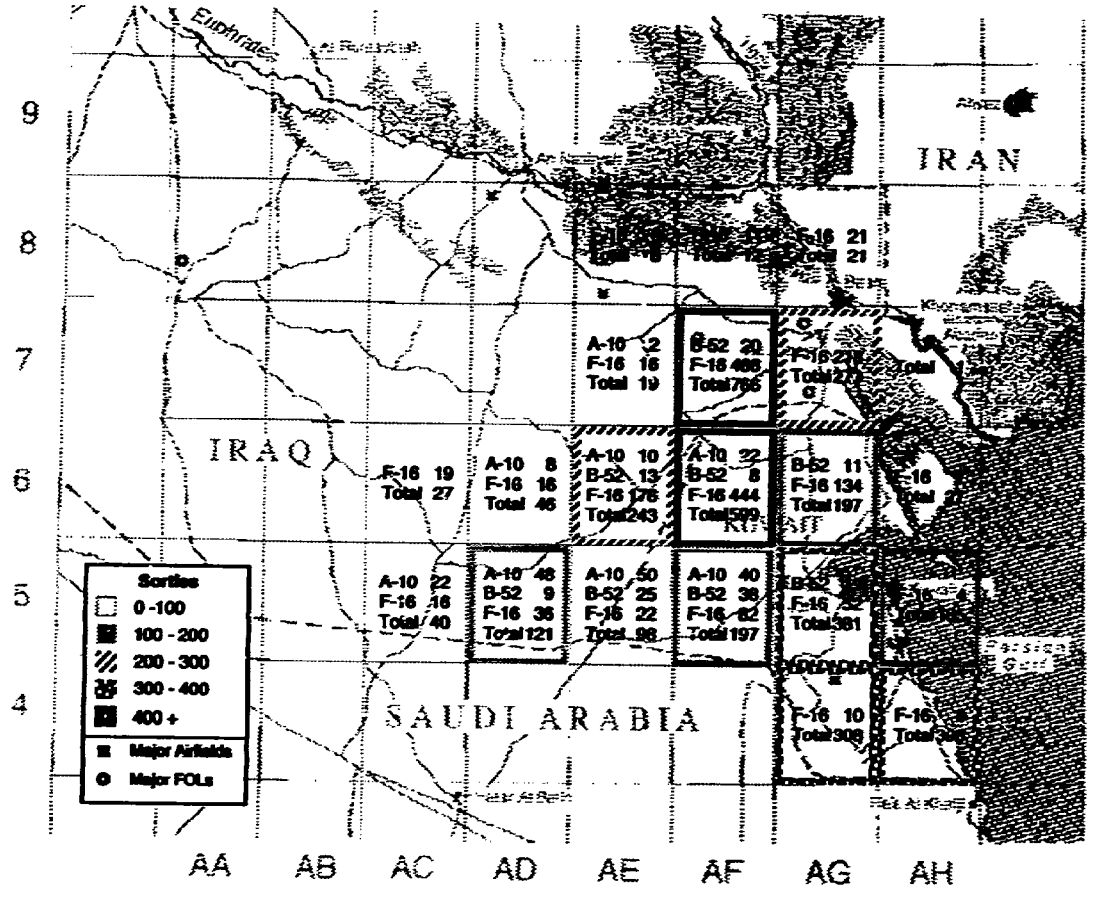
[84]Lt Col Mack A. Welsh, "Day of the Killer Scouts," *Air Force Magazine*, Apr 1993, pp 68-69. The killer-scout F-16s from the 388th Fighter Wing operated under the call sign "Pointer," which reflected their primary task: pointing ground-attack fighters to the best targets.

[85]See above Chapter 4. See also TACC, CC/DO Current Ops Log, 7 Feb 1991, GWAPS, NA 215.

[86]See above Chapter 2.



Map 40
Week IV
Strikes in KTO
3972 Total Sorties

where the sorties went in the KTO.] Nearly 500 sorties more than the previous week went into the theater. More than 360 of those were F-111Fs delivering 500-lb. laser-guided bombs against Iraqi armor.[87] During this week, there was less emphasis on border areas where the army was deploying than had been the case the week before; this may have represented an effort at deception. The kill boxes close to the Marines continued to attract heavy attention from Marine air, while the Republican Guard received its usual drubbing, including attention from F-111Fs. In the southern portion of Kuwait, special operations MC-130s dropped 15,000-lb. BLU-82 fuel/air bombs on Iraqi positions to help lower the morale of enemy troops.[88]

At the end of the fourth week, Horner and his planners had confronted the crucial decision of what to do with the deep strike mission of the A-10s. By this point in the war, the "Warthogs" were operating over the Republican Guard kill boxes as well as over the areas immediately adjacent to the Saudi frontier. Late on the morning of 15 February, the TACC log recorded that an A-10, badly damaged by a near miss from an Iraqi SAM, had recovered despite the fact that the missile had blown the right elevator off, bowed in the right rudder, and perforated the entire tail area aft of the engines. The fact that the pilot was the commander of the 354 TFW(P) added special emphasis to the notation in the log.[89] Before the day was out, CENTAF would lose two more A-10s, this time shot down by Iraqi missiles.[90] Horner's reaction was immediate; within two hours of learning that a second A-10 had probably gone down, he restricted the Warthogs to within twenty nautical miles of the frontier.[91]

On the next day, Col. David Sawyer, Commander of the 354th and survivor of the previous day's incident, wrote a detailed summary of the A-10s travails to that point in the war. For the first two weeks in the war, his A-10s had operated at medium-level altitudes in an effort to minimize potential losses. But even using binoculars, such attack altitudes made it difficult for pilots to identify the targets which they were

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[87]GWAPS Database.

[88]USCINCENT to AIG 904, subj: Sitrep, 082115Z Feb 91, GWAPS, CSS #29.

[89](S) TACC Log, 15 Feb 1991, 0820Z.

[90](S) *Ibid*, notation 1323Z and 1500Z, 15 Feb 1991.

[91](S) *Ibid*, notation 1720Z, 15 Feb 1991.

attacking. On 31 January, Glosson (as 14th Air Division Commander) had ordered the Warthogs to move down to 4-7,000 feet unless the ground threats dictated otherwise. From that point, the success rate for A-10s climbed significantly, but so did their exposure to enemy antiaircraft defenses. In the two weeks before 31 January, A-10 squadrons had suffered damage to three of their aircraft; in the two weeks thereafter, they had six more aircraft damaged and one shot down.[92]

Such losses did not seem insupportable compared with the Vietnam war or earlier conflicts. But on the 15th, after laying low for a considerable period of time, the Iraqis fired no less than eight infrared SAMs at their A-10 tormentors. On returning to Coalition lines with his damaged aircraft, Sawyer noted a flight of F-16s working over Iraqi positions just north of the frontier. As he commented to Horner, "A-10s over the Republican Guards and F-16s in the southern KTO doesn't compute."[93]

From the point of view of aircraft performance and survivability, Colonel Sawyer had a point. But from the point of view of hitting targets on the ground, the use of A-10s against the Republican Guard had made sense. However, the use of infrared surface-to-air missiles and the ensuing losses had caused Horner to rethink this approach. Henceforth, A-10s would only fly along the border. There was some considerable loss in daytime capabilities, since the F-16s were not capable of hitting Iraqi ground targets with the accuracy of A-10s and their Mavericks. But at this point in the war, with F-111Fs attacking the Republican Guard, it no longer seemed worth the risk to expose A-10s and their aircrew to sophisticated enemy air defenses and missiles.

The fifth week–the last without ground combat–saw a continued upswing of air force and other sorties attacking KTO targets. In fact, the sortie total reached the highest number flown in the KTO during the entire war–4,048.[94] [For the distribution of Coalition sorties over the course of the fifth week see Map 41.] The Republican Guard was again the major interest of Coalition air power, but Iraqi positions opposite the Marines

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[92](S) Letter from Col David A. Sawyer to Lt Gen Charles A. Horner, 16 Feb 1991, Ref. 1519302 Msg, "Aircraft Losses."

[93](S) *Ibid.*

[94]GWAPS Database.

also received much attention. What appears to have been a relative paucity in the number of sorties delivered against kill boxes in the west, probably reflects Coalition deception efforts and fewer enemy targets.

Air operations during these two weeks represented an intensive effort to pound the Iraqi Army into the ground. However, there is no consistent pattern in the Master Attack Plans beyond geographic distribution and tank "plinking" efforts of F-111Fs. As suggested above, the impression is of a great effort to bludgeon the enemy into collapse. These air attacks were already destroying much Iraqi equipment, but it is impossible on the basis of the video tapes to determine whether the destruction was of tanks, armored personnel carriers, trucks, or artillery pieces. Many enemy supply dumps went up in smoke under B-52 or other attacks.[95] In fact one B-52 strike hit the Adnan Division's logistic site near Basra with such effect that the secondary explosion was seen and reported by Space Command.[96] Both the Soviets and Israelis appear to have initially estimated that someone had fired a nuclear weapon in the theater; the resulting cloud reached 25,000 feet.

Much of the daytime truck traffic had ceased soon after the beginning of the war, but there was no coherent or consistent effort to close down nighttime traffic. JSTARS reported major enemy movements, and Coalition aircraft, if available, would strike such targets. Overall, the interdiction effort was not high on most priority lists.[97] By early February, most of the bridges into the theater had been cut as a result of Coali-

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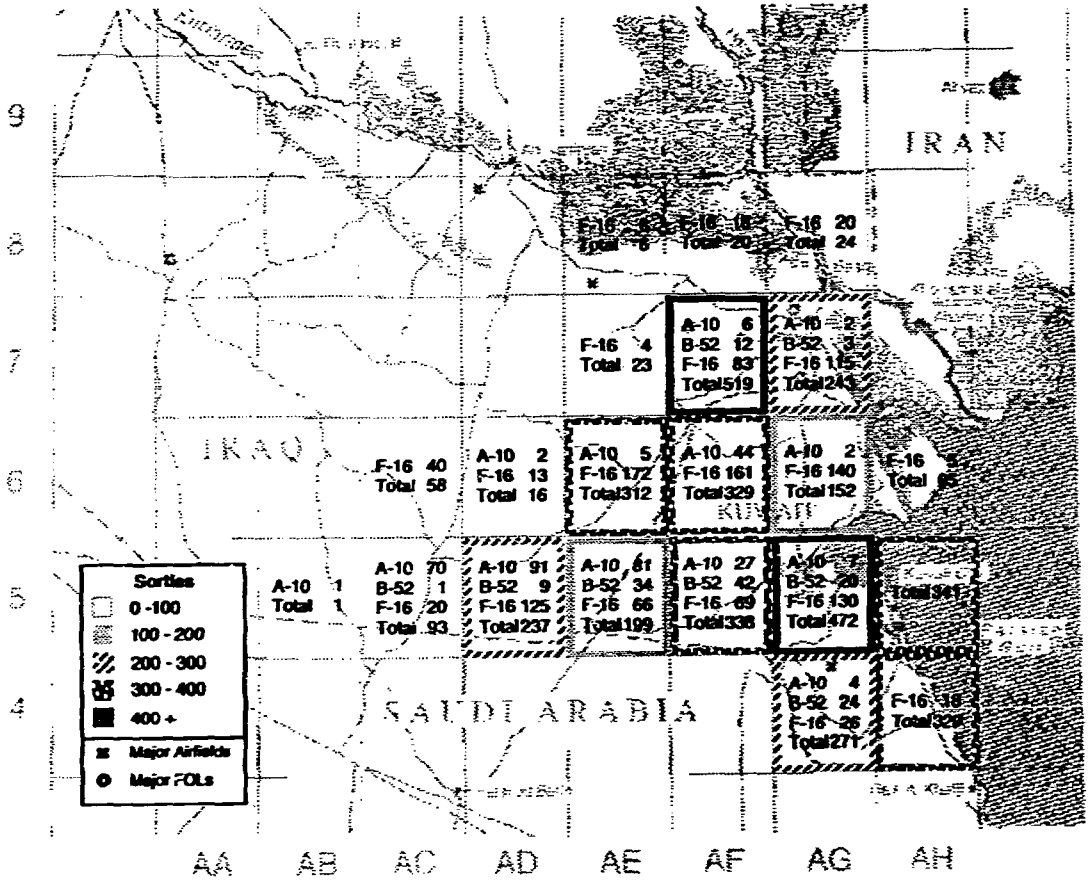
[95]Personal testimony of Lt Col Clint Ancker to the author. Col Ancker was the XO of the 2d Armored Division's Brigade Forward that filled out 1st Infantry Division in place of its reserve roundout brigade.

[96]TACC, CC/DO, Current Ops Log, 28 Jan, GWAPS, NA 215.

[97]There was some effort to cut down the Iraqi capacity to move in and out of the theater, but Coalition commanders estimated that with five months to get ready the Iraqis had stockpiled more than enough ammunition and supplies in the theater to last a considerable period of time. They were right.



Map 41
Week V
Strikes in KTO
4048 Total Sorties

tion air attacks.[98] But the Iraqis proved most resourceful, constructing pontoon bridges and filling in where possible with earth-moving equipment the damage caused by air attacks.

Still, by 11 February ARCENT showed enemy frontline divisions below 50 percent; operational reserves at 71 percent; and theater reserves, the Republican Guard at 82 percent.[99] However, on the 15th, DIA reassessed the Tawakalna division at 74 percent; CENTCOM's estimate had put the unit at 48 percent. With the ground war looming, and largely dependent–at least in terms of casualties–on the success of the air campaign, this higher assessment was deeply disturbing. Not surprisingly, it prompted further controversy. Just prior to the onset of the ground war, the CIA, skeptical of CENTCOM's claims of 1,700 tanks, 900 armored personnel carriers, and 1,400 artillery kills took its concerns, which had been communicated previously to CENTCOM, to the President. The agency could validate only about 500 kills and felt it had no choice but to surface its concerns prior to G-Day. However, Secretary of Defense Cheney, having seen the video films of F-111F strikes, backed CENTCOM's estimates and it is likely that his influence was decisive with the President to push forward with the offensive.[100]

In the end, Schwarzkopf played a crucial role in the assessment process. While he did not fully agree with all of CENTAF's claims, by and large he came down on their side. Ultimately, it was not the amount of damage to Iraqi military equipment that mattered, but rather the damage done to the minds of the Iraqi soldiers. And so Schwarzkopf determined how CENTCOM would assess the strength of each individual Iraqi unit; his criteria were as much subjective as objective. However, as the ground war would prove, his estimates were closer to the mark in estimating Iraqi fighting power than were those based on various "objective" measures.

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[98]GWAPS Chronology, *The War*, Vol. II, p 31

[99]Lt Col Lewis, "Close Air Support in Desert Storm."

[100]Lewis, "Close Air Support in Desert Storm."

Final Arguments with the Corps Commanders

Between 20 February and D-Day (24 February) there was another and mercifully final controversy over the employment of air in preparing the battlefield. Army corps commanders complained as before, but more urgently, that insufficient sorties were attacking Iraqi frontline divisions. With the so-called "breaching operations"–breaking through Iraqi mine fields and defensive positions while under fire–soon to occur, ground commanders wanted maximum firepower concentrated on targets immediately next to them. Schwarzkopf, on the other hand, was still directing Horner to attack the Republican Guard. Since few ground commanders were privy to the CINC's guidance, ground commanders blamed the air force for failing to strike their target nominations. To make matters thoroughly testy, CENTAF planners often found army target nominations out of date or of low priority. The result was that Coalition air power often failed to strike targets nominated by ground commanders: after the war, corps commanders criticized the air force by claiming that the ground forces had nominated more than 2,000 targets, and air had attacked only 300 (15 percent).[101]

Throughout February, battlefield preparation was the principal mission of Coalition air forces. By 20 February, when corps commanders became most concerned, the air effort was pouring into the KTO, primarily against armor, artillery, and armored personnel carriers. On 23 February, the ATO tasked 89 percent of all sorties against the Iraqi Army and Republican Guard. BDA calculations, while not matching earlier predictions of annihilation, or even reaching 50 percent criterion, were nonetheless impressive. By 22 February, Checkmate reported twenty-two of Iraq's forty-three divisions at less than 75 percent; of these, eleven were less than 50 percent effective, including Iraqi frontline divisions closest to VII Corps' area of operation.[102] Of the Republican Guard divisions, only two, in Baghdad, were fully intact; the rest varied in effectiveness between 55 and 88 percent.[103]

Whatever the actual effectiveness of the Iraqi Army on G-day, Coalition ground forces did not suffer from lack of air support. As G-day

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[101] *Ibid.*

[102] Point Paper: Checkmate Strategic Assessment, 22 Feb; Checkmate File CC-35.

[103] *Ibid.*

approached, Horner ordered his aircrews to press attacks home at lower altitudes, even with an accompanying higher risk. The cumulative effects of the bombing reduced the food, water, and ammunition distributed to enemy frontline forces; most POWs asked for food from their captors.[104] [For the total strikes and the total strikes by selected airframes, see Maps 42, 43, 44, 45, and 46.] The air campaign planners termed the result not "battlefield preparation, but battlefield destruction."[105] But at CENTCOM disagreement continued over how to shape the target list and score (BDA again) what had been attacked.

One such misunderstanding occurred regarding targeting. Both Lt. Gen. Walter Boomer of the Marines, and Lt. Gen. Frederick Franks, of the Army, noted after the war that it was artillery pieces they needed air power to destroy, not tanks.[106] Marine ground commanders in particular feared Iraqi artillery, because it outranged Coalition guns and threatened breaching operations. Just prior to G-day, however, VII Corps requested that two Iraqi divisions credited with greater than 50 percent effectiveness, the 47th and 26th Infantry Divisions, receive additional air strikes. The 47th was a particularly urgent target, as it apparently possessed more than 200 artillery pieces in its divisional park–the standard Iraqi division had seventy-two–and was in a position to fire against either the Egyptians or VII Corps. Over the night of 22 February, CENTAF diverted the F-111Fs from the Republican Guard, to the 47th. The F-111Fs claimed more than 100 artillery pieces destroyed, yet ARCENT had not credited the kills by the start of the ground war.[107] Thirty-six

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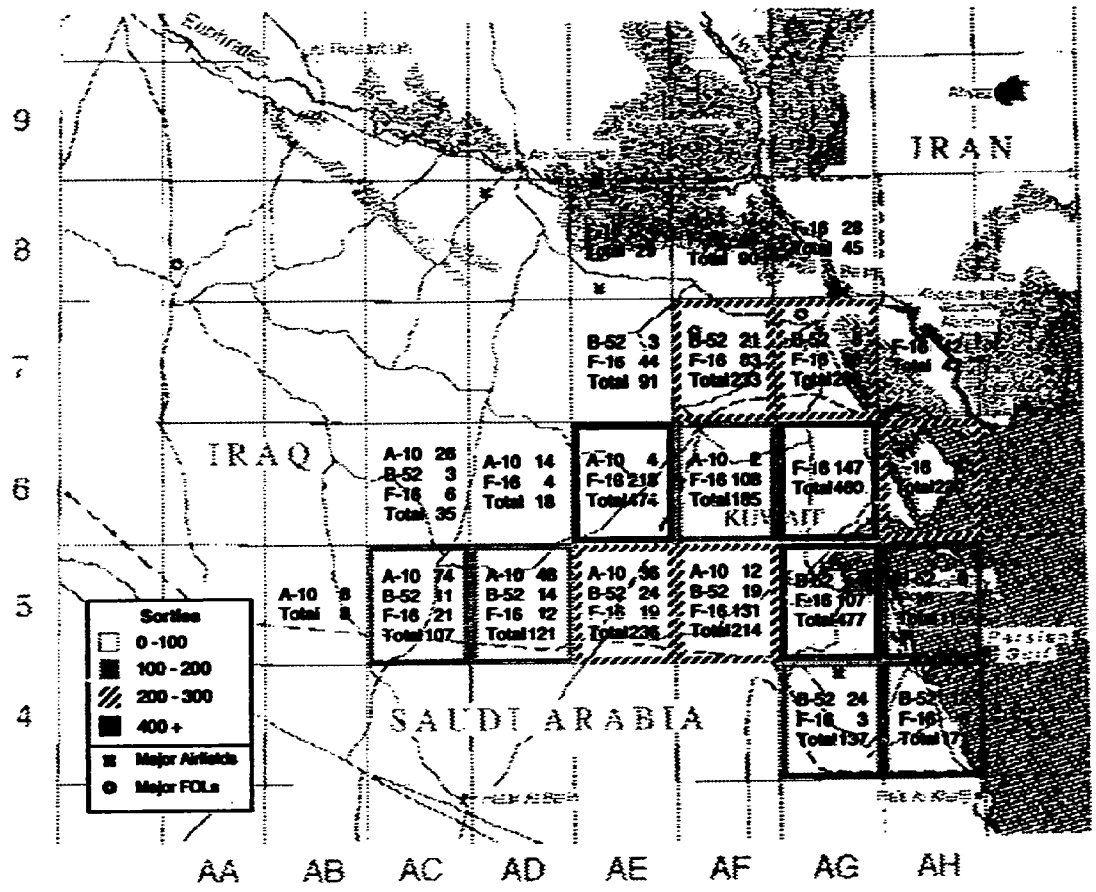
[104]See the next chapter for a detailed examination of this point.

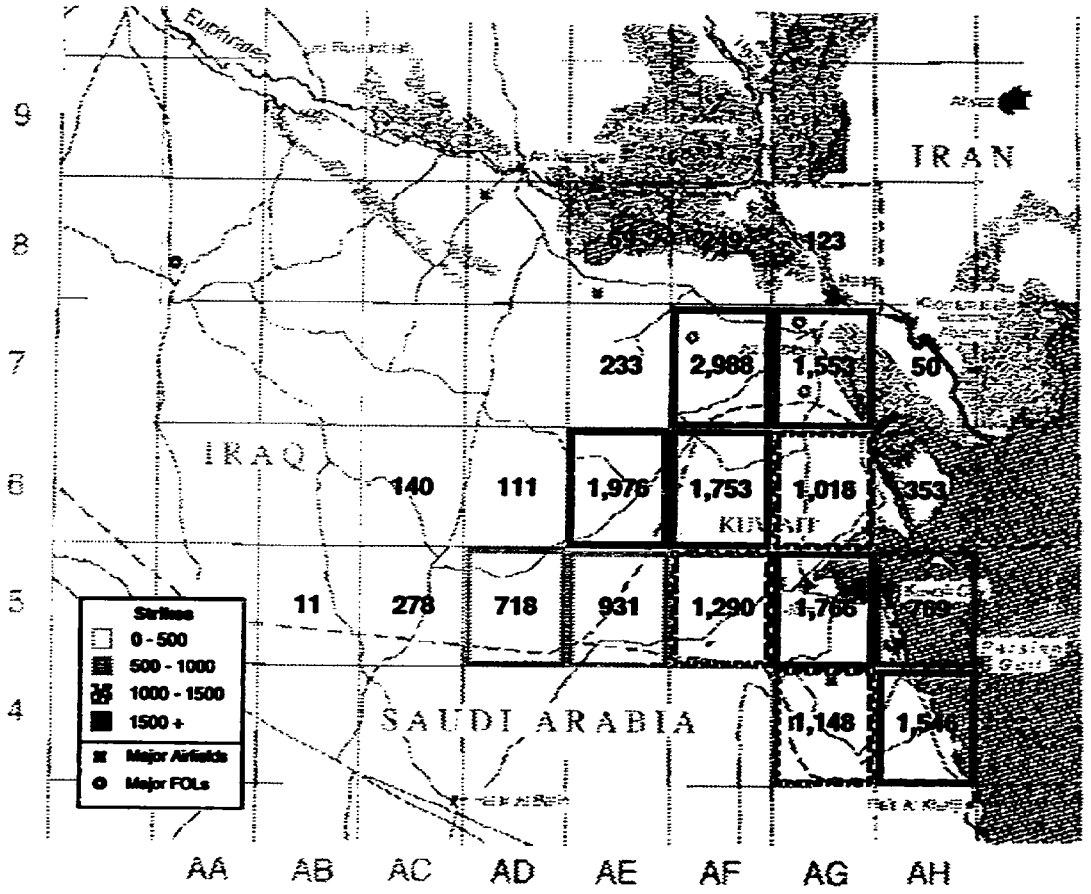
[105]"Planning and Executing the Air Campaign against Iraq: An Interview with Brig Gen Buster Glosson," 6 Mar 1991. On 29 Jan, Col Deptula had posted a sign in the Black Hole which read, "We are not preparing the battlefield, we are destroying it!" Richard P. Hallion, *Storm Over Iraq, Air Power And The Gulf War*, (Washington, 1992), p 209.

[106]Intvw, Lt Gen Walter Boomer with GWAPS personnel (Thomas Keaney, Wayne Thompson, and Eliot Cohen), 18 Feb 1992.

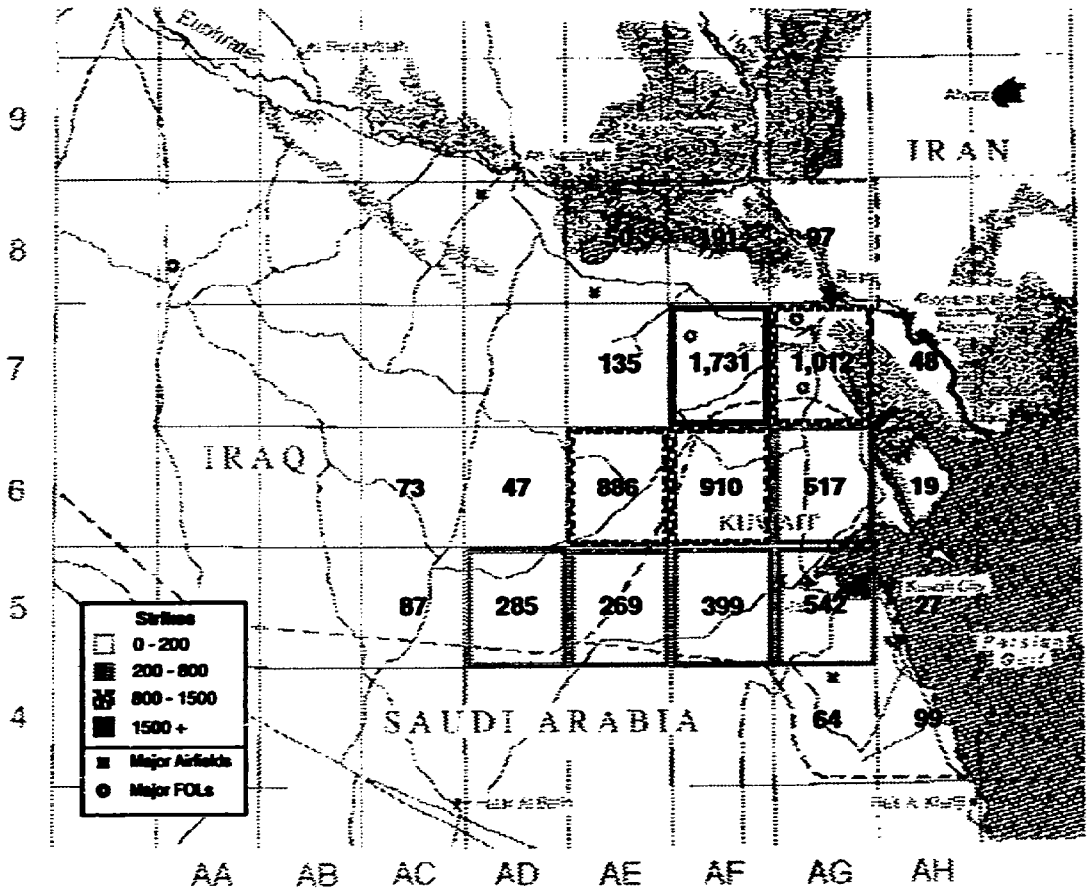
[107]Lewis, "Close Air Support in Desert Storm."



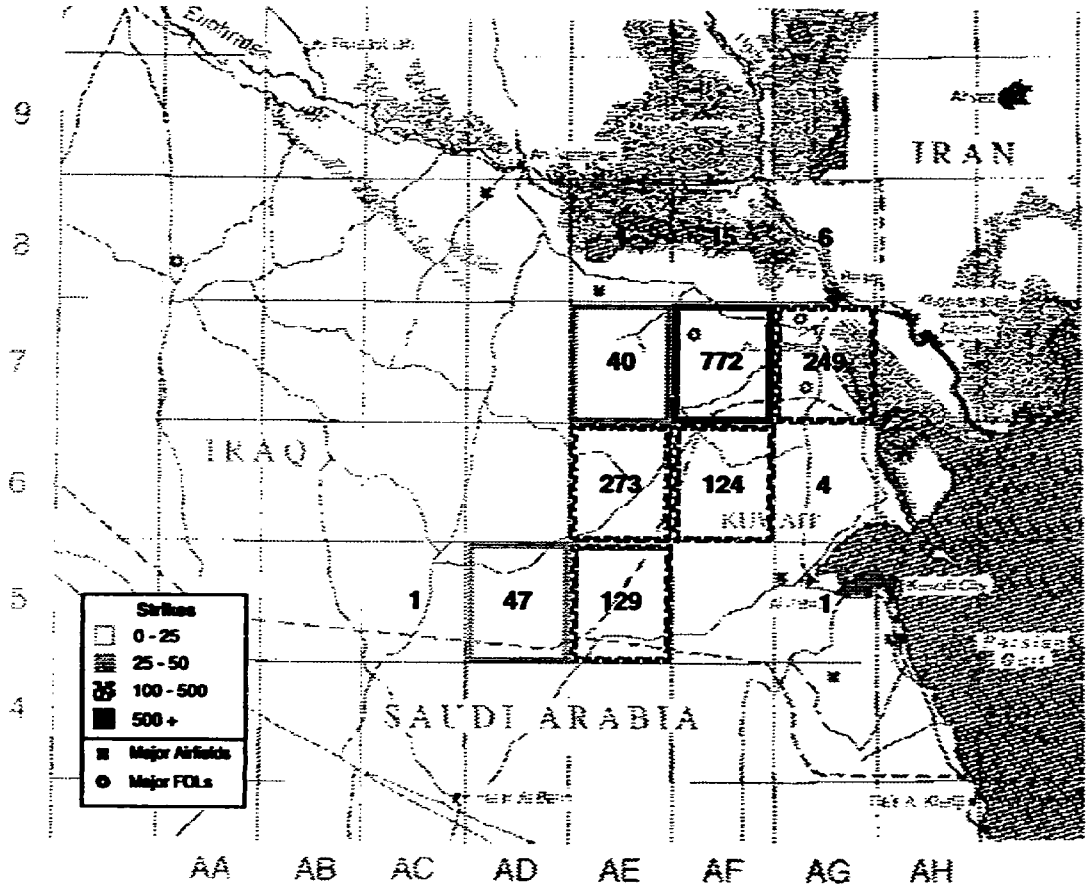
Map 42
Week VI
Strikes in KTO
3807 Total Sorties



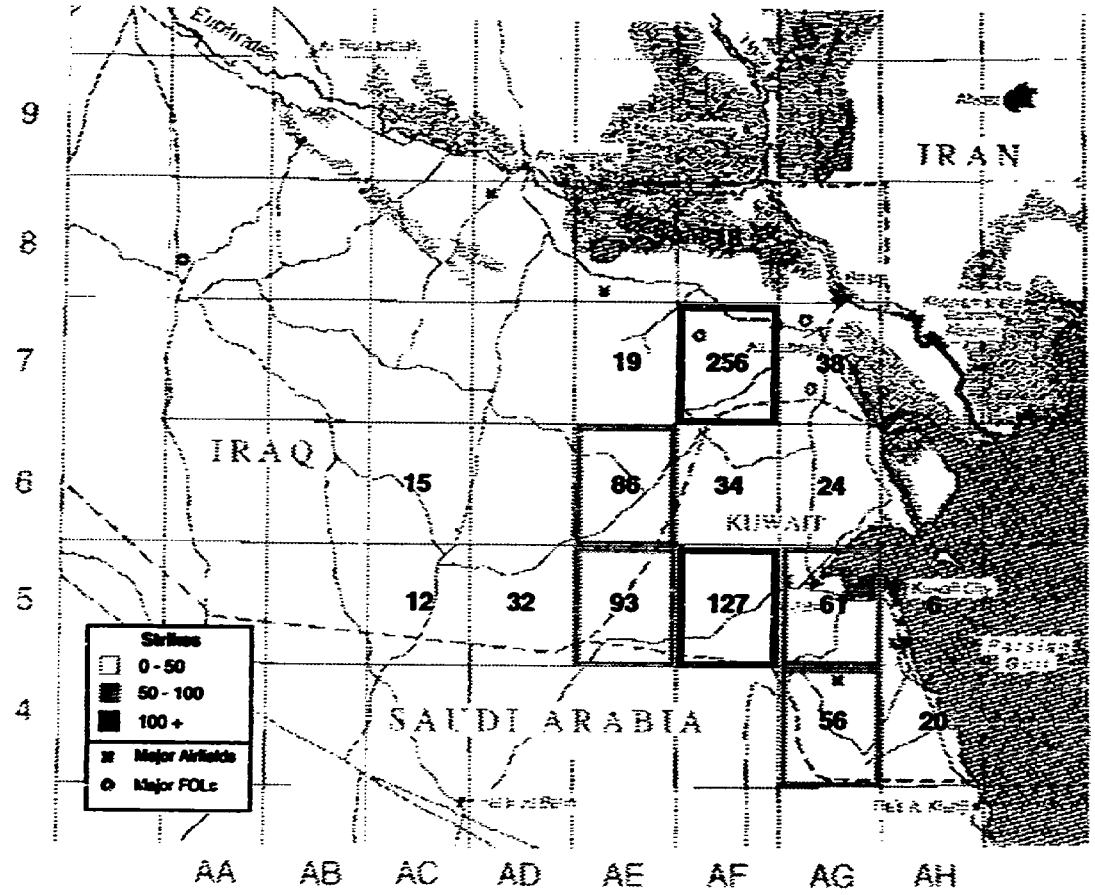
Map 43
Total Strikes
Against Kill Boxes
in the KTO



Map 44
Total F-16 Strikes Against Kill Boxes in the KTO



Map 45
Total F-111 Strikes Against Kill Boxes in the KTO



Map 46
Total B-52 Strikes
Against Kill Boxes
in the KTO

hours later, however, as VII Corps undertook its breaching operation, an operation designed to allow its armor to drive into the flank and rear of Iraqi forces, enemy artillery remained silent.[108]

In the last days before the ground war, Checkmate planners urged CENTAF to reexamine the allocation of air effort between the strategic portion of the air campaign and the KTO. Warden argued that the strategic bombing campaign should be intensified to avoid a ground war entirely.[109] But this was not to be, and Horner's focus was on doing everything possible to ensure that Coalition casualties during the ground campaign would be minimal. Any serious "diversion" from this tasking was unthinkable and would have intensified an already difficult situation between Horner and ARCENT's subordinate commanders.

Conclusion

By 24 February, as the diplomatic *pas de deux* between Iraq and the powers ended, the air campaign had focused on the Iraqi Army for most of the campaign and with increasing intensity over the past four weeks. The campaign was an odd mixture of the scientific and the primordial: from F-111Fs, precisely "plinking" tanks and other Iraqi military equipment, to B-52s, spreading fear and demoralization from high altitude. The result was a campaign that is difficult to measure. Neither air force nor army had developed a methodology for attacking ground forces from the air, and once this task was undertaken, both discovered that they lacked the systems or the concepts to evaluate, except in the loosest fashion, how the campaign was going. It was ironic that Horner felt compelled to take some of his most accurate bombing platforms and task them to attack tanks in order to satisfy stringent BDA criteria for an overall goal that was itself exceptionally high; at the same time, ground commanders were clamoring for B-52 strikes, which, because of their bombing parameters and weaponry, provided sorties with no quantifiable BDA.

As the ground war began, then, one could find reason for optimism, for pessimism, certainly for skepticism, regarding the conduct of air

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[108]"Conduct of the Persian Gulf War," Vol. II, p VII-187.

[109]Msgs: Checkmate to CENTAF/XX, 18-24 Feb 1991, GWAPS, Checkmate Box 3, folder 6.

operations thus far in the war, and what the ground war would bring. Certainly there were positive signs, from increasing numbers of POWs to the continuing air supremacy enjoyed by the Coalition. Still there were questions: how effectively had air power attrited the enemy? What was the psychological state of Iraqi soldiers after the sustained pounding from the air? How at risk would Coalition ground forces be in their "assault columns," as they breached Iraqi front lines? Would the anticipated allied victory be decisive? And most importantly and ominously of all: what would it cost?

An Iraqi POW is being inprocessed into the 101st MP co. POW camp 80 miles inside Iraq.

7

The 100-Hour Ground War

Planning for the ground war had begun in earnest in September, 1990.[1] To destroy what many in the intelligence community regarded as the "battle hardened," highly sophisticated Iraqi ground forces,[2] the Army brought together a team of graduates from its Command and General School for Advanced Military Studies. Over succeeding months, that team played a crucial role in putting together CENTCOM's plans to destroy Iraqi ground forces in the KTO.

Two assumptions formed the core of their eventual plan; both rested on the success of the air campaign. The first was that air power would allow a massive redeployment of Coalition forces to the west and shield that movement entirely from Iraqi intelligence. The creation of a secure zone over U.S. ground forces has been a basic task of American air power since the earliest days of World War II–one that air force, naval, and marine aircraft have accomplished over every battlefield on which American ground forces have fought, since spring 1943 in North Africa.

Still, the hundreds of thousands of troops moving west with tens of thousands of vehicles and the great supply dumps provided an enormously lucrative target. As one of the several U.S. Army histories of the war points out:

> If an Iraqi pilot had managed to penetrate the airspace over the border area during the great shift west, he would have been stunned by the panorama below. It was "mile after mile of tank transporters, gasoline tankers, troop and ammunition carriers," while "overhead was the continuous clatter of C-130 transport planes and cargo helicopters.". . . If

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[1]Frank N. Schubert and Theresa L. Kraus, eds, *The Whirlwind War, The United States Army in Operations Desert Shield and Desert Storm*, draft manuscript, Center for Military History, United States Army, p 174.

[2]See in particular: US Army Intelligence and Threat Analysis Center, "How They Fight: Desert Shield Order of Battle Handbook," AIA-DS-2-90, Sep 1990.

any proof of allied air supremacy were necessary, this was it: "I shudder to think," an American observer wrote, "what a couple of Iraqi planes could have done to that column on a strafing and bombing run." Fortunately, as the phrase went, Saddam Hussein had been "deaired."[3]

But equally important, the Iraqis had not picked up the slightest hint as to what was occurring on their western flank.[4] The blow from that direction would come as a complete surprise to Iraqi commanders at every level.[5]

The second assumption on which Army planning rested was that an air campaign could reduce the enemy's fighting power by 50 percent.[6] As suggested in previous chapters, it was remarkable that Army planners believed that air power could achieve such effectiveness, as well as that the Air Force would sign up to the task. By 24 February air attacks had in fact reduced enemy combat effectiveness in many units in the KTO below that 50-percent criteria. On this bewildered and battered force the Coalition ground offensive fell.

With defeat at Khafji, Iraq had the choice of either quitting or hunkering down and hoping that its ground forces could withstand the pressure until the beginning of the ground campaign. By mid-February, however, the destruction of Iraqi units in the KTO finally worked its way into the consciousness of the Iraqi senior leadership. They seem finally to have recognized that not only might they lose Kuwait, but that they might also suffer the loss of their entire army in the process. Such a result would have completely destabilized the Ba'th regime; the threat created a situation where Saddam finally acted to end the war.[7]

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[3]Schubert and Kraus, *The Whirlwind War*, p 265.

[4][DELETED].

[5]It is worth noting that had the Iraqis possessed a few RPVs (remotely piloted vehicles) they could have picked up at least some of this movement at no cost to themselves. What they could have done with this knowledge is, of course, another question.

[6]Schubert and Kraus, *The Whirlwind War*, p 179.

[7](S) CIA Briefing to OWAPS, 25 Jun 1992.

But still, even at that late date, he believed he had cards to play. On 15 February, the Iraqis offered to withdraw from Kuwait; the offer's conditions, however, made it easy for the Coalition to reject. Among other things, Iraq demanded the Western Powers withdraw their military forces from the Middle East and persuade Israel to leave the occupied territories, while the Gulf states and Saudi Arabia paid off Iraq's war debts.[8] The scornful response underlined the Coalition's determination to finish the war.

Thereafter, the Iraqis came up with more proposals, none of which, however, had much relationship to actual conditions. Only at the last moment, on 21 February, did they finally make a more serious effort to escape their hopeless position; Soviet diplomats, with Iraqi concurrence, proposed an immediate ceasefire in return for an unconditional Iraqi withdrawal from Kuwait.[9] It was all too late. Nevertheless, these diplomatic moves underlined Iraq's desperation to escape with some shred of reputation, as well as Saddam's continuing disbelief that the U.S. would actually risk a ground war against his army.[10]

The U.S. plan on which ground operations rested had evolved into a highly sophisticated plan based on deception and rapid movement–maneuver warfare in its classic and best sense. Far to the west, XVIII Airborne Corps was to strike at the Euphrates Valley in a move that the Iraqis might well interpret as the first stage of an assault on Baghdad. The primary purpose of XVIII Airborne Corps' move, however, was to establish a blocking position and to protect the flank of the main drive by VII Corps. That corps would also swing in from the west to attack the Republican Guard and the heart of the Iraqi Army.

Further east, 1st Cavalry Division would make a major demonstration up the Wadi al Batin at the onset of ground operations to confirm Iraqi assumptions that a major attack might develop from that direction.

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[8]Schubert and Kraus, *The Whirlwind War*, p 282.

[9]*U.S. News and World Report, Triumph without Victory, The Unreported History of the Persian Gulf War* (New York, 1992), p 279.

[10](S) CIA Brfg, GWAPS, 25 Jun 1992.

Finally, two Marine divisions, reinforced by the Army's "Tiger" Brigade with M1A1s, would push almost due north from Saudi Arabia towards Kuwait City, while an amphibious task force demonstrated off the coast. The intention of these various moves was to overload the enemy's command structure by confirming previous assumptions, along with moves that seemed almost impossible in terms of Iraqi doctrine and experience. All these drives, except for the main attack by Frank's VII Corps would begin on D-Day. Here the intention was to force the Iraqis to commit their operational reserves before the main blow occurred.

CENTCOM plans expected the support of considerable air assets for the ground offensive: interdiction and deep strikes to prevent the Iraqis from concentrating their forces for counterattacks and close air support strikes to smooth the Coalition advance. They were not wrong in expecting that the air forces under Horner would give extensive cooperation. The CENTAF Commander made clear at his evening briefing on 24 February the level of support he expected air units to provide soldiers and marines on the ground:

> There are people's lives depending on our ability to help them, if help is required. So I want a push put on. I want people feeling compulsion to hit the target. I do not want fratricide. . . .But up over the battlefield, it's time to go to work. Because other people's lives depend on ours. It's no longer a case of the air just risking their own lives[;] other lives have to be considered.[11]

On a number of other occasions Horner had emphasized his worries about fratricide; he expected his pilots to return with their munition loads still

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[11](S) Daily Comments of Gen Horner, 1700 Brief, 24 Feb 1991, HQCENTAF, Office of History, 20 Mar 1991. Horner had told his morning briefing, "The pressure today is for us to provide support for the maneuvering forces on the ground. So be alert and aggressive. I want the close air support to be flown. I'm not particularly concerned about the weather. The interdiction targets should be flown as possible. . . .I think the ground forces will do just exactly what they want to do, and they'll execute superbly. So make sure that the air is there where they need it, when they need it–that's your job. No excuses. I don't want to have any weather abort or any of that crap. Get up there and do the job the best you can." (S) Daily Comments of Gen Horner, 0900 Brief, 24 Feb 1991, HQCENTAF, Office of History, 20 Mar 1991.

onboard their aircraft rather than drop on targets that might harm friendly troops.[12] Once G-Day arrived, Horner kept this admonition in place, but ordered his pilots to take greater risks to support Coalition ground forces.

At 0100 on 24 February the Coalition ground offensive officially began.[13] [For the movement of Coalition ground forces up to 0800 hrs, 25 February, see Map 47.] French scouts probed the desert before the main attack by their 6th Light Armored Division rolled towards the Iraqi forward-operating air base at As Salman. On the way, the French ran into a portion of the Iraqi 45th Infantry Division–assessed at 50-percent effective as a result of air attacks. Gazelle helicopters prepped the Iraqis and the ensuing battle cost the French two dead and twenty-five wounded. They captured 2,500 prisoners and left an unknown number of enemy dead on the battlefield.[14]

Shortly after the French, the 101st Airborne launched its helicopters to seize forward operating base "Cobra," 110 miles deep in Iraq. Apache helicopters took the unfortunate Iraqis in the vicinity under fire; then a mission coordinated through the air liaison officer brought A-10s to pound Iraqi opposition further. In the end, 340 Iraqis surrendered.[15] Shortly after 1030, the forward base was ready to support the 101st's Apache helicopters in further attacks to the north.[16] Meanwhile, a massive supply convoy drove forward to establish the logistic infrastructure

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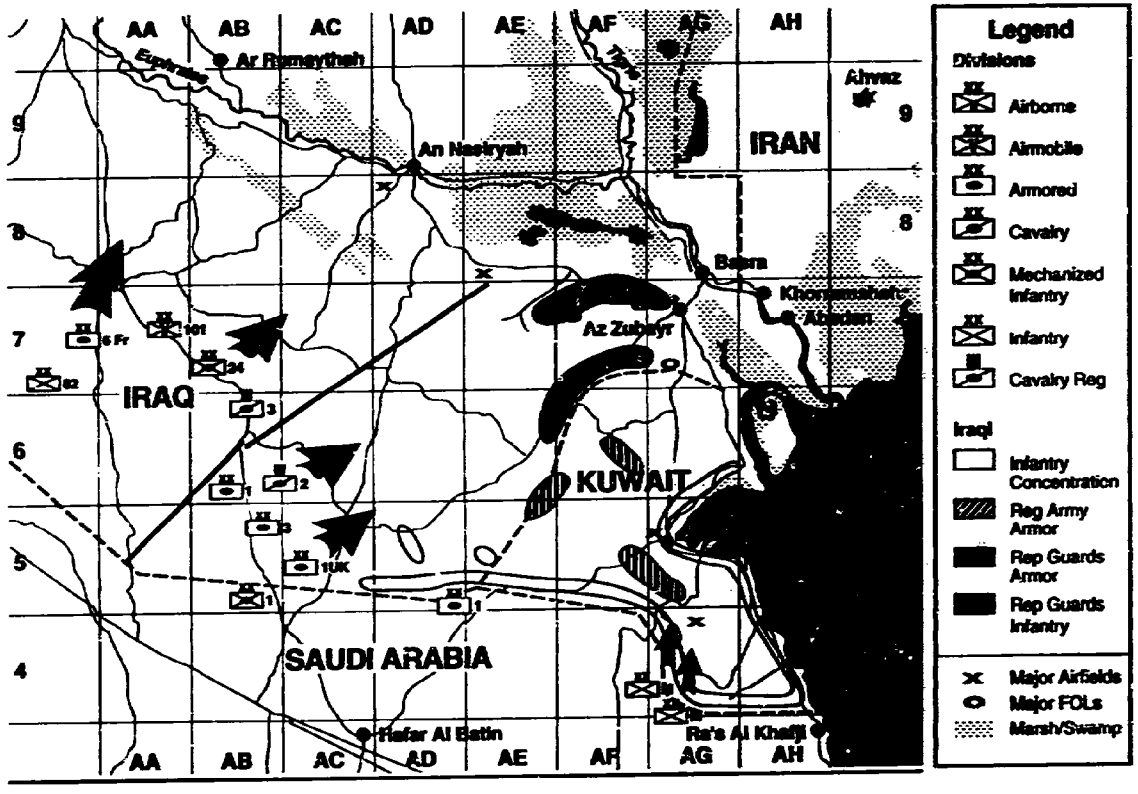
[12](S) *Ibid*, Brfg on 23 Feb 1991. Horner commented: "The point we must remember is that our weapons are far more lethal than anything the Iraqi has in his inventory. Therefore we must be absolutely sure where we put our munitions, whatever role you play in putting munitions onto a target, that it is in fact an enemy target. Because we're better off if we don't drop and let an Iraqi escape by mistake than if we make a mistake the other way and kill a lot of Coalition forces on the ground."

[13]The Coalition ground forces had already started to mount cross border raids for intelligence purposes well before G-Day on 24 February.

[14]Schubert and Kraus, *The Whirlwind War*, p 290.

[15]Brig Gen Robert H. Scales, Jr, *Certain Victory: The U.S. Army in the Gulf War*, draft manuscript, Chapter 5, p 5.

[16]101st Airborne Division (Air Assault), "After Action Report Operation Desert Shield/Desert Storm," Command Report, 13 Jun 1991, pp 45-7.



Map 47
Ground Forces
25 February
0800 hours

required for the next move. By noon, 25 February, the 101st was within forty kilometers of the Euphrates; by late afternoon its Blackhawk helicopters had put troops down on Highway 8, a major highway along the Euphrates River Valley.

The third and most powerful prong of XVIII Airborne Corps, the 24th Infantry Division, moved out last. By midnight on the 24th/25th, it had reached seventy-five miles into Iraq. Its mission was perhaps the most complex of any confronting divisional size units among Coalition ground forces. First, it had to form a blocking force to protect full deployment of VII Corps; then it had to catch up with and shield the advance of that neighboring corps and, finally, it would form the last gate slammed shut on Iraqi forces in the KTO.

Further east, 1st Cavalry Division launched a series of limited probes near Wadi al Batin to pin down Iraqi forces and persuade the enemy that the main offensive would occur in this area. So successful was it in this mission that in the first two days of the war–before it pulled out to support VII Corps' drive directly–it destroyed elements from five separate enemy divisions.[17]

The Marines in the east, directly opposite Kuwait, had the shortest distance to go, but were supposed to face the most significant defensive obstacles and defenses. Yet, from the first, the Marine advance, in Schwarzkopf's words, "encountered no impassable mine fields, no wall of flame, no murderous gas barrage, and very little resistance."[18] While its advance did not reach as far as army units on the first day, 2d Marine Division had captured the enemy's 9th Tank Battalion intact with its thirty-five T-55s, along with 5,000 men in the first twenty-four hours. Also, by the end of day one, the 1st Marine Division attacked and captured Al Jaber airfield, while it destroyed twenty-one tanks and captured 3,000 Iraqis.[19]

These first advances of XVIII Airborne Corps and the Marines underlined that Iraqi resistance would crumble at the first push; to wait until D + 1 to launch the main attack of VII Corps was to risk the possi-

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[17]Schubert and Kraus, *The Whirlwind War*, p 297.

[18]Schwarzkopf, *It Doesn't Take a Hero*, pp 452-53.

[19]*Ibid*, p 300.

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bility that the Marines might push the Iraqis out of Kuwait before the sledgehammer blow from the west slammed the door shut.[20] As a result, Schwarzkopf ordered VII Corps to begin its advance on mid-afternoon, 24 February.[21] Unfortunately, the ensuing advance was more cautious than that of the neighboring corps; Franks' troops only reached approximately fifteen miles into Iraq before going into a laager for the night.[22]

The enemy displayed little capacity to react to these unexpected blows. "Tactical armored reserves, crippled by air attack, failed to counterattack in any coherent fashion. Saddam's infantry collapsed into disorganized rabble."[23] The Iraqis had believed that the coming ground battle would quickly degenerate into a static meat grinder battle with heavy attrition on both sides. They had positioned frontline units to provide warning and begin the process of attrition; extensive mine fields and burning oil trenches were to increase that attrition of Coalition forces and gain time. Behind frontline divisions, four armored divisions of the regular army were then to launch local counterattacks to seal off penetrations. Behind these divisions, two maneuver corps would launch heavier counterattacks; finally Republican Guard divisions were to provide the *coup de gras* by launching an operational level counterattack. Crucial to their conceptions was the assumption that Iraqi troops would have time to concentrate and counterattack at each stage in the battle.[24]

None of their assumptions held. The infantry immediately collapsed, largely as a result of the air campaign.[25] Rear area reserves then confronted Coalition forces moving faster and deeper than the Iraqi high command had calculated. Coalition deception plans had reinforced Iraqi

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[20]It is worth noting that the whole idea of holding up VII Corps attack for a day assumed that the enemy high command possessed the communications, sophistication, and intelligence to recognize and react to the opening moves in the first twenty-four hours.

[21]Schwarzkopf, *Hero*, p 453 and Scales, *Certain Victory*, Chapter 5.

[22]*Ibid*, p 455. In fairness to VII Corps one must note that 1st Infantry Division and the British 1st Armored Division were about to do a passage of lines after the former had breached Iraqi defenses, and a passage of lines by division-sized formations under the conditions of combat is no easy task.

[23]Scales, *Certain Victory*, Chapter 5.

[24][DELETED]

[25]See the numerous EPW (enemy prisoner of war) reports from which this study has drawn much of its picture of the Iraqi Army in the KTO.

beliefs that the attack would come from the south or the Persian Gulf; blinded by Coalition air power, the Iraqis only recognized the blow coming from the west at the last moment when it was far too late.[26]

Not only was the speed and flexibility of the Coalition advance beyond enemy comprehension, but delaying tactics (such as setting fire to oil trenches to create impenetrable walls of fire in front of defenses) no longer functioned because of air attacks. Even F-117s had participated in that effort; but most of the task of destroying the oil trench systems had fallen to work horses of the ground support war, A-10s, AV-8Bs, and F/A-18s.[27]

Throughout the daylight period of the ground war, air force, navy, and Marine fighter units expended a maximum effort to ease the way for ground forces. Much of that effort occurred beyond the Fire Support Coordination Line (FSCL)–the line within which ground force commanders directly controlled delivery of ordnance to minimize the possibility of fratricide. Within this area between FSCL and the front lines, aircraft sorties rendered close air support and remained under rigid control from ground units. Because of problems in identifying targets from the air as well as the need for greater accuracy, altitude restrictions no longer applied.

The provision of close air support was a "push CAS" system in which aircraft launched into particular areas at set intervals–in some cases

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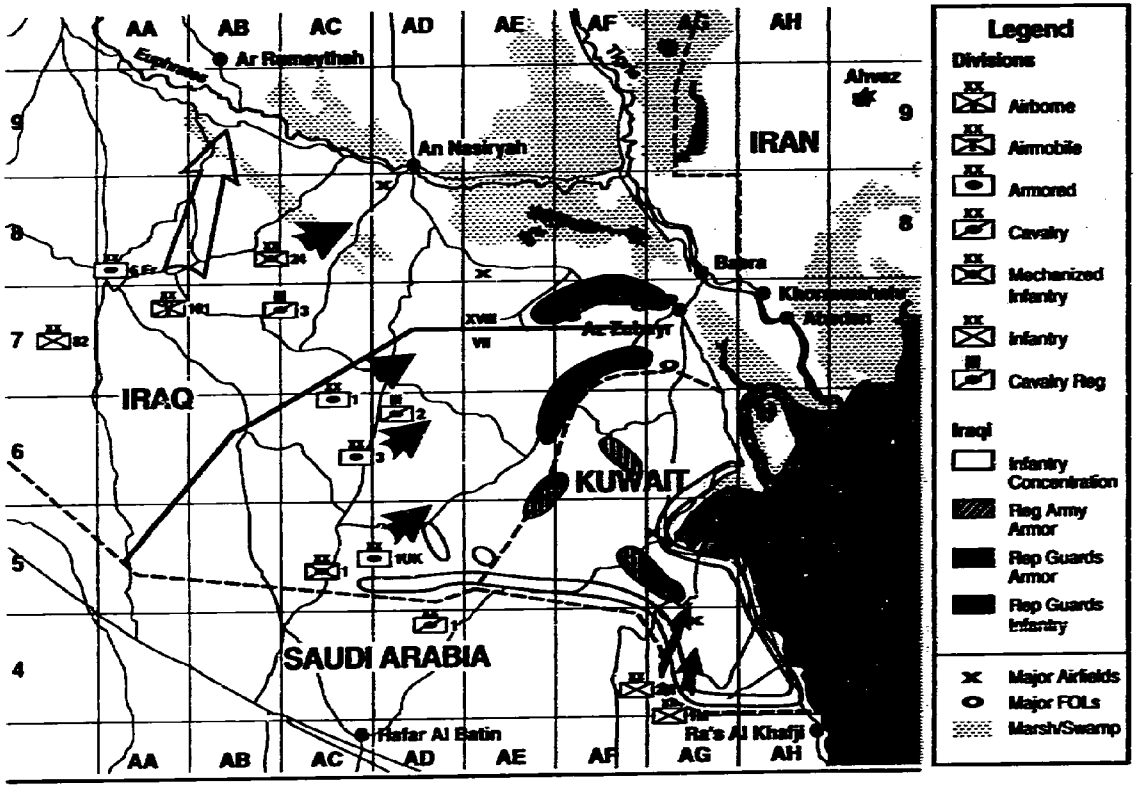
[26][DELETED]

[27]On the night of 15-16 February a substantial F-117 raid–for the only time into the KTO–had taken out most of the oil trench system by destroying its tanks and distribution system [Contingency History Report, 37 FW(P), 10-16 Feb 1991, AFHRA]. As late as 22 February, however, the A-10s had nearly lost an aircraft on such a mission: "Capt Rich Biley, 76th TFS, returned with yet another badly damaged A-10. He had undertaken a mission to set fire to the oil trenches in southern Kuwait in preparation for the ground war. While undertaking a firing pass with white phosphorous rockets, his aircraft's tail was struck by a SAM (in very favorable visual conditions for an optically-guided missile). Captain Biley lost complete hydraulic power, and recovered only through the use of manual reversion and throttle manipulation." Combat Chronology, 23/354 TFW(P), 17 Jan-28 Feb 1991.

as rapidly as seven-minute intervals, if an area possessed particularly heavy concentrations of Iraqi forces. If ground forces did not need that close air support, these aircraft then moved on to strike predetermined targets that lay deeper on the battlefield; new aircraft arriving on station would then replace those that departed; as a result ground forces would always have close air support aircraft available for unforeseen situations. For the most part, the system worked relatively well. Nevertheless, such an operational approach depended on the fact that there was a surplus of air power available within the theater. On 24 February, planners provided no less than 600 air force and marine close air support sorties--A-10s, AV-8Bs, and F/A-18s.[28] The major problem for all aircraft operating in the KTO was that of visibility. Not only was the weather bad through most of the ground war, but dense smoke rose from oil well fires set by Saddam's troops.

Burning oil well spews flames and smoke into the air.

[28]USCINCCENT Sitreps, 23-28 Feb 1991; also see the (S) Master Attack Plan for 24 Feb and the GWAPS Database.



Map 48
Ground Forces
25 February
2400 hours

The initial Coalition moves on the first day of the ground campaign succeeded beyond CENTCOM expectations.[29] For the Iraqis the picture remained unclear. Something completely unforeseen was occurring along the Euphrates west of An-Nasiriyah; moreover, U.S. Marines were making such good progress towards Kuwait City that they were approaching a position that threatened to cut off troops in the Kuwaiti capital as well as Iraqi forces in southeastern Kuwait.

On day two, the offensive gathered steam; 101st Airborne Division completed its task of establishing blocking positions along the Euphrates west of An-Nasiriyah; its troopers thereby cut Highway 8. [For the movement of ground forces up to 25 February, 2400 hrs., see Map 48.] Their movement upon the Euphrates would receive considerable help from C-130s which dropped over 100 tons of food and water to replace the supplies that the large number of prisoners taken thus far in the war had substantially depleted.[30] To its east, 24th Infantry Division closed on its first objectives and would soon be in the position to cover VII Corps' flank. Unfortunately, the division ran into difficult terrain where the desert transitioned into the Euphrates River Valley; heavy rains made much of the terrain impassable even to light vehicles; the division spent much of 25 February looking for the few passable routes through the quagmire.[31] Nevertheless, XVIII Airborne Corps had achieved its three objectives in a day and a half.

Meanwhile, VII Corps moved forward to contact. First and 3d Armored Divisions, screened by 2d Armored Cavalry Regiment, rolled north to form the corps' left wing, while the British completed passage through 1st Infantry Division's breach.[32] Seventh Corps met only scattered resistance during the day. First Armored Division began prepping

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[29]Schwarzkopf records in his memoir the call from Lt Gen Gary Luck, commander of XVIII Airborne Corps on the morning of the second day to report that his units had already captured all of the objectives for the first two days and that the casualties thus far in the war for US units in his corps *amounted to one wounded man*. Schwarzkopf, *Hero*, p 456.

[30]GWAPS Logistics report, Chapter 4.

[31]Scales, *Certain Victory*, Chapter 5.

[32]In expanding their breech, units of the 1st Infantry captured the command post of the Iraqi 26th Infantry Division and its entire staff. Schubert and Kraus, *The Whirlwind War*, p 304.

areas of enemy resistance thirty-five to forty miles away with massive doses of A-10s as it moved forward. Then, as it closed on the enemy, it plastered the area with artillery and rocket fire; in its only significant engagement of the day, one brigade destroyed an enemy counterattack of forty to fifty tanks in ten minutes.[33] By evening deployment of VII Corps was nearly complete with 1st and 3d Armored on line and beginning to turn east.[34] Further south, the British 1st Armored Division was also turning east in preparation for its coming destruction of the Iraqi 52d Armored Division.

The Marine drive was also gathering steam. The Iraqis made some attempt to interfere with the advance by launching a series of counterattacks.[35] After fighting off these attacks, with minimal loss, the Marine divisions and the Army's "Tiger" Brigade continued their advance to the north. If their move forward was slower than in other areas, there were good reasons; enemy defenses were stronger and it paid to be cautious to keep American casualties down. Equally important was the fact that too rapid an advance might push the Iraqis out of the sack before the advance from the west closed in. This advance towards Kuwait City involved considerable use of close air support throughout the ground war. Particularly on 25 February, AV-8Bs, and at times A-10s and F/A-18s, worked in the difficult conditions to provide ground forces with air support.[36]

Twenty-five February was one of the better times in the war for those who flew in the KTO. A message from the A-10 wing to CENTAF ended

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[33] *Ibid*, p 304.

[34] The advance of the 2d Armored Cavalry Regiment to and through "Objective MERREL" was helped considerably by what one of its officers termed the "incessant attacks by A-10s." 1st Lt John Hillen, "Desert Storm, 2d Armored Cavalry: The Campaign to Liberate Kuwait," *Armor*, Jul-Aug 1991, p 9.

[35] Their attack was, of course, in line with their (and Soviet) doctrine of counterattacking enemy breakthroughs and sealing up any breaches that the enemy made. But the Iraqis possessed neither the weapons nor training to be effective against American forces. The pounding that they took from Marine close air support reinforced their dismal showing.

[36] "Testimony of Maj Gen James M. Myatt, 8 May 1991," Hearings before the Committee on Armed Services, United States Senate (Washington, DC, 1991), pp 60-2.

with the comment: "Having a wonderful day."[37] Despite the fact that weather conditions were less than optimal, with cloud cover, thunderstorms, and even dust storms throughout the region, air operations went forward with a vengeance.[38] Horner commented after his morning briefing:

> Of course, the real tragedy of all this is what he [Saddam] is doing to Kuwait on the way out. There is no excuse for that–and it should not be forgotten. In war there [are] a lot of horrible things that go on but they're understandable in light of the people protecting their own lives and fighting for their country. But to desecrate a country because you're losing, there is no excuse for that and no forgiveness. So I hope we're just as tough, mean, and vicious as we possibly can be in these last two days and get it over with.[39]

As the A-10 wing chronology noted, the "Warthog" was in its element. "As the ground battle swept away fixed AAA and SAM sites, the A-10 roamed the battlefield with near total impunity. The only problem was actually employing weapons, as many aircraft were in the queue." Consequently, of 239 sorties launched, eighty-nine were "ineffective."[40] Flying at lower altitudes, A-10s could use their 30-mm gatling guns armed with depleted uranium slugs with deadly effect. Two pilots, Capt. Eric Salmonson and 1st Lt. John Marks received credit for destroying twenty-three tanks by ground forward air controllers. In another case, Iraqi soldiers surrendered themselves and their tanks at the first appearance of A-10s overhead.[41]

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[37](S) Combat Chronology, 23/354 TFW(P), 17 Jan 1991-28 Feb 1991, entry for 25 Feb 1991.

[38]Kenneth R. Walters, Sr, et al, "Gulf War Weather," USAF Environmental Technical Applications Center, Mar 1992, pp 3-90 to 3-91.

[39](S) Daily Comments of Gen Horner, 25 Feb, 0930 Brfg, HQCENTAF, Office of History, 20 Mar 1991.

[40]Marine AV-8Bs seem to have had the same problem as A-10s–out of 274 close air support missions, 143 resulted in no drop. The record for the A-10s was 316 no-drop sorties out of 909 launches. These high totals reflected a number of causes: 1) the Iraqis did not fight with anything like the intensity expected; consequently there were less targets to strike; 2) the bad weather undoubtedly interfered with air operation and coordination with ground forces; and 3) there were often too many sorties in the air and available for the number of targets. "Marine Corps Reconstruction Report," Vol IV, p 77.

[41](S) Combat Chronology, 23/354 TFW(P), 17 Jan 1991-28 Feb 1991.

On the 25th, the Iraqis finally appear to have woken to the extent of the looming battlefield catastrophe. Saddam announced a general withdrawal from Kuwait.[42] The Iraqi high command undertook to get as much of its army out of Kuwait as it could. While ill-prepared Iraqi forces scrambled to escape, the Iraqis attempted to establish two screens to cover the retreat. In the west, the Republican Guard was to gain time against the Coalition drive from the west; regular armored divisions further east were to screen the retreat from Kuwait City. Both moves resulted in Iraqi forces having to fight in positions not of their own choosing. The Iraqi high command also undertook another redeployment that had considerable political consequences after the war. It moved units of the Republican Guard that were outside the theater to occupy Baghdad and Basra. When the war was over, that deployment allowed the regime to maintain its hold over the center and southern portions of Iraq despite the political ramifications of its disastrous military defeats.[43]

By midday 26 February, 24th Infantry Division had completed its move into the Euphrates River Valley. Its advance on this day established a second powerful block on Highway 8 and involved its units in heavy fighting to overrun the airfields of Tallil and Jaliba. The attack on Tallil received considerable support from preparatory A-10 strikes.[44] By evening 26 February both fields were in American hands and 24th Infantry Division could advance down the Euphrates to cover the VII Corps' flank and destroy whatever Iraqi units got in its way.

By this point, VII Corps completed its combat deployment to the north; it was ready to move east to sweep up Iraq's ground forces. From north to south, VII Corps deployed four divisions and one armored cavalry regiment: 1st Armored Division, 3d Armored Division, 2d Armored Cavalry Regiment, 1st Infantry Division–which ironically, given its name, possessed more tanks than any other U.S. division in the theater–and the British 1st Armored Division. To the south, ARCENT released 1st Cavalry Division–which had formed the theater reserve and had launched the demonstration attack on the Wadi Al-Batin–to VII Corps.

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[42]Undoubtedly a political smoke screen to cover the regime from the political fall out of having its army thrown out of Kuwait.

[43]The US and British advance from the west, of course, would have forced the Iraqis to fight under such circumstances.

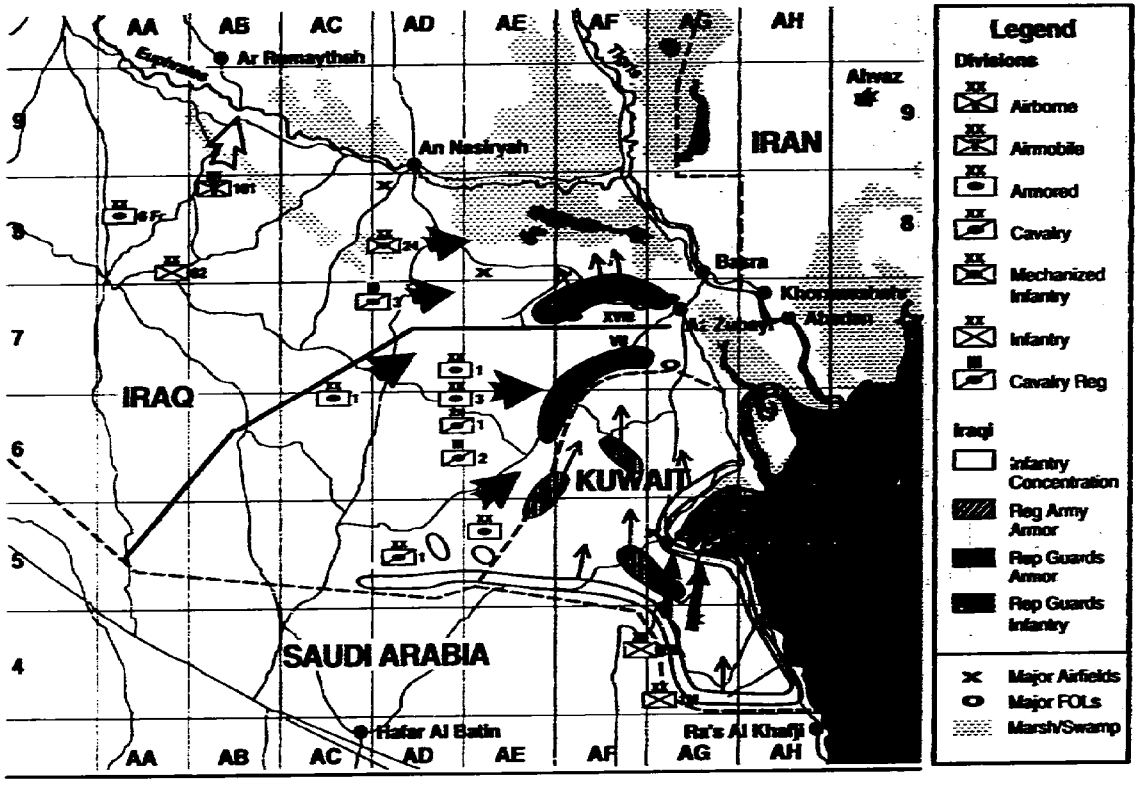
[44]Scales, *Certain Victory*, Chapter 5.

Wretched weather, including rain showers, thunder storms, and dust storms, accompanied VII Corps' advance during the night of 25/26 February.[45] In this situation there was little that air units could do to support the advance directly; their contribution to the ensuing ground battles depended on the effectiveness of their efforts in the KTO since 17 January. Beginning in late afternoon, the wedge of VII Corps chewed through enemy formations. The Iraqis were in considerable disarray; units supposedly in blocking positions had not yet arrived when Coalition forces attacked them; Saddam's retreat order added to the confusion; and as always, air attacks throughout the KTO created further disorder.[46] What occurred over the night of the 26th/27th was the wholesale destruction of Iraqi ground forces in their blocking positions. [For the ground situation as of 26 February, see Map 49.] The attacking forces of VII Corps destroyed 12th and 52d Armored Divisions, much of the Tawakalna Republican Guard Division, and the 48th Infantry Division with minimal loss to U.S. units.

By 26 February the Marine advance had broken up whatever cohesion remained in Iraqi defenses south of Kuwait City. Saddam's retreat order completed the disarray, as desperate Iraqis, civilian administrators as well as soldiers, desperately sought to flee. By early afternoon "Tiger" Brigade had reached the main highway running out of Kuwait City to Basra. Air Force, Navy, and Marine strikes had already bottled up a flood of fleeing military and civilian vehicles. With the head of the pass blocked by vehicles destroyed by air attacks, a gigantic traffic jam formed–one that Army and Marine units pounded along with aircraft in the area. Most Iraqis had sense enough to abandon their vehicles and walk out; the "Highway of Death," a name popularized by the press, was

[45]Walters, et al, "Gulf War Weather," pp 3-94 to 3-95.

[46]For a reconstruction of the difficulties encountered by the 50th Armored Brigade see Scales, *Certain Victory*, Chapter 5.



Map 49
Ground Forces
26 February
2400 hours

in fact largely a highway of dead vehicles, but the name certainly conveyed the extent of the Iraqi defeat.[47] While the advance to the "Highway of Death" occurred, other Marine units reached Kuwait International Airport south of the capital. Here the Iraqis put up stiff resistance. The Marines found close air support of direct utility; their own AV-8Bs and F/A-18s provided considerable preparatory support for their mechanized units to finish off Iraqi resistance in front of Kuwait City.[48]

The ground advance on the final day involved cleaning up the wreckage of fleeing enemy units. [For the ground situation of 27 February, 1400 hrs, see Map 50.] All pretense by the Iraqis of forming a coherent defense ended as they desperately attempted to extricate what was left in the theater. Many surviving units, including those from the Republican Guard, managed to reach Basra. In that position, they were exposed to a thrust by 24th Infantry Division, supported by 1st Cavalry and 1st Armored Divisions. But at the time, it appeared wiser to cease military operations and grant the Iraqis an armistice.

Coalition air power rendered useful support to ground forces in flying close air support missions. There were some striking differences in how such missions were flown. Seventh Corps utilized its air power assets in accordance with the army's "air-land battle" doctrine–as a tool to fight the deep battle.[49] The lack of coherent or effective Iraqi ground resistance aided that conception. On the other hand, the Marines with less organic firepower in their ground units depended more on close air support. Never, however, in either case did the Iraqis put up effective enough resistance to test the system fully.

The bulk of Coalition sorties in the KTO during the ground war flew against interdiction targets. While bad weather made the task of providing close air support almost impossible at times, it was not much kinder to aircraft flying interdiction missions. In terms of the state as well as capabilities of Iraqi ground forces after the air campaign, one can

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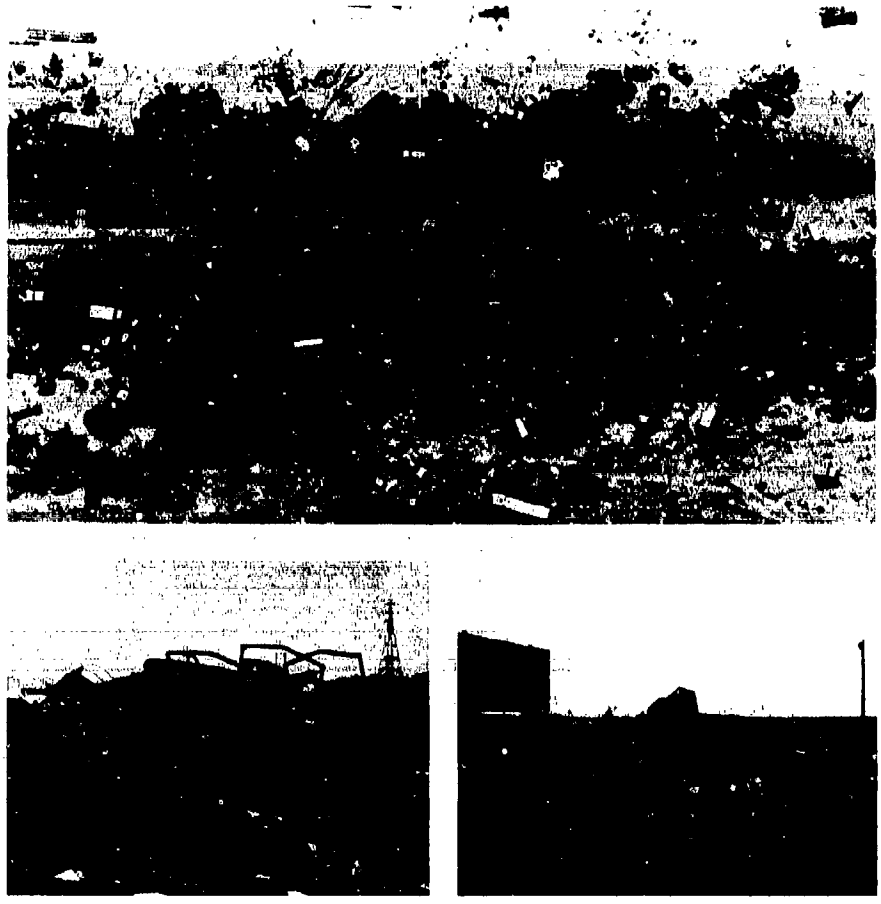
[47]Schubert and Kraus, *The Whirlwind War*, pp 311-13.

[48]"Testimony of Maj Gen James M. Myatt, 8 May 1991," Hearings before the Committee on Armed Services, United States Senate (Washington, DC, 1991), pp 60-62.

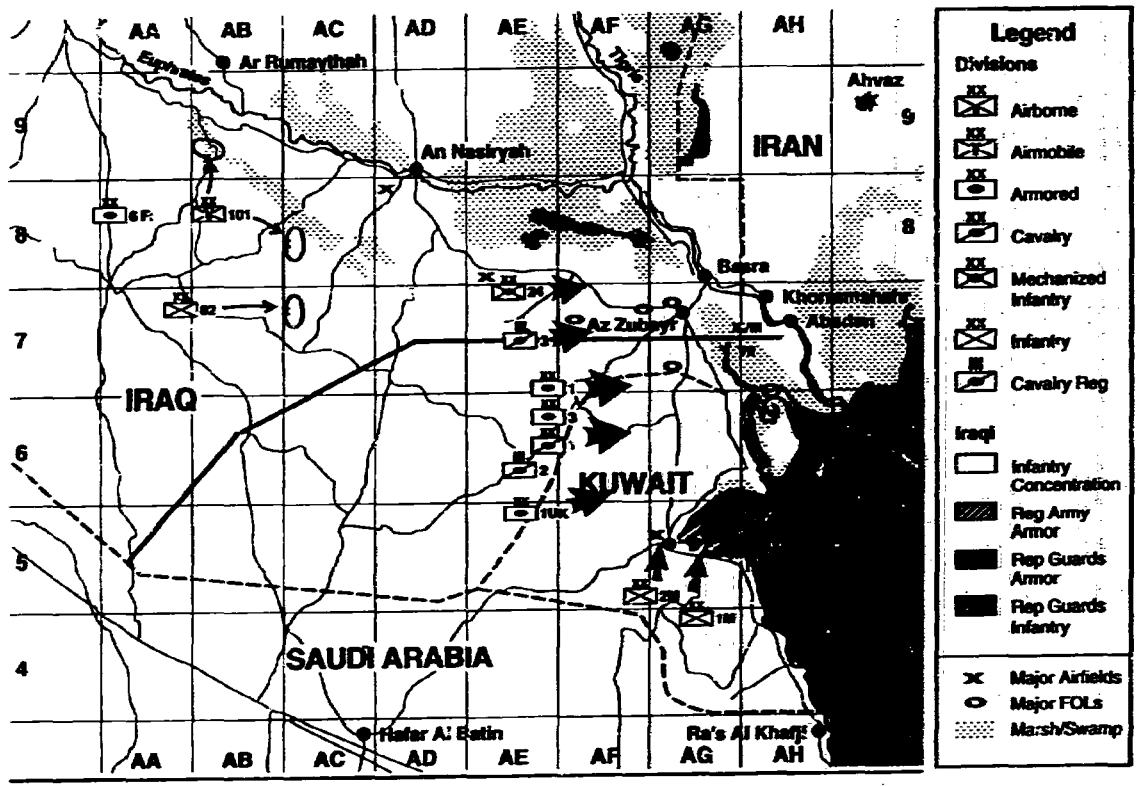
[49]Intvw, Gen Frederick Franks with GWAPS personnel (Thomas Keaney), 2 Sep 1992.



"Highway of Death," north of Kuwait City.

agree that close air support was never essential to accomplishment of the ground mission.[50] But on the interdiction side of the ledger with the

[50]The case is somewhat different with regards to the Marines. The Army has always invested heavily in artillery support for frontline units; the Marines on the other hand have put its resources into support for their own air component. Consequently, particularly in the Kuwait theater they had to have close air support at times, while Army units could rely on artillery fire to fight the close in battle.



Map 50
Ground Forces
28 February
1400 hours

Iraqis concentrating to meet the ground offensive, air power was in a position to strike lucrative targets. Unfortunately, bad weather prevented Coalition aircraft from taking advantage of this situation to the fullest extent.

Air interdiction involved two distinct periods during the ground war: in the first, Coalition air power aimed to destroy, disrupt, and delay the enemy's ability to launch effective counterattacks against Coalition ground forces. However, once it became clear on 25 February that the Iraqis were fleeing Kuwait as quickly as possible, the interdiction focus shifted to attacks on a fleeing enemy.[51]

The interdiction effort against fleeing targets was not as successful as air commanders expected. There were a number of reasons why this was the case. The weather was a major factor. Both the Iraqi concentrations and retreat from the theater took place under conditions adverse to the employment of air power. The choke point north of Kuwait City involved mostly civilian vehicles commandeered by fleeing Iraqi soldiers. There was the possibility of a second choke point west of Basra, where Coalition air attacks had destroyed most of the bridges over the canals. However, a final reckoning from the air did not occur. For one thing, bad weather with low ceilings forced attacking aircraft to bomb through clouds on radar. Moreover, Schwarzkopf's fears about a possible incident with Iran led him to put the area near the Iranian frontier off limits to air attacks.[52]

During the last forty-eight hours, a serious dispute arose between Army and Air Force over placement of the fire support coordination line (FSCL)—a dispute which shows neither service in the best of lights. The FSCL represents an essential element in inter-service cooperation to limit fratricide. Between front line and FSCL all aircraft sorties remain under the positive control of ground forces or airborne forward air controllers in communication with those on the ground; beyond the FSCL, attack aircraft have *carte blanche* to attack any targets they believe to be enemy.

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[51]For a more detailed discussion of the interdiction effort, see The Effectiveness report, Chapter 5.

[52](S) "TSgt Barton's Notes from the TACC," 1020 25 Feb 1991, GWAPS, NA 200; and TACC Log, entries for 27 Feb 1991, GWAPS, NA 215.

This is not an arcane doctrinal issue; aircraft not under positive control and attacking targets in the vicinity of friendly ground forces–particularly in a war of rapid movement–may either bomb their own troops or themselves fly into artillery or rocket barrages. Consequently, within the FSCL all Coalition aircraft remained under the positive control of forward air controllers. AWACS and ABCCC generally coordinated the flow of information from JSTARS, but crucial to the information flow to the forward air controllers were the corps' Air Support Operations Centers (ASOC). That direct link provided immediate confirmation as to whether units seen moving on the ground were hostile or friendly. In one case, an F-16 "Killer Scout" reported to XVIII Airborne Corp's ASOC a major armored formation near the Iraqi airfield of Jaliba; the Corp's ASOC identified the armored formation as a brigade of the 24th Infantry Division. Consequently, despite considerable enthusiasm by aircraft arriving on station to attack "the mother lode just northeast of Jaliba,"[53] the "Killer Scout" warned the aircraft off what appeared to be a wonderful target, but what in fact were friendly troops.

There were, of course, a number of fratricide incidents. Because of the low casualty rates, the Army was able to examine in great detail nearly every incident in the war involving the loss or injury of its troops. The dark side of the Coalition victory was the significant percentage of Coalition casualties inflicted by "friendly fire." In recognizing that considerable percentage however, one needs to keep in mind the extraordinary rapidity of the ground force's advance. Considering that speed and the conditions of the battlefield–much bad weather and the smoke from Kuwait's oil fields–it is perhaps surprising that there were so few incidents. One might have lowered the level of fratricide by slower and more methodical movements. Such an approach would have allowed greater ground-air coordination, but that in turn might well have raised the gross number of casualties by allowing the Iraqis greater time to recover their equilibrium.

However, there were problems with the fire support coordination line (FSCL). Late in the ground war, army commanders, without reference to their air counterparts, moved the FSCL, in one case north of the Euphrates, and in another close to Basra. The first case is the most interesting and

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[53]Capt Rob Hartberg, "Beyond The Fire Support Coordination Line (FSCL): Contact The Killer Scouts," *USAF Fighter Weapons Review*, Spring 1992, p 12.

deals with XVIII Airborne Corps. On 27 February, XVIII Airborne Corps wanted to use its helicopters against enemy targets on the causeway at Hawr al Hammar; consequently, it moved the FSCL forward to accommodate such strikes. By moving the line forward, the airborne corps staff avoided having to put its helicopters under Air Force control. That decision, however, had unforeseen consequences; XVIII Airborne Corps had created a situation that severely limited the potential of the Coalition's available air power. Despite the fact that no U.S. ground troops were north of the Euphrates–nor were there plans for such a movement–navy and air force aircraft now could only attack the causeway and highways north of the Euphrates under direct control of forward air controllers (FACs). But virtually all the FACs were concentrated in supporting troops in combat further south in Kuwait. Moreover, conditions were not favorable to the employment of FACs even if they had been available.[54]

In the end, the TACC appealed to Schwarzkopf to move the FSCL back to the Euphrates so that air strikes could hit both the causeway and the roads north of the river. Unfortunately, it took *fifteen* hours to resolve the dispute–a period during which there were only sporadic helicopter attacks on fleeing Iraqis, while the bulk of Coalition air power remained on the sidelines.[55] In the end, the argument may not have played a decisive role in the enemy's escape. The weather was such that it is improbable that Coalition air power could have prevented the retreat of most of those Iraqi forces, given bad weather and the difficulty in employing precision-guided munitions. Nevertheless, the incident does suggest a parochialism that for the most part was not prevalent during the war. Fortunately such incidents rarely occurred during the conflict.

The Impact of Air Power on Ground Forces

There is no exact fashion in which one can measure the impact of the air campaign on Iraqi ground forces. After the war, there was no way to calculate the contributions that air attacks had made in preparing the battlefields on which Coalition ground forces fought. Even officers in

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[54](S) Intvw, Maj Gen John A. Corder with GWAPS, 18 May 1992; TACC log, entries of 27 Feb 1991, GWAPS, NA 215; TACC Historian Transcripts, "TSgt Scott A. Saluda's Notes," GWAPS, NA 200.

[55](S) *Ibid.*

senior positions serving in the same brigade with previous combat experience were unable to agree on what air power had done. Lt. Col. John Brown, battalion commander in the 2d Armored Division's Brigade forward–part of 1st Infantry Division–noted to this author that the battlefield crossed by his unit suggested that air attacks had not destroyed much Iraqi armor or artillery; nevertheless, he believed that those air attacks had savaged the enemy's transport with innumerable truck wrecks as witness.[56] On the other hand, the G-3 of that same brigade, Lt. Col. Clint Ancker noted that from his vantage point air attacks had destroyed much Iraqi armor.[57] Ancker noted a number of tank wrecks and cold T-72s that the Iraqis had abandoned either because of crew desertions or supply difficulties resulting from the air campaign. Brown and Ancker transited Iraqi territory within approximately a kilometer of each other; yet their impressions were considerably different. Admittedly, their units were trying to move rapidly to the east, were involved in "heavy" fighting, and were often enshrouded in miserable weather.

Their differences encapsulate the difficulties confronting the historian in estimating the effects of the air campaign against Iraqi ground forces. Had U.S. authorities undertaken a systematic survey of the battlefield after hostilities, we might possess a more coherent picture on which to estimate the direct results of the air campaign–at least against equipment. But neither Air Force nor Army displayed much interest; therefore the data available comes from aerial surveys–which do not indicate what destroyed Iraqi equipment–or individual surveys undertaken by the units themselves.[58]

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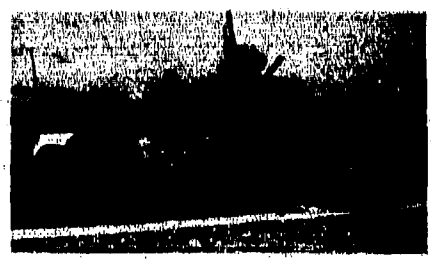
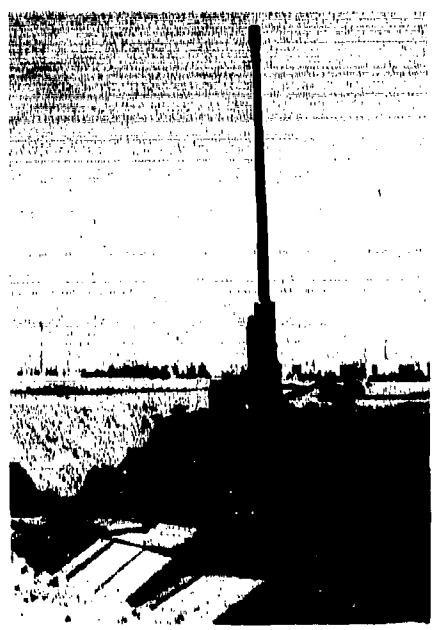
[56]Intvw, Lt Col John Brown with GWAPS personnel (Williamson Murray), Naval War College, May 1992.

[57]Intvw, Lt Col Clint Ancker with GWAPS personnel (Williamson Murray), Naval War College, May 1992.

[58]In this case the 2d Armored Division's Brigade (forward) did send a team under Col. Ancker to survey the area through which it moved during the fighting. But while that team made a complete survey of all damaged and destroyed equipment, it did not have the technical expertise to determine what weapons systems had achieved the destruction. The largest official effort to survey damaged Iraqi military equipment, the Joint Intelligence Survey Team, only examined a sample of 163 tanks out of the 2,633 tanks that were destroyed during the war. This team examined 145 hits on 85 tanks (78 of the 163 were not hit) and found that 28 had been hit by air-dropped or fired munitions. The fact that 78 tanks had been abandoned does suggest an indirect impact of air attacks, but the sample size is too small and isolated in its geographic area to reach any firm conclu-

The GWAPS Effectiveness report has examined the question of the equipment air attacks destroyed or damaged in detail.[59] It is, however, useful for our purposes to recapitulate its main argument. Destruction of Iraqi equipment depended on the air campaign's focus in the KTO as well as its form. The destruction wrought by Coalition air and ground campaigns against Iraq's forces are indeed impressive. Of approximately 3,475 tanks in theater on 15 January, the Iraqis possessed only 842 on 1 March; the artillery losses were even heavier: of 2,475 tubes on 15 January, only 279 remained at the beginning of March.[60] Of course, the ground war did destroy much of that equipment.





Military equipment destroyed by Coalition bombing or abandoned by Iraqi troops.
Left: T-54/55 tank.
Right: S-60 57mm automatic antiaircraft gun.

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sions. Memorandum and attached briefing viewgraphs (S), Foreign Science and Technology Center, "Joint Intelligence Survey Team Report," 14 Jan 1992, GWAPS, NA 167. See also Marine Corps Research Center, "Armor/Antiarmor Operations in Southwest Asia," Research Paper #92-0002, US Marine Corps, Quantico, VA, Jul 1991.

[59](S) GWAPS Effectiveness report, Chapter 4.

[60]1 Mar 1991 equipment totals derived from U-2 Imagery of the same date. Data provided in the CIA Briefing to GWAPS, 25 Jun 1992.

Much destruction centered on units of Iraq's army; despite heavy attacks on the Republican Guard, those units suffered less heavily. Undoubtedly, that fact reflected the heavy engineering preparations undertaken by the enemy to protect these elite troops, as well as the wide area over which the Republican Guard had dispersed.[61] But even among regular army units, there were disparities in losses that units suffered. [DELETED].[62] Again the determining features appears to have been the degree to which units were removed from Coalition air attacks and the extent of defensive preparations.[63]

In retrospect, the most effective weapons against Iraqi equipment were the laser-guided bombs. Here again, it was the degree to which the Iraqis protected their equipment that was critical in weapon effectiveness. [DELETED].[64] The analysis suggests that ARCENT assessments that laser-guided bomb hits against enemy equipment in revetted positions should count as a 50 percent kill were close to the mark.[65]

Maverick missiles (over 5,000 expended by air force aircraft) also made a major contribution to destruction of Iraqi armor; there is no reason to disbelieve the one third credit that ARCENT gave to Maverick claims. However, the combination of laser-guided bomb and Maverick successes suggests that aircraft dropping free-fall bombs–B-52s, F-16s, F/A-18s, and AV-8Bs–achieved relatively little against enemy equipment

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[61]Since they were far removed from the front lines the Iraqis felt that they could disperse more widely and that they would then have sufficient time to concentrate when warning came that the Coalition ground offensive had begun.

[62][DELETED]

[63][DELETED]

[64]In this case, the damage occurred prior to the ground war, since Republican Guard units moved from deployment areas against the Coalition offensive that was coming from a different direction. (S) Memo, Chief Third World Military Division, "Effectiveness of Laser-Guided Bombs against Republican Guard Armor," 24 Sep 1992, GWAPS, NA 385.

[65]A 60% success rate is still an impressive rate of success by anyone's criteria.

despite considerable efforts. At the beginning of the ground war on 23 February, CENTCOM's reported attrition of Iraqi equipment had reached the following totals: 1,688 armored fighting vehicles (39 percent), 929 armored personnel carriers (32 percent) and 1,452 artillery pieces (47 percent).[66] Again, as the Effectiveness report suggests

> The best approximation, and that is all it can be, is that while the *numbers* claimed by Central Command on 23 February were high, the *percentages* were probably not (given that there were fewer tanks and artillery pieces in the theater than believed). In other words, the counts of tanks and artillery pieces destroyed by air prior to the ground war are each too high by around 300 pieces of equipment.[67]

The disquieting aspect of any analysis of the air campaign against enemy ground forces is the fact that the Republican Guard, which received a disproportionately heavy emphasis in CENTAF's targeting, suffered less damage than the other units of the Iraqi Army. Moreover, they also seem to have kept their morale in better shape throughout the attacks. Undoubtedly, the fact that they were dispersed over wider areas and possessed substantially better engineer support in laying out defensive revetments contributed to their ability to withstand the air bombardment.

The beginning of F-111F attacks with precision-guided munition capabilities in early February caused a significant rise in Republican Guard losses, but such losses never caught up with the level of damage that Coalition aircraft had inflicted on other Iraqi formations. Moreover, CENTAF pulled the A-10s, the other precision-guided munition-capable aircraft, out of Republican Guard areas in mid-February because of the missile threat.[68] Unfortunately, those aircraft that dropped "dumb" bombs contributed little to the direct attrition of equipment possessed by the regime's elite divisions. Consequently, despite heavy commitments of F-16s and B-52s against the Republican Guard these elite troops, crucial to the regime's political survival, suffered less than their army counterparts.

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[66]Viewgraph contained in "J2 BDA Briefing to the President," GWAPS, NA 353 has the JCS/CENTCOM figures.

[67]GWAPS Effectiveness report, Chapter 4.

[68]As discussed above, on 15 February the A-10s lost two of their aircraft with one damaged. "Operation 'Desert Storm' A-10 Combat Recap," GWAPS, NA 292.

But the air campaign's true impact should not be measured on the basis of indices that calculate only the amounts of equipment destroyed by air attack. The issues on which one needs to judge the air campaign's effectiveness are the degrees to which air attacks impeded or prevented enemy military action to protect his forces and to which air attacks reduced the willingness of Iraqi soldiers to fight.[69] The problem with estimating the indirect effects of air attacks on Iraqi ground forces has much to do with the nature of evidence. The low casualty rates suffered by Coalition forces are the best indicators of the air campaign's contribution to the ground war, but here one deals entirely with intangibles. There is no way of estimating casualty levels that would have occurred had there been no air campaign.[70] And we have suggested, little documentation outside of EPW (enemy prisoner of war) reports exists on the Iraqi Army before or during the ground war.[71]

Consequently, interrogations of Iraqi EPWs provide the best evidence on the indirect impact of the air campaign. Even here there are ambiguities. The greatest number of the EPWs came from Iraqi units deployed furthest forward; Coalition ground forces captured and interrogated significant numbers of senior officers from these infantry divisions defending the Saudi border. Unfortunately, only a few Republican Guard officers fell into Coalition hands. As a result, the picture of the air cam-

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[69]On the basis of the EPW interviews, the morale of Iraqi forces was not high even before the air campaign began. As one of the comprehensive intelligence debriefs suggested: "There is little doubt that there were many thousands of veterans of the Iranian war in the army Saddam Hussein rushed to the south. However, the evidence is convincing that most Iraqi soldiers, both officers and enlisted, did not believe in the cause." Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "Analysis of Source Debriefings," JDC Rpt #065, 15 Mar 1991. See also (S) IIR 6-072-0037-91.

[70]One of the army veterans from "Desert Storm" who talked to GWAPS commented that the air attacks had broken most of the Iraqi Army before the ground war began. He had no doubt that Coalition ground forces could have beaten the Iraqis without an air campaign, but noted that Coalition ground casualties would have increased *significantly*. Oral presentation, Lt Col Clint Ancker to GWAPS, 19 Oct 1992.

[71]Given the nature of the Iraqi regime and Saddam's ability to remain in power whatever the level of disaster for which he is responsible, it is unlikely that we will ever get a clear picture of what happened within the Iraqi military as the air campaign unfolded. What makes the future picture even darker is that considering the nature of the Ba'th tyranny, it is doubtful whether the Iraqis themselves could construct an accurate picture of what happened in the Gulf War.

paign's impact is much clearer for regular army units than for those of the Republican Guard.

Nevertheless, one can make interesting judgments. It did not take the Iraqis long to recognize that Coalition aircraft were targeting equipment; as soon as precision-guided munitions impacted on equipment near their positions, Iraqi troops moved away from the danger area.[72] As one Iraqi noted to his captors after the war, "The love affair between tank and tankers ended."[73] The result was a direct decrease in maintenance and preparation of equipment for combat. Moreover, precision-guided munition attacks reinforced Iraqi perceptions of an overwhelming American technological superiority.[74]

[DELETED],[75]

EPW reports provide evidence that CENTCOM analyses of enemy equipment losses were close to the mark.

> Equipment attrition due to the air campaign appears to have been extremely heavy, with all sources reporting that tanks, trucks, water and fuel tankers, armored personnel carriers and anything else that moved were systematically targeted by Coalition aircraft with great success. [DELETED][76]

During the five months before 17 January the Iraqis had stockpiled large amounts of ammunition, fuel, and rations. They had done this not because of expectations that the air campaign would last a long time, but rather because they believed the ground war, if it occurred, would become a long slogging match similar to the war against Iran. Since the enemy had such large stockpiles, Coalition planners dealing with the KTO never attempted a coherent campaign to interdict the flow of supplies into the

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[73]Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "Analysis of Source Debriefings," JDC Rpt #065, 15 Mar 1991.

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[76]Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "The Gulf War: An Iraqi General Officer's Perspective," JDC Rpt #0032, 11 Mar 1991.

theater; but air attacks did knock out the railroad running from Baghdad to Basra, while other attacks took out most of the bridges along the Euphrates. In the latter case, the aim was as much to prevent the escape of the Republican Guard as the movement of supplies into the theater.

Air attacks did impose a significant level of interdiction on the flow of supplies within the KTO. Ironically, that effect was an indirect result of Coalition air attacks; there is no evidence that planners in the "Black Hole" aimed at interdicting the resupply of Iraqi forces from supply bunkers to defending units.[77] During the day, Coalition aircraft, when weather permitted, did a thorough job of shutting down movement of Iraqi vehicles; during the night, however, a different situation obtained and the Iraqis could move some needed supplies from depots to units.

Nevertheless, there were serious problems for the Iraqis. For one thing, few supply vehicles were bunkered; they were therefore more vulnerable to air attacks. One Iraqi indicated that he had felt that the Coalition had waged a systematic campaign against the logistic system. [DELETED].[78] Another Iraqi indicated that whereas supply runs had occurred before the war in daylight, "supply runs now were made at night with the routes varied for safety reasons. As the air war progressed, these runs became harder to make as more trucks were damaged and the fuel became scarcer."[79]

[DELETED][80]

The Iraqi Army was not in danger of starving to death. But the collapse of its logistics, occurring in a number of divisions, resulted in pervasive problems in supplying frontline units with anything more than bare necessities. As early as Khafji, this state of affairs was clear in

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[77]OWAPS discussions with those running the JSTARS effort suggest no consistent effort to shut down the movement of Iraqi vehicular traffic at night, unless it involved the movement of large convoys. Most Iraqi resupply took place with small groups or singular trucks distributing supplies to the units. See the oral interview, Brig Gen George K. Muellner with OWAPS personnel (Thomas C. Hone, Anne Leary, Mark Mandeles), 16 Apr 1992.

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looking at EPWs. Intelligence reports at the time indicated that Iraqi EPWs were in wretched health and malnourished, but wearing new boots and new uniforms. As the Effectiveness report suggests: "The one pattern that emerges from the evidence is not of a starving army, but of the signs evident in a country in which the distribution system has ceased to function–illogical distributions, goods absent, being hoarded, or lying unused."[81] By the beginning of the ground campaign much of the Iraqi Army was in serious trouble with a collapsing logistical system. Several EPWs went so far as to state that the ground campaign was unnecessary, and had the air campaign continued two or three weeks longer, the Iraqi Army would have been forced to withdraw due to logistical strangulation.[82]

EPW reports on their logistics suggest that a more methodical campaign against the enemy's distribution at night as well as by day might have brought Iraqi forces to the brink of collapse.[83] As it was, the effects of air operations on the enemy supplies caused serious difficulties to Iraqi troops. These difficulties, however, represented only a portion of what was occurring to the enemy's army.

The breakdown of consistent and coherent supply also had a direct impact on Iraqi morale. But the steady pounding of the Coalition air campaign had the greatest impact on the enemy. Again to quote from the Effectiveness report:

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[81]GWAPS Effectiveness report, Chapter 4.

[82]Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center," The Gulf War: An Iraqi General Officer's Perspective," JDC Rpt #0052, 11 Mar 1991.

[83]Such a campaign might have been waged by using JSTARS, but it is clear that there was no clearly thought-through plan for using this new technological intelligence system in such a role. Rather than as a guide to funneling real-time intelligence into air operations (with the possible exception of the battle of Khafji), JSTARS seems to have played a role as a glorified ABCCC and allocated sorties among different sets of targets drawn up by competing authorities on the ground (The Battlefield Control Element, CENTCOM, ARCENT, MARCENT, and even VII Corps). JSTARS also participated in the hunt for Scuds. But the evidence does not suggest that those in JSTARS or those who attempted to utilize it ever conceived of it as having a mission to participate in the closing down and interdiction of the Iraqi supply system within the theater. See in particular: Oral intvw, Brig Gen George K. Muellner with GWAPS personnel (Thomas C. Hone, Anne Leary, and Mark Mandeles) 16 Apr 1992.

> The pervasive impression left by the interrogation reports of prisoners who deserted or who were captured was the sense of futility felt by the Iraqis after weeks of extensive bombing. When the bombing started, their ground transportation began to crumble. They ran short of water, food, fuel, and all spare parts. Some units had their supply stocks destroyed. Training in the units ceased. Soldiers moved apart from their equipment because they well understood what the targets were. Many captured Iraqis stated they thought the air campaign would last several days to a week at most. When it did not end, the sense of futility and inevitability of the outcome became more apparent.[84]

Here the question is not one of equipment destruction, but rather the impact that ceaseless air attacks had on the minds of enemy soldiers. No Iraqi could know whether B-52 raids attacking neighboring divisions were hitting their targets or not; the sounds and trembling in the ground told him all he needed to know.

In the meantime, Coalition psyops leaflets assured him that soon he and his unit would also fall under the Buff's terrible wrath. If that were not enough, day-to-day living conditions worsened with the incessant appearances of A-10s and F-16s. Here again the issue is not one of accuracy. Iraqis soldiers had no idea of whether bombs impacting down the road were hitting targets or not; psychologically, the air attacks added to the sense of an endless terror--a situation moreover, where the Iraqis could undertake no action to retaliate for the punishment that Coalition aircraft inflicted on them.

As suggested above, Iraqi ground forces were already in bad shape before the air campaign began. But air bombardment placed extraordinary pressures on vulnerable military forces.[85] It took a weak reed and smashed it into the ground:

[DELETED][86]

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[84](S) GWAPS Effectiveness report, Chapter 4.

[85][DELETED]

[86]Department of the Army, 513th Military Intelligence Brigade, Joint Debriefing Center, "The Gulf War: An Iraqi General Officer's Perspective," JDC Rpt #0052, 11 Mar 1991.

The EPW reports underline the terrible effects that unceasing air attacks had on Iraqi troops. Most felt no shame for having surrendered because they were overwhelmed by the Allied air campaign and that resistance was futile."[87] [DELETED].

High desertion rates suggest the general breakdown of enemy ground forces as they awaited the start of the "Mother of all Battles." Moreover, one must place such desertion rates, reaching 50 percent, within the context of Iraqi political life: anyone who crossed the regime risked paying a heavy price not only in terms of his own survival, but for that of his family as well.

As the pounding continued, the Iraqi high command displayed some sense of what was happening in the KTO. It ordered commanders to undertake summary executions of deserters. [DELETED].[88]

From the Iraqi perspective, there were several factors that resulted in the collapse of morale. The length of the air offensive as well as its intensity played a major role in undermining morale.[89] Soldiers recognized that they were helpless. Their equipment steadily disappeared in explosions and smoke; trucks on which resupply depended disappeared fastest of all; but as day-to-day living conditions deteriorated, all feared that aircraft attacking their comrades would soon come after them.

[DELETED][90]

[DELETED][91]

[DELETED].[92] [DELETED][93].

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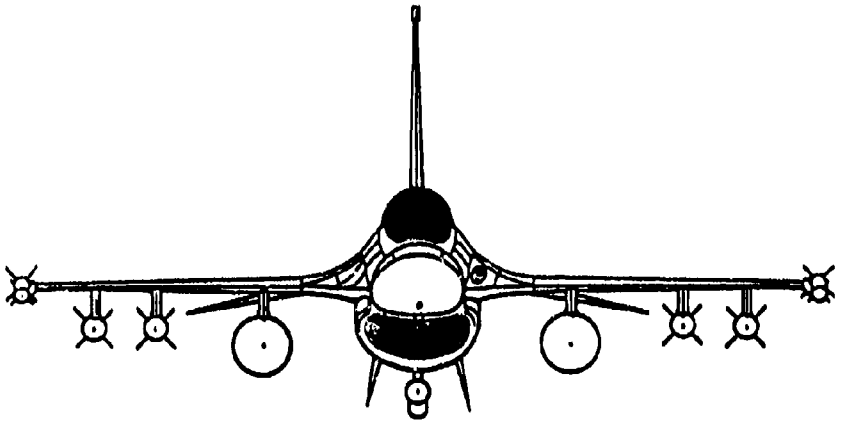
One comes away from extensive readings in the EPW reports that whatever will existed in the Iraqi Army to see another war through to the end that might have existed on 17 January, had vanished by the beginning of the ground campaign. Some units did admittedly fight, but for the most part, the structure collapsed as its most basic building block, the common soldier surrendered, in great numbers and after minimal resistance.

Conclusion

The 100-hour ground war to a great extent represented the achievement of air power. By creating the conditions under which CENTCOM could redeploy its forces and by executing an almost ceaseless campaign against enemy forces in the KTO, air power established the conditions under which Coalition ground forces could catch enemy forces by surprise. By hammering Iraqi forces in the KTO from the beginning of the war, Coalition air power destroyed whatever willingness most might have had to fight the ground battle with the kind of tenacity that they had displayed during the Iran-Iraq War. One of course will never know how well the Iraqi Army might have fought without an air campaign. But the extraordinarily low level of casualties on the ground war is a fitting tribute to the efforts and success of those airmen who flew in the KTO.



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Conclusion

At the beginning of this report, we recorded Gen. Bernard Trainor's observation that the Gulf War represented the first conflict in which a ground campaign had supported an air campaign. In this sense, the war against Iraq represented air power's coming of age; for the first time in history, air power had reached the expectations of its proponents.

Any critical examination of American performance in the war may seem like quibbling with what was an enormous success story. One could also argue that the U.S. brought such power and superiority to the Gulf that victory was a foregone conclusion. Yet, such a conclusion would be misleading. It was not inevitable that Coalition forces would break Iraqi air defenses at such low cost or with such devastating ease. Given the often vast gap between "real war" and "war on paper," the American military did perform in a highly competent fashion. Admittedly, there were weaknesses and areas that deserve attention. But Coalition forces consistently placed their strengths against Iraqi weakness.

Moreover, any serious analysis of the results in the Gulf during Desert Storm must recognize the imponderables. It was not inevitable that Saddam Hussein would allow the Coalition time to gather, organize, and deploy its forces to the Gulf. It was not inevitable that the Iraqis would deploy so much of their ground forces in the desert areas of Kuwait and southeastern Iraq–a region that minimized their strengths and maximized their weaknesses. The Coalition did reap full advantage from the mistaken decisions and misapprehensions of Iraqi leaders before the war. Again, this was not inevitable.

Yet this study of the Gulf War also suggests that the air campaign operated, as have all previous campaigns, within the realm of friction and ambiguity. Historians may never be able to unravel some of the effects of the air campaign against Iraq and its forces–the impact of bombing on the morale of Iraq's soldiers is a particularly good example. Allied air commanders and planners, however, had to operate in their real world of

incomplete information and uncertainty; their decisions consequently reflected the situation as they saw it and external pressures–political as well as military–all worked on their judgements of the situation. It is in that light that one must assess the operational conduct of the air war against Iraq and its military forces.

(S) We might begin our conclusion by examining the larger question of what the air campaign achieved in the political realm. The saga of Saddam's success in maintaining his hold on power and his defiance of those who have brought his regime to its current state have suggested to many that the war against Iraq failed. After all, it did not remove the dictator from power. With two years of hindsight and Iraqi intransigence, it is thus easy to argue that Coalition failed to achieve its goals. But in the political conditions of the time, the maximum goals that the Coalition could pursue were the liberation of Kuwait, the destruction of Iraq's armed forces to the greatest extent possible, and the debilitation of Saddam's efforts to construct weapons of mass destruction. The pursuit of more ambitious goals than these might well have led to the collapse of the Coalition; it certainly would have resulted in serious troubles within the Arab world.[1] Within the political and international context of the 1990/1991 period, President Bush staked out a maximalist position for the Coalition in the confrontation with Iraq.

The best way to judge the Coalition's strategic and political achievements in the air campaign is to estimate what might have happened had the United States and its allies *not* embarked on war in January 1991. At this time there were substantial numbers in Congress and the media who argued that a continued embargo would resolve the crisis and force the Iraqis to disgorge Kuwait. The intransigent and often effective campaign that Saddam has waged *since* Iraq's military defeat to undermine, mitigate, or ignore the UN Security Council underlines what Iraq's behavior would have been had there been no air and ground campaign to

[1]As stated in Chapter 1 of this study, the Coalition's objectives as stated in the last operations plan before the onset of the war were: 1) destroy Iraq's military capability to wage war; 2) gain and maintain air superiority; 3) cut Iraqi supply lines to the KTO; 4) destroy Iraq's chemical, biological, and nuclear capabilities; 5) destroy the capabilities of the Republican Guard; and 6) liberate Kuwait City. (S) HQUSCENTCOM, Combined OPLAN for Offensive Operations to Eject Iraqi Forces from Kuwait, 17 Jan 1991, pp 2-4.

limit its options.[2] Under such circumstances it is unlikely that the Coalition could have held for a substantial period of time, or whether the United States, Great Britain, and France could have maintained those forces deployed before November 1990 for an indeterminate period. Moreover, an unwillingness to take on Iraq's military forces would have had a disastrous impact on political attitudes within the Arab world; the actions of the Palestinians and troubles in Morocco, Algeria, and Egypt during the crisis suggest that any perception in the Arab world that Saddam had successfully defied the west would have had a disastrous impact on moderate regimes in the Arab world. Finally, without the war Saddam might well have had nuclear weapons as early as 1995; one can scarcely imagine a more destabilizing factor in the Middle Eastern balance.

Beyond the air campaign, one must note that it was essential for the Coalition to conduct a ground campaign to lay out the impact of the air campaign on Iraqi ground forces. Through mid-February, Saddam retained the option of abandoning Kuwait and thereafter claiming that his ground forces had remained unbeaten in the field, too powerful and tough for soft Americans to attack.[3] But Saddam seems to have calculated that the Coalition would not attack on the ground, or he may have thought that his forces would be able to turn a Coalition offensive into a bloody meat grinder. In the end, his miscalculation was disastrous; the resulting allied success in the ground war and the concurrent collapse of Iraqi forces largely rested on the effects of the Coalition's air campaign.

If the Coalition achieved its strategic goals, how did the air campaign fit within this strategic and political framework? Here one might contrast the air war in the Gulf with the air campaign against North

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[2]One can also gain insight into Iraq's capacity to defy the United Nations and "world public opinion" by noting the effective campaign of defiance and ruthless military action that little Serbia has pursued against its neighbors. An Iraq emboldened by a refusal of the Coalition to take action is not a pretty picture to consider.

[3]This is of course what happened in World War I, when a German army, completely beaten on the Western Front, was allowed to retreat to the Fatherland rather than surrender in place. Within a matter of months, the German military and right-wing political leaders were claiming that the army had stood unbeaten in the field, only to be stabbed in the back by traitors, commies, and Jews. In the case of Iraq, it is worth noting that within a year after military defeat in Kuwait, Saddam was holding great celebrations and parades to honor the heroes in his armed forces on their "victorious"effort against the Coalition.

Vietnam from 1965 through 1968. In Vietnam, American airmen argued at the outset of Rolling Thunder that they should wage a campaign aimed at breaking the will of Ho Chi Minh's regime to continue the war in South Vietnam.[4] The strategic assumption on which such a campaign rested was that the North Vietnamese regime represented a relatively easy political target for air power–properly employed of course–to force the North Vietnamese to the peace table. Moreover, airmen did not estimate the enemy's operational and tactical capabilities to defend himself at a high level.[5] In both respects, events proved their calculations over-optimistic, but the dramatic air campaign recommended by the airmen was not permitted by the politicians.

In the conflict against Iraq, Coalition air commanders and planners did *not* underestimate enemy operational capabilities. If anything they overestimated those capabilities.[6] But on the strategic and political levels, Coalition air plans did underestimate the political stability of the Ba'thist regime, as their predecessors had done with the North Vietnamese. The calculations on which Instant Thunder rested were indeed dangerously optimistic. Six days of strategic bombardment in anything other than a nuclear context–which of course was completely unthinkable–had little chance of persuading Iraq to do the Coalition's bidding. The political strength of Saddam's regime was such that only a campaign aimed at breaking Iraq and probably involving tens of thousands of casualties

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[4]Department of Defense, *United States–Vietnam Relations, 1945–1965* (Washington, 1971), Book 4, Part IV.C.3, pp 71-72. Even after the war was over, airmen continued to argue that "dramatic, forceful, and *consistent* application of air power" would have achieved US political objectives. Adm U.S.G. Sharp, *Strategy for Defeat, Vietnam in Retrospect* (Novato, CA, 1978), p 268.

[5]For the best study thus far on the nature of the air war against North Vietnam and the weaknesses within which airmen cast their approach see: Mark Clodfelter, *The Limits of Air Power*.

[6]As we have argued in Chapters 2 and 3, the US planners recognized substantial weaknesses within the Iraqi military organizations. Nevertheless, Horner, Glosson, and the planners in the Black Hole did expect some substantial losses, especially in the opening days of the air offensive; moreover, the meticulous planning that went into the opening moves of the war indicate a healthy respect for the enemy's defenses. In the end, the airmen may have overestimated the enemy's capabilities, but that overestimation and the careful planning that resulted from that overestimation only magnified the success. Only if overestimation had led to a Coalition refusal to undertake military action would such an assessment have resulted in serious consequences.

could have toppled the dictator. Such an approach was also clearly unthinkable within the context of American politics.

Basic to the U.S. approach was a belief that the weak link in Iraq's armor was its political stability: a major setback would lead to a collapse of the regime either through political action or military coup.[7] As suggested in Chapter Two, such an assessment had the situation in Iraq reversed. In fact, it was the military who were the weak link, while the political regime displayed an impressive capacity to absorb punishment and retain its hold on power.[8] In the end, this miscalculation did not interfere with the Coalition's successful prosecution of the war or the achievement of political goals, as they existed in January, 1991. But airmen would do well to remember that even direct attacks on centers of enemy military power from the Second World War to the present have had little effect on the *political* stability of regimes under attack. In this sense, despite the introduction of new weapons possessing vast technological capabilities, the results were similar to those obtained in the strategic bombing campaign against Germany: whatever impact bombing might have had on popular morale, neither campaign resulted in the overthrow of the tyrant.

On the operational side of the air campaign, there are a number of significant points. To begin with, the success of the opening two days of the air campaign represent the operational high point of the conflict. Air attacks fully achieved their immediate objectives in deconstructing the Iraqi air defense system and laying open Iraq and its military forces to a

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[7]It is worth noting that a belief in the political vulnerability of regimes to the political impact that strategic bombing would have on the will of the people to continue a conflict has been an article of faith among airmen since the first prophets of air power began writing. It was central to the arguments of Trenchard and Douhet and implicit in the writings of Mitchell and the teachings at the Air Corps Tactical School in the 1930s.

[8]The misassessment flowed as much from the peculiar political misconceptions and misunderstandings of Americans in general as from the errors that US military or intelligence organizations made during the crisis. The latter of course reflect the cultural attitudes and misperceptions of American society, and Americans, at least in the 20th Century have had a difficult time in recognizing or understanding the importance of ideology to other peoples or cultures in the world. The attention of the reader is once again drawn to Samir Al-Khalil's *Republic of Fear, The Politics of Modern Iraq* (Berkeley, CA, 1989) as a book that should have disabused most military planners and commanders of the notion that military pressure, no matter how successfully applied, would quickly lead to Saddam's replacement by a more acceptable leadership in Baghdad.

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sustained air campaign. Moreover, these strikes obtained their objectives at an astonishingly low cost in aircraft and aircrews lost.

Indeed this is the first case in military history in which commanders and planners were able to use air power directly, as an operational tool to achieve immediate results. In February 1944, during World War II, Eighth Air Force had attacked the Luftwaffe's production facilities to prevent German industry from producing the single-engine fighters that were the backbone of its air force. "Big Week" did in fact damage the German aircraft industry, but it could not stop aircraft production; ironically over the course of 1944 enemy fighter production increased dramatically.[9]

Nor did air battles at the end of February 1944 break the Luftwaffe as a fighting force. Instead a great three-month battle of attrition occurred that finally destroyed the effectiveness of the Luftwaffe's fighter pilot force. The results of the focused attempts to destroy the Luftwaffe by destroying its production base were thus indirect. Similarly, attacks on German oil production which began in May 1944 were also indirect in their impact on the *Wehrmacht*'s ability to continue to prosecute the war. Whatever the aims, the achievements of strategic bombing in World War II remained indirect in their impact on the course of the conflict.

In the case of the war against Iraq, however, the air planners sought to attack the center of Iraq's military power in order to break up the capacity of its air defense system to mount effective resistance. By a skillful use of deception, drones, ECM capabilities, F-117s and Tomahawk missiles, preemptive fighter sweeps, and a carefully crafted plan that launched a massive SEAD package disguised to look like the great air attack on downtown Baghdad, the planners succeeded in sowing doubt, confusion, and disruption–rather than destruction–throughout the whole of the enemy's system.

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[9]However, it is worth noting that while German fighter production increased 55% over the course of 1944, the weight of airframes produced by German industry only increased 22% in comparison to the previous years production. The Germans were able to get such an increase only by halting the production of every other type of aircraft, including bombers. Moreover, the quality of the fighters that German industry produced in 1944 also showed a significant decrease. See Williamson Murray, "Reconsidering the Combined Bomber Offensive," *Militärgeschichtliche Mitteilungen*, Heft 1, 1992.

Moreover, unlike the envelopment of Iraq's army that took place at the end of February, Coalition air attacks against the Iraqi air defense system–and other targets–occurred in the teeth of enemy defenses as yet undamaged and fully expecting an allied air attack. The fact that F-117s flew into the heart of enemy defenses without any support at the onset of the war suggests the extraordinary capabilities that Coalition air forces brought to the job. But it was *how* planners and commanders utilized those capabilities that represented the significant innovation of the Gulf War.

Given the disparity between contending forces in the Gulf, it is impossible to see how Coalition armed forces could have lost the war–except perhaps in the political sense. Yet there were other approaches to air war that would have carried with them less effective uses of resources as well as the possibility of considerably higher losses. In the mid-1980s there had been opposition from the Navy and Marines even to the concept of a joint forces air component commander (JFACC). It was certainly not incumbent on Schwarzkopf that he appoint Horner as the JFACC with the powers to control and coordinate.[10]

Without a JFACC, Schwarzkopf would have had to assign the different air forces separate areas in which to operate: the Navy would most probably have gotten much of western Iraq and a slice of eastern Iraq where Iraq's naval forces lay. The air force, probably supported by the Coalition air forces, would have gotten the central section, especially the area around Baghdad.

Such an air campaign would not have had a coherent focus. Given the problems that occurred in providing battle damage assessment to a centralized command structure in the war, it is difficult to see how Coalition commanders in a route package system could have gained any clear idea of what levels of damage their attacks had achieved. Much like the air campaign in the KTO, such an air war against Iraq–one could hardly have spoken of a campaign–would have degenerated into racking up sorties, generally attacking targets rather than target sets, and pursuing a number of uncoordinated aims.

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[10]Schwarzkopf was probably driven to assigning Horner so much power to conduct the air campaign, because it was the only obvious way that they could control the air resources available.

A route package war would also have carried with it the danger that the operational coordination between Coalition air forces would have run into substantially greater problems. Certainly, coordinating tankers and SEAD packages would have been more difficult, and such difficulties would have resulted in the cancellation of sorties beyond those lost for coordination breakdowns.[11]

Moreover, such an operational approach would have created fault lines between these separate air wars. Even within the JFACC system, there were problems between conflicting jurisdictions. On 25 January the Iraqis were able to get two Mirages out into the Gulf within range of Coalition ships, largely because their flight path followed a gray area between Coalition air defense areas of responsibility. Since the USS *Roosevelt* had just arrived, it was not familiar with the procedures in the theater; its F-14s on Combat Air Patrol (CAP) over the Gulf thus did not have the frequencies on which AWACS was operating–nor for that matter did the USS *Worden* that was controlling the CAP station. Consequently, the Navy did not pick up AWACS warnings. A Saudi F-15 who was monitoring the calls from AWACS eventually splashed the Iraqis.[12]

The point here is not to find fault with the Navy, but rather to underline that even within the JFACC system, coordination problems could occur. Within the context of an air war where there were competing commands with little coordination, the potential for such incidents would have been greater. Whether the Iraqis would have utilized such opportunities is open to question. But the possibility would have been there, and any Iraqi successes would have had considerable political and strategic consequences.[13]

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[11]This certainly occurred in the week after the first two days and reflected the considerable problems of coordination even when there was a central directing authority and process.

[12](S/NF) Charles E. Chambers, et al, *Desert Storm Reconstruction Report, Vol III: Antiair Warfare*, Center for Naval Analyses, 1991.

[13]The crucial point here is not whether the Iraqis might or might not have taken advantage of such a situation. A route package approach to attacking Iraq would have inevitably led to a roll back campaign against the enemy air force; the Iraqis in turn would have possessed air options that were not open to them as a result of the focused campaign that began on 17 January. And with such options available to attack the Coalition forces the Iraqi could have launched their aircraft against an air defense system with competing authorities, unclear jurisdictions, and gray areas between areas of respon-

Whatever the possibilities that a splintered air war would have offered the Iraqis, there would certainly have been increased chances of blue-on-blue engagements resulting in aircraft losses. The fact that there were no such losses is indeed high tribute to the professionalism of the aircrews flying in the Gulf. It is also a tribute to the organizational framework and operational control within which this campaign functioned. But an operational framework that depended on a number of independent air authorities would have invited trouble. It certainly would have added to the inherent frictions involved in the complex tactical and operational environment of the Coalition's air campaign.

In the end, any reasonable examination of the issue suggests that there were no alternatives to the air campaign that would have much improved its conduct; and most alternatives, in all likelihood, would have been less effective.[14] Admittedly, the air tasking order (ATO) process was cumbersome and awkward in planning and processing the thousands of sorties that made up each day's effort against Iraq. Nevertheless, it achieved considerable success and made possible an operational employment of air power. Undoubtedly, the Air Force and the Navy will improve the *process* of putting together an effective ATO.

But improvements in the process only beg larger issues raised by the conflict. Shortly after the war was over, a senior naval officer wrote a perceptive critique of naval operations in the Gulf; his criticisms of certain areas of Navy preparation for the war are worth quoting in detail, not because of what they say about Navy leadership, but because they apply equally to the senior leadership of the Air Force–and the other services as well:

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sibility.

[14]As one Navy commentator on the war noted: "During my trip [to the Persian Gulf], several senior officers expressed reservations about the Navy's involvement in an air campaign directed by a Joint Force Air Component Commander (JFACC), a function performed in Desert Storm by the Air Force Component Commander. They were concerned that independent naval operations were threatened by that participation because the carriers' missions were tasked by the JFACC using the . . . ATO system. But the Navy has no alternative to the ATO system. Without it, the campaign would have been planned and directed manually. Sortie rates would have been far lower and strike deconfliction much less certain." Letter from Captain Steven U. Ramsdell to Director, Naval Historical Center, Subject: Trip Report, 14 May 1991.

> Lacking any system to plan and direct air campaigns, the Navy has no policy or official view of them. . . .[The Navy's alternative to the fashion in which the air campaign was conducted–by route packs] is the epitome of operations designed to facilitate tactics, not to achieve strategic [or operational] objectives. . . .The source of the trouble is that the concept of conducting campaigns and the process of implementing an approach to war in which tactical decisions are driven primarily by strategic objectives have not been within the field of view of our leaders in the fleet. . . .In my opinion, the Navy paid a significant price during Desert Storm in the areas of campaigning and jointness for its neglect of the non-technical education of its senior officers. . . .The real barrier that must be broken is the pervasive belief that war fighting is mostly a matter of technology and logistics and that, consequently, there is little to be gained from time spent studying other subjects. In fact, the most decisive factors in war above the tactical level are intellectual, not technical or material.[15]

No more than the Navy did the Air Force prepare its leaders to wage an air *campaign* that aimed at achieving operational-level objectives. Throughout the 1980s, the Air Force had set about to remove the *tactical* weaknesses that had shown up during the course of Vietnam. It succeeded admirably in that effort. But it did not aim at creating an officer corps that understood the wider application of air power or which could address the substantial problems raised by the use of air power on the operational level of war.

How then to explain CENTAF's success in developing a focused, operational-level air campaign?[16] Much of the credit rests on idiosyncratic factors that placed individuals in control of CENTAF and within its planning process who either intuitively understood or who were willing to be educated in the possibilities that such an operational-level air campaign could offer.[17]

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[15] *Ibid.*

[16] Cynically one might suggest that 1) the disparity of power between Iraq's air power and that of the Coalition was so great that the result was completely inevitable and 2) with five months to prepare to launch the knock out blow it would have been almost impossible to design a faulty plan. Such explanations, however, largely beg any close look at how the air campaign was planned and was executed.

[17] It is worth noting for those who believe that chance plays little role in war that the two greatest commentators on this aspect of human nature, Thucydides and Clausewitz place chance at the heart of any understanding of war. According to Clausewitz: "If we

That is not, however, to suggest that planning and execution occurred flawlessly or that there were not substantial problems. The first two days' success suggests the strengths of the plan and its execution. By providing the Iraqis with what appeared to coincide with their expectations, Coalition air power deconstructed the enemy's defensive *system* and prevented any coherent defense of Iraqi air space during the entire war.

In effect, Coalition attacks over the course of the first two days maximized frictions within enemy forces. Air attacks destroyed, damaged, or impaired many targets crucial to the effective running of his air defenses. But the crucial element both in the planning and in the results was not the number of targets destroyed or damaged; rather it lay in the overall effectiveness of what those attacks achieved. The KARI computer system no longer functioned as an integrated air defense system. We cannot identify the exact point at which this event occurred--nor quite probably could the Iraqis who survived the collapse of the system. But sometime during the first six hours the system died.[15]

Admittedly, pieces of the system did put up fitful resistance. But those pieces functioned in fitful fashion. This was particularly the case with portions of the Baghdad defenses, as the fate of Package Q demonstrated on the afternoon of the third day. The initial wave of attacks on the first night only damaged sector and intercept operations centers (SOCs and IOCs); many SAM sites remained untouched. But the psychological impact of the first two days' attacks suppressed the effectiveness of what had survived. Enemy communication systems no longer functioned effectively; radar operators were unwilling to turn their radars on for sustained periods of time; SAM sites fired their missiles ballistically. And the continuing pressure of Coalition SEAD aircraft thoroughly intimidated

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now consider briefly the *subjective nature* of war--the means by which war has to be fought--it will look more than ever like a gamble. . . .In short, absolute, so-called mathematical factors never find a firm basis in military calculations. From the very start, there is an interplay of possibilities, probabilities, good luck and bad that weaves its way through the length and breadth of the tapestry. In the whole range of human activities, war most closely resembles the game of cards." Clausewitz, *On War*, pp 85-86. In this case chance determined that the commanders and planners at the highest levels of the air campaign would be more than adequate.

[15]Various pieces of evidence that were available to OWAPS--enemy radar emissions, communications between parts of the defensive system, as well as the responses that the Iraqis were able to make to the attacks--suggest to those involved in the Operations and the Effectiveness reports that the system ceased to function during that period of time.

the defenders. A SAM site whose commander was afraid to turn on his system was as good as destroyed, at least for the purpose of attacking Coalition aircraft.

In effect, Coalition air attacks significantly increased the enemy's level of friction both relatively and absolutely. Consequently, the Iraqis confronted not only the normal frictions that occur during war, but a host of additional frictions that air attacks had imposed on their systems and combat organizations. In no fashion, especially in view of the political framework within which they operated, could the Iraqis deal with such a state of affairs. One suspects that Saddam never fully came to grips with how extensive was the damage that Coalition air attacks had achieved in their attacks on the air defense system and then on the whole military structure.

If planning and conduct of the air war in the first two days underlines the possibilities open to a coherent, operational focus, then the remainder of the war suggests some of the limitations as well as the difficulties involved in such an endeavor. The enemy, no matter how badly damaged, was able to impose frictions on the Coalition's campaign. The Scud campaign was a sure indication that no matter how well things might go, the enemy may possess unpleasant operational capabilities of his own.[19] In this case, a considerable portion of the Coalition's precision-bombing platforms pursued the will-o'-wisp of mobile Scud launchers with little evidence to suggest success.

One of the Coalition's planning assumptions had been that once air attacks had wrecked the KARI system, CENTAF could send large formations of F-16s downtown to accomplish two objectives. The first was that, even considering the inaccuracy of the F-16 bomb platform–using conventional unguided munitions from medium altitudes–such attacks could destroy large industrial targets in and around Baghdad. This would allow precision F-117s to concentrate on targets that demanded greater accuracy. Similarly, they also believed that large packages of F-16s flying downtown on a regular basis would have a significant effect on Iraqi morale. While the F-117s flew only at night, F-16s could bolster

[19]And it is well to remember the extraordinary inaccuracy of the missiles. Had the Iraqi Scuds had even slightly greater accuracy, their military and political impact would clearly have increased enormously.

and prolong the daylight attack begun by the Navy's Tomahawk cruise missiles.

Unfortunately, Package Q underlined that such assumptions were dangerously flawed. Enemy air defenses in the Baghdad area *were* able to significantly threaten such attacks.[20] Then too, if one placed F-16s over densely populated areas and exposed them to the threat of SAMs, one risked the possibility that the fighter bombers, to evade SAMs, might jettison their bombs. The risk of the resulting civilian casualties was one that Coalition air commanders did not want to take. What is significant here, however, is not that Coalition commanders and planners held faulty assumptions; the crucial point is that they readily adapted to the situation as it actually was: F-16s were no longer tasked to go to downtown Baghdad.

At this point in the war, the mere presence of the Iraqi Air Force, lamed, blind, and inert in its hardened aircraft shelters represented a sufficiently powerful threat to refocus Coalition air attacks on the shelter busting effort. Whatever the success of that campaign in destroying hardened shelters, the number of precision weapons expended would undoubtedly have done much damage to other target sets in the strategic campaign. Considering the poor showing that the Iraqi Air Force had made in both the Iran-Iraq War and in the Gulf War, one can question whether it represented much of a threat to anyone in the Middle East. But perhaps the political value of an air fleet "in being" was such that air leaders felt constrained to eliminate the enemy's force before moving on to other targets. Here the dark memory of the Tet offensive during the Vietnam War raised fears in the minds of U.S. commanders that the Iraqis might launch a sudden, massive, and suicidal air attack that could turn the war against the Coalition–at least in a psychological sense.

As the Iraqi shelters disappeared in clouds of smoke and debris, Schwarzkopf and the looming ground campaign forced the shifting of F-111Fs to a campaign against Iraqi ground forces in the KTO. There was, in fact, no other choice, given the poor performance of nonprecision munition platforms against targets in the KTO. Since political necessity

[20]Although in fairness, one should note that larger SEAD support packages would probably have been able to suppress the threat of enemy SAMs. The next day, for example, a package of F-16s would reach within the environs of the Baghdad air defense system and not suffer any losses.

dictated an absolute requirement for a ground war, Coalition air power had to achieve significant reductions on the enemy ground forces before the ground war could begin. This again had an effect on the forces available to attack strategic targets with precision weapons.

But there were options beyond limiting the strategic campaign to only F-117s at this point in the war. One of the few oversights in the conduct of the air campaign was the failure to provide lasing capability to F-111Es operating from Incirlik. Only at the end of the war did F-4s from Clark Air Base arrive, but their designator pods did not reach the theater until after the war. Such a capability in Turkey would have accelerated destruction of strategic target sets.

Still the Black Hole retained considerable assets in the F-117s. Even here, friction interfered with hopes of decapitating the Iraqi leadership by sustained attacks on headquarters and command and control centers within Baghdad. The night of 12/13 February was the first of a number of nights in which planners hoped that air attacks would accomplish this objective. The Al Firdos incident, however, ended this effort before it had barely begun.

An examination of air attacks against central Baghdad suggests the parameters within which strategic attacks on the enemy's heart occurred. Over the first twenty-four hours F-117s dropped only fourteen bombs against nine targets in downtown Baghdad; thirty-nine cruise missiles were launched against six other targets.[21] Over the course of the next twenty-four hours, F-117s managed to drop only one bomb there, while the Navy launched eighteen Tomahawks against three targets. The major F-117 attack of the war against Baghdad occurred over the night of 12/13 February; F-117s struck fifteen targets with thirty-four bombs.[22] As a result of Al Firdos, there were no bombs dropped on the capital for a week.

Then with the end of the war rapidly approaching, F-117s were to strike a few carefully selected targets in central Baghdad. While the F-117s dropped eighty-five bombs on Baghdad over the last week, they attacked only five targets, and one of those targets was Muthena airfield,

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[21]GWAPS Database.

[22]*Ibid.*

which drew nearly one third of their effort.[23] One senses that attacks on Muthena (and Rasheed airfield in the city's outskirts) represented an effort to keep the psychological pressure on the capital and Iraqi leadership. But the record suggests that there was no sustained attack on Baghdad as an operational focus of the campaign. There was an effort made throughout much of the war to lead the capital's population to believe that they were under siege. Nevertheless, as a coherent focus for the air effort, Baghdad faded in and out of the Coalition campaign. One must recognize that a more sustained effort against the headquarters structure of the regime might well have resulted in an Al-Firdos-like incident earlier in the war.

The Effectiveness report will examine in greater detail the effects and effectiveness of Coalition air power against various targets sets, including the nuclear, chemical, and biological programs of the Iraqi regime. What assessments in that report emphasize is the fundamental uncertainties that underlay much of the conduct of the air campaign against such special targets. To begin with, intelligence was generally unclear as to the extent of Iraqi programs in these areas. Furthermore, the operators failed to query their intelligence about likely enemy counter-measures and reactions to affect or ameliorate Coalition air power. Granted, even the best intelligence in the real world would have confronted difficulties in answering what the Iraqis had done, were doing, and might do in dispersing programs in such a fashion as to make them largely invulnerable to Coalition air attacks. But the fact remains that neither intelligence nor operators made much of an effort to address, much less resolve, such questions.

Once the air campaign began, problems arose in achieving satisfactory feedback from intelligence to those who were responsible for planning the conduct of operations. It is not the responsibility of this report to assign blame; neither operations nor intelligence appears in a particularly favorable light. That problems should arise in this area is not surprising, especially considering the divorce between operations and

[23] *Ibid.*

intelligence that has occurred–and not just in the Air Force but in the other Services as well.[24]

The air campaign against the KTO stands in stark contrast to the strategic campaign against the Iraqi heartland. Whatever difficulties and frictions arose in the conduct of the latter, there was a recognizable effort to conceptualize the operational-level employment of air power against the enemy. Throughout this report, we have catalogued efforts to focus air power to achieve larger effects in the attacks on Iraq beyond a mere racking up of targets hits. Whatever the difficulties of waging such a campaign, and they were considerable, there was an *overarching* conception.

None of the documents dealing with the air war against the KTO, however, suggest such an effort to conceptualize an operational-level air campaign against Iraqi ground forces. The planners in the Black Hole responsible for the KTO simply threw air power up against an enemy sheltered in well-dug-in positions. Every day large numbers of aircraft flew into kill boxes where the Iraqi Army had hunkered down; some dropped precision-guided munitions; others spread their loads of bombs and cluster bomb units over the landscape, in hope that if they did not hit anything then at least they would damage Iraqi morale. Whatever focus the campaign against Iraqi ground forces possessed only existed in numerical indices of aircraft committed to particular kill boxes.

In effect, the air campaign in the KTO represented a massive hammer that aimed to bludgeon enemy ground forces and combat potential into dust. In the end, the campaign was relatively successful, but only because the time and air assets that were available to attack those enemy forces were almost limitless and because Coalition commanders had so much surplus air power available to pursue their goals.

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[24]Here it is worth noting the one intelligence organization that functioned in an exemplary fashion throughout the period leading up to the war and during the course of the war as well: namely the Navy's SPEAR. The reason for the success of that organization appears to have been the Navy's willingness to fashion SPEAR in such a fashion that both operators and intelligence officers worked together to impart the wisdom of their separate worlds to each other. Moreover, SPEAR had a clearly understood mission to serve the tactical and operational employment of naval and naval air power in combat situations.

Moreover, there was a substantial disconnect between the assumptions of those who planned and estimated the effects of an air campaign against Iraqi ground forces, and the units who actually executed the plans. In particular, Checkmate's estimates had calculated the effectiveness of a campaign against Iraqi ground forces on the basis that F-16s would use Mavericks against enemy equipment. But the F-16 community had not prepared itself in peacetime to employ that anti-tank missile and so it could not utilize that weapon in the ground war.

In the end, these difficulties with conceptualization and employment of air power in the KTO did *not* matter. The sheer magnitude of the air campaign against the Iraqi ground forces in the KTO achieved reasonable levels of destruction against the enemy's equipment in the theater. Also the shift of the F-111Fs to "plinking" tanks finally began to deliver on the promise that air power could substantially attrit the enemy's equipment. Even more to the point was the effectiveness of the attacks in damaging the morale of the Iraqi soldier.[25] By the end of the campaign against the Iraqi ground forces in the KTO, air power had achieved much the same effect that it had achieved against Iraq's air defenses; it had broken the enemy force into its component parts and those parts could no longer put up a coherent or effective resistance.

All the squabbling about numbers of tanks and artillery pieces destroyed that occurred during the war, and which even two years later remain as a bones of contention, however, miss the point. It was not the numbers of tanks or artillery pieces destroyed, or the number of Iraqi soldiers killed that mattered. It was the effectiveness of the air campaign in breaking apart the organizational structure and cohesion of enemy military forces and in reaching the *mind* of the Iraqi soldier that counted.

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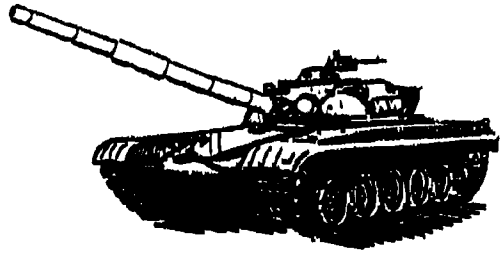
[25]There is some irony in a comparison of the casualties caused by air attacks against Baghdad and those caused in the KTO. In the case of the former, those who were killed and wounded in the Al Firdos bunker were the family members of the elite of the Ba'thist regime (the regime did not make shelters for the general population of Baghdad–only for those with connections to the powerful); the casualties at the bunker were intimately tied to the elite who had imposed such misery not only on their own population, but those of Iran and Kuwait as well. On the other hand, most of the soldiers that Iraq deployed to Kuwait, certainly in the regular army were conscripts who had not wanted the war, had little desire to fight, and for the most part despised the regime. The sympathy that the Al Firdos victims received does stand in some ironic contrast to the lack of sympathy that the Iraqi soldier received.

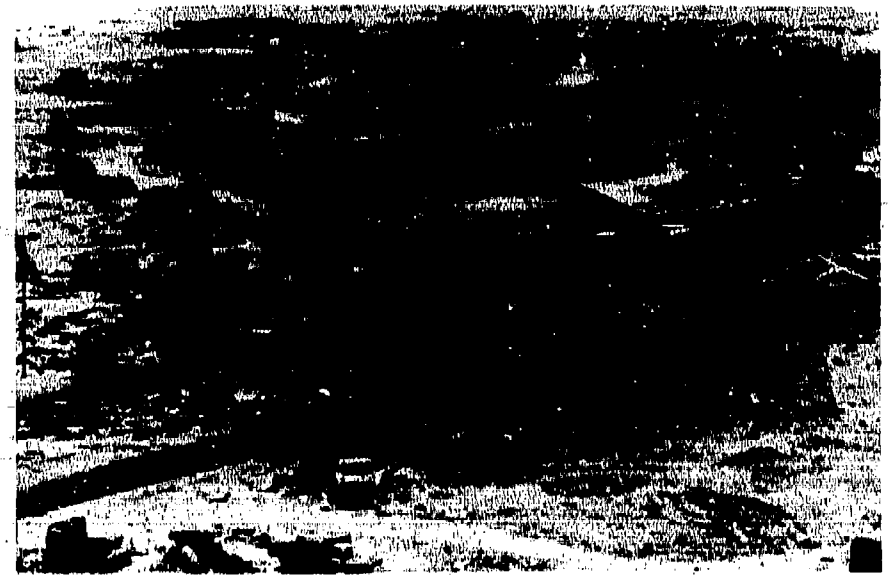
There is a larger issue here: to believe that levels of destruction of certain items of equipment guarantees success misses the nature of military organizations. Military forces reflect their human creators. The death of such an organization occurs in a biological fashion. For example, in a heart attack, death occurs not at some precisely calculable point when 30 or 40 or 50 percent of the heart muscles, heart nerves, or heart valves lose their ability to function, but rather at some inexplicable threshold when the degrading synergies between the damage to different, interrelated systems cause the general and complete collapse of the whole. For military organizations, the French author Antoine de Saint Exupèry caught this phenomenon best in his book on the 1940 campaign in France:

> In every region through which [the German *Panzers*] have made their lightening sweep, a French army, even though it seems to be virtually intact, has ceased to be an army. It has been transformed into clotted segments. It has, so to say, coagulated. The armored divisions play the part of a chemical agent precipitating a colloidal solution. Where once an organism existed they leave a mere sum of organs whose unity has been destroyed. Between the clots--however combative the clots may have remained--the enemy moves at will. An army, if it is to be effective, must be something other than a numerical sum of its soldiers.[26]

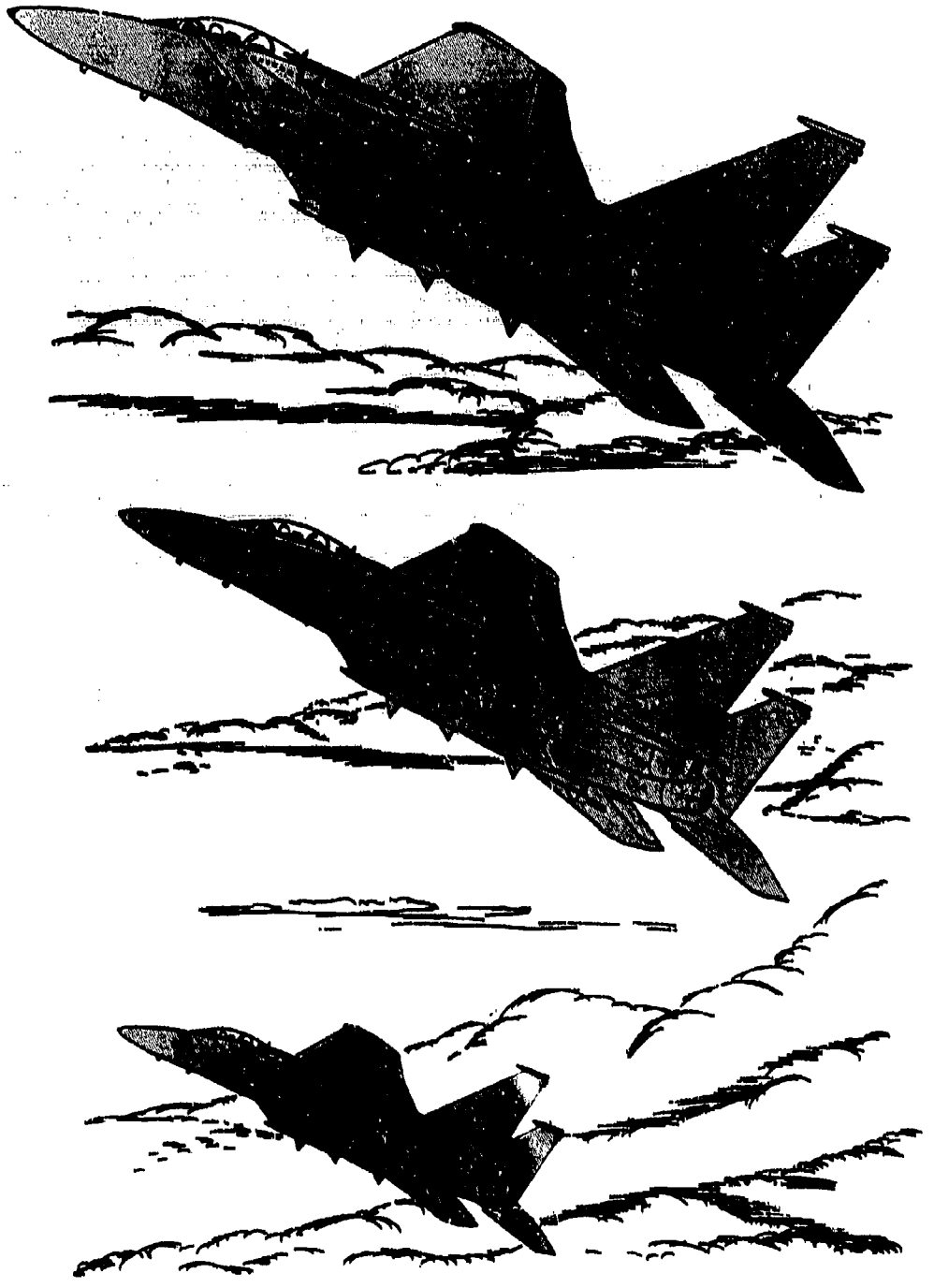
De Saint Exupèry's description of the death of French armies in 1940, though written over a half century ago, applies even more vividly to the death of Iraq's air defense system as well as the death of the Iraqi Army in the KTO.



[26]Antoine de Saint Exupèry, *Flight to Arras*, translated by Lewis Galantière (New York, 1942), p 56.



Iraqi military vehicles destroyed by Allied air-force on the highway near Al Mutlaa, deemed the "Highway of Death."
UN Photo 158276/J. Isaac



Appendix 1

Disposition of Aircraft

Airfield	Aircraft	1-Sep-90	1-Oct-90	1-Nov-90	1-Dec-90	1-Jan-91	1-Feb-91
USAF							
Abu Dhabi	KC-135	-	-	-	-	-	10
Al Ain	C-130	15	31	32	32	32	40
Al Dhafra	F-16C	46	48	48	48	72	72
	KC-135R	5	7	7	7	7	7
	RF-4C	6	6	6	6	0	18
Al Kharj	C-130	-	-	-	-	8	16
	F-15C	-	-	-	-	24	24
	F-15E	-	-	-	-	48	48
	F-16A	-	-	-	-	22	24
	F/A-16A	-	-	-	-	-	18
Al Minhad	F-16C	36	48	48	48	48	74
Bateen	C-130	16	16	16	16	16	16
	C-29	-	-	1	1	-	-
	EC-130(CC)	5	-	5	5	5	6
	EC-130H	2	5	5	5	5	8
Cairo West	KC-135E	-	-	-	-	15	15
	KC-135R	-	2	3	3	3	-
Dhahran	F-15C	48	48	48	48	48	48
Diego Garcia	B-52G	20	20	20	20	20	19
	KC-10	-	2	2	2	2	7
	KC-135R	8	6	7	5	5	5
Doha	F-16C	24	24	24	24	24	25
Dubai	KC-135	-	-	-	-	-	10
Jeddah	KC-10	-	2	2	2	2	13
	KC-135	-	-	-	-	-	66
	KC-135A/Q	-	-	-	-	20	-
	KC-135E	18	18	20	20	25	-
	KC-135R	10	20	20	20	20	-
King Fahd	A-10	72	96	96	96	114	131
	AC-130	-	5	5	4	4	3
	C-130	-	-	-	-	-	16
	C-130	-	-	-	-	-	3
	EC-130(VS)	2	2	2	2	2	2
	HC-130	4	4	4	4	4	4
	MC-130	4	4	4	4	4	4
	MH-53	4	8	8	8	-	-
	MH-60	-	8	8	8	8	-
	OA-10	-	-	-	-	6	12
King Khalid	KC-135L	-	-	-	-	-	2
	KC-135	-	-	-	-	-	46
	KC-135A	-	-	5	27	20	-
	KC-135Q	-	-	3	8	7	-
	KC-135A/Q			20	40	20	-
	KC-135R	20	20	20	5	25	-

Disposition of Aircraft (cont'd)

Airfield	Aircraft	1-Sep-90	1-Oct-90	1-Nov-90	1-Dec-90	1-Jan-91	1-Feb-91
Masirah	C-130	16	16	16	16	16	16
	F-15C	-	-	4	5	-	-
	KC-135R	-	-	2	2	10	10
Moron	B-52	-	-	-	-	-	10
Riyadh	C-20	1	1	1	1	1	-
	C-21	4	8	8	8	8	8
	E-3	6	6	6	6	7	11
	E-8	-	-	-	-	-	2
	EC-130E	3	-	6	6	4	7
	KC-135Q	10	10	10	10	10	10
	RC-135	4	4	4	4	4	7
Seeb	KC-10	-	2	2	2	2	10
	KC-135R	10	10	8	10	10	15
Shaikhisa	F-4G	24	36	36	36	48	49
	RF-4C	-	-	-	-	6	18
Sharjah	C-130	3	16	16	16	16	16
	EC-130E	6	6	-	-	-	-
Tabuk	F-15C	22	24	24	24	24	24
Taif	EF-111	10	14	14	14	18	18
	F-111F	18	32	32	32	64	64
Thumrait	C-130	16	16	16	16	16	24
	F-15E	24	24	24	24	26	48
Proven Force							
Hellenikon	RC-135	-	-	-	-	-	2
	KC-135	-	-	-	-	-	7
Incirlik	E-3A	-	-	-	-	-	3
	EC-130	-	-	-	-	-	3
	EF-111A	-	-	-	-	-	6
	F-111E	-	22	22	22	22	26
	F-15C	-	-	-	-	24	29
	F-16C	-	-	-	-	-	24
	F-16WW	-	-	-	-	-	12
	F-4G	-	-	-	-	-	13
	F-4E	-	-	-	-	-	4
	RF-4C	-	-	-	-	-	6
	C-130H	-	-	-	-	-	11
	C-130E	-	-	-	-	-	8
	EP-3	-	-	-	-	-	2
	KC-135A	-	-	-	-	-	15
Malpensa	KC-10	-	-	-	-	-	7
Zaragoza	KC-10	-	-	-	-	-	7
	KC-135	-	-	-	-	-	1
Mont de Marsen	KC-135	-	-	-	-	-	9
Mildenhall	KC-135	-	-	-	-	-	9
Andravida	KC-135	-	-	-	-	-	1

Disposition of Aircraft (cont'd)

Airfield	Aircraft	1-Sep-90	1-Oct-90	1-Nov-90	1-Dec-90	1-Jan-91	1-Feb-91
Souda Bay	RC-135	-	-	-	-	-	2
	HC-130	-	-	-	-	-	4
	MC-130	-	-	-	-	-	3
	MH-53J	-	-	-	-	-	5
USN							
America	A-6E	-	-	-	-	-	12
	E-2C	-	-	-	-	-	5
	EA-6B	-	-	-	-	-	4
	F-14	-	-	-	-	-	20
	F/A-18	-	-	-	-	-	20
	KA-6D	-	-	-	-	-	4
	S-3B	-	-	-	-	-	8
	SH-3	-	-	-	-	-	6
Independence	A-6E	13	13	13	-	-	-
	C-2A	1	1	1	-	-	-
	E-2C	4	4	4	-	-	-
	EA-6B	4	4	4	-	-	-
	F-14	18	18	18	-	-	-
	F/A-18	18	18	18	-	-	-
	S-3B	7	7	7	-	-	-
	SH-3	6	6	6	-	-	-
Kennedy	A-7	-	24	24	24	24	24
	A-6E	-	13	13	13	13	13
	E-2C	-	4	4	4	4	4
	EA-6B	-	5	5	5	5	5
	F-14	-	20	20	20	20	20
	KA-6D	-	4	4	4	4	4
	S-3B	-	8	8	8	8	8
	SH-3	-	5	5	5	5	5
Midway	A-6E	-	-	-	-	-	14
	C-2A	-	-	-	-	-	1
	E-2C	-	-	-	-	-	4
	EA-6B	-	-	-	-	-	4
	F/A-18	-	-	-	-	-	30
	KA-6D	-	-	-	-	-	4
	SH-3	-	-	-	-	-	6
Ranger	A-6E	-	-	-	-	-	24
	C-2A	-	-	-	-	-	1
	E-2C	-	-	-	-	-	4
	EA-6B	-	-	-	-	-	4
	F-14	-	-	-	-	-	22
	S-3B	-	-	-	-	-	7
	SH-3	-	-	-	-	-	6

Disposition of Aircraft (cont'd)

Airfield	Aircraft	1-Sep-90	1-Oct-90	1-Nov-90	1-Dec-90	1-Jan-91	1-Feb-91
Roosevelt	A-6E	-	-	-	-	-	18
	C-2A	-	-	-	-	-	10
	EA-6B	-	-	-	-	-	5
	F-14	-	-	-	-	-	18
	F/A-18	-	-	-	-	-	20
	S-3B	-	-	-	-	-	4
	SH-3	-	-	-	-	-	6
Saratoga	A-6E	-	-	-	14	14	14
	E-2C	-	-	-	4	4	4
	EA-6B	-	-	-	4	4	4
	F-14	-	-	-	19	19	19
	F/A-18	-	-	-	18	18	18
	KA-6D	-	-	-	4	4	4
	S-3B	-	-	-	10	10	10
	SH-3	-	-	-	6	6	6
*USMC:							
King Abdul Aziz	AV-8B	40	40	40	40	60	59
	OV-10A/D	-	8	8	8	8	19
Sheik Isa	A-6E	9	10	10	10	20	20
	EA-6B	12	12	12	12	12	12
	F/A-18A/C	48	48	48	48	72	72
	F/A-18D	-	-	-	-	-	6
	KC-130	6	8	8	8	12	15
Al Jabail	AH-1T/W/J	34	39	40	28	28	39
	CH-46E	15	24	24	24	24	60
	CH-53D	12	20	20	20	20	29
	CH-53E	8	15	15	15	15	24
	UH-1N	18	18	18	18	18	30
Afloat	AH-1T/W/J	-	6	7	15	15	36
	AV-8B	-	20	20	20	21	25
	CH-46E	-	36	36	24	48	60
	CH-53E	-	20	20	14	18	24
	UH-1N	-	10	8	6	18	20
USA							
Unknown	AH-1S	4	48	82	84	112	141
	AH-64	46	108	144	146	189	245
	CH-47	-	49	84	84	99	127
	OH-58C	40	119	175	178	257	324
	OH-58D	21	43	56	59	79	97
	UH-1H	4	50	127	127	169	202
	UH-60	52	152	205	206	279	303

Source: "Desert Shield CSAF Briefings," GWAPS Folders #32-#35; USCINCCENT SITREPs; USCINCENTAF SITREPs; CMSgt J.E. Schroeder, USAF, "History of Joint Task Force Proven Force (U), 27 Dec-7 Jan 91, Vol I – Narrative," HQ USAFE/HO, Ramstein AB, Germany.

*HQMC Monthly Operations Summaries (S).

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Part II

Effects and Effectiveness

Part II

Effects and Effectiveness

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Report Acknowledgements

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Security Review

The Gulf War Air Power Survey reports were submitted to the Department of Defense for policy and security review. In accordance with this review, certain information has been removed from the original text. These areas have been annotated as [DELETED].

Introduction

Report Aim and Focus

This report will attempt to *survey*, as impartially and expertly as possible, the effects and effectiveness of Coalition air power during the Gulf War precipitated by Iraq's invasion of Kuwait in August 1990. More precisely, it will focus on what Coalition air power accomplished at the operational level and above relative to the military and political objectives for which the war was waged. Except for certain areas of unavoidable overlap, deployment coverage, strategic planning, and other preparations that preceded Operation Desert Storm (17 January-28 February 1991), the tactics and weapons employed during the forty-three days the campaign lasted, its day-by-day operational-strategic conduct, the logistical and other support required, and the overall or summary implications of the conflict will be found in other Gulf War Air Power Survey (GWAPS) reports.

Scope

For purposes of *surveying* operational-strategic effectiveness, the term "air power" has been interpreted to encompass a number of systems and functions not always, or immediately, associated with air forces in wartime. More specifically, air power has been taken to include not only the use of traditional fixed-wing fighters and bombers such as the F-15C and the B-52, but, in addition, the extended-range variants of the Soviet "Scud" ballistic missile fired by the Iraqis against Israel and Saudi Arabia; the Tomahawk land attack missile launched from U.S. naval combatants; the conventional air-launched cruise missile employed from B-52s; the unmanned drones used to deceive Iraqi air defenses; the U.S. Army Tactical Missile System (or ATACMS); the array of weather, communications, reconnaissance, and navigation satellites exploited by Coalition forces; and the attack helicopters belonging to the U.S. Army and Marine Corps. In general, ownership by non-air force Services, being ground- or sea-launched, or, in the case of Iraqi Scuds, operating largely outside the earth's atmosphere were not considered reasons for excluding weapons or delivery platforms from being considered part of air power. If they contributed materially to the air campaign, especially to its operational-strategic effectiveness, they were included.

The emphasis on the term *survey* in describing the aim of this report touches on a second issue of scope. The period in which GWAPS did its work was too short, and too close to the events themselves, to permit a definitive *history* of air power in the Gulf War. For example, efforts by International Atomic Energy Agency teams while this report was being prepared continued to add new information on the wartime effectiveness of Coalition air power in eliminating Iraq's nuclear-weapons program. Given the likelihood that such issues would continue unfolding even after GWAPS had completed its work, an initial *survey* of air power's effectiveness during Desert Storm seemed the most that could be reasonably attempted.

Distinguishing Operations and Strategy from Tactics

Another terminological issue that warrants clarification at the outset concerns our decision to focus on operational and strategic effectiveness. The initial problem that this decision posed was that of drawing a reasonably clear line between the tactical and operational levels of war.[1] Towards this end, we adopted a schema in which the conduct of modern war was divided into four hierarchical levels: political, strategic, operational, and tactical. During the 1980s, this four-level view of war had gained currency among scholars focused on military matters and within some portions of the U.S. military.[2] To avoid getting entangled in definitional disputes or related arguments, an illustrative list of examples from

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[1]During Desert Storm the 5 January 1984 version of *Air Force Manual 1-1: Basic Aerospace Doctrine of the United States Air Force* was still in effect, notwithstanding repeated efforts, dating back to 1985, to update this manual. As a result, *official* US Air Force doctrine during the war did not explicitly recognize the existence of an operational level of war between strategy and tactics. The operational level of war did not gain official doctrinal acceptance by the US Air Force until the release of the March 1992 version of *Air Force Manual 1-1*.

[2]This schema was used, for example, to structure the three-volume series on military effectiveness sponsored by Andrew W. Marshall, the Director of Net Assessment [see Allan R. Millett, Williamson Murray, and Kenneth H. Watman, "The Effectiveness of Military Organizations," *Military Effectiveness*, ed Allan R. Millett and Williamson Murray (Boston: Allen and Unwin, 1988), Vol I, *The First World War*, pp 1-27]. The Murray and Millett series covered World War I, the interwar period, and World War II. Essentially the same schema has been used in the US Army's basic doctrinal manual for some years (see *FM 100-5 Operations*, May 1986, pp 1 and 9-11).

the Gulf War was outlined in Table 1 to clarify how these terms would be understood within this report.[3]

It is possible, of course, to quarrel with the categorization of many, if not all, of the entries in Table 1. Aspects of the F-117 strike against the Al Firdos bunker in downtown Baghdad early in the morning of 13 February 1991,[4] for instance, are mentioned on all four levels, which indicates that a single air strike can, potentially, have political, strategic, operational, and tactical dimensions. Hence it is possible to argue, by stressing one aspect of given missions or decisions over others, that virtually any entry in the table should be shifted to some other level. However, to focus exclusively on these inevitable ambiguities in individual entries would be to miss the broader point of the table as a whole: namely, to summarize how the terms "political," "strategic," "operational," and "tactical" were generally interpreted and used in this report.

It should also be noted that military objects such as individual platforms, munitions, or targets do not appear by themselves as entries in the taxonomy outlined in Table 1. As U.S. airmen have rightly emphasized in recent years, a *strategic* bomber can be employed tactically, and a *tactical* fighter can be used strategically. An oft-cited case-in-point is Operation Rolling Thunder (1965-1968), during which B-52s were employed, for the most part, in South Vietnam and Laos in direct support of ground forces, whereas strategic bombing in the Hanoi-Haiphong "heartland" of North Vietnam was carried out by fighter-bombers like the F-4

[3]One alternative approach to distinguishing tactics from operations would be to show that these levels of combat demand different degrees of support and coordination, command perspectives, and mixes of employment "rules" (see George M. Hall, "Military Operations: Catchall, Catch-22," *Army*, Nov 1989, pp 16-20). This approach is not only more complex but may apply much better to land warfare than to air warfare.

[4]Unknown to Coalition air planners, the Al Firdos bunker was, according to the Iraqis, occupied by women and children when it was hit by two separate F-117s on the night of 12/13 February 1991. Television pictures of the aftermath were quickly broadcast around the world. A more detailed discussion of this tragedy can be found in the section of Chapter 6 devoted to the leadership and telecommunications/C[3] target categories.

Table 1
Levels of War

POLITICAL LEVEL: ***Decisions and actions that set war objectives and overall conflict parameters.***

- Iraqi judgment that the U.S. would not use force to oppose the annexation of Kuwait.
- George Bush's declaration that "This will not stand."
- Establishing the wartime goals of the U.S.-led coalition.
- TV coverage of the results of bombing the Al Firdos bunker.

STRATEGIC LEVEL: ***Decisions, actions, and efforts bearing directly on the achievement of war aims.***

- Determinations of what forces to deploy to Southwest Asia.
- Decision to begin offensive operations with a single, integrated air campaign.
- The Coalition's initiation of a ground campaign; Iraq's attempt to do so at Al-Khafji.
- Iraqi use of SCUDs against Tel Aviv and Riyadh.
- Iraqi marketing of Al Firdos, the "Baby Food Factory," etc. over CNN.

OPERATIONAL LEVEL: ***Decisions, actions, and efforts focused on the orchestration of campaigns and operations.***

- Designation of a single air component commander (the JFACC).
- The choice of "strategic" target categories for the air campaign.
- Identifying the Republican Guard as an Iraqi "center of gravity."
- Tanker allocations between services and platforms.
- Shifting the weight of the overall air effort from strategic targets in Iraq to the KTO.
- Decision to require CINC approval of all "downtown" Baghdad targets after Al Firdos.
- Iraqi decision to begin flying their most capable combat aircraft to sanctuary in Iran.
- Coalition decision to release bombs from medium altitudes to minimize air losses.

TACTICAL LEVEL: ***Decisions, actions, and efforts concerning HOW to plan or execute particular sorties, flights, missions, and mission packages.***

- Matching specific platforms with specific targets for given missions.
- Selection of DMPIs and munitions for specific targets (Al Firdos bunker, Taji SOC, etc.).
- Detailed planning and conduct of individual sorties, flights, and mission packages.
- Use of F-111Fs for "tank plinking," or of F-117s to suppress SA-3s for a B-52 strike.
- Airspace deconfliction, tanker track selection, AWACS employment, etc.
- Close control of Iraqi fighters by GCI; post-launch target/TOT changes by ABCCCs, etc.
- Iraqi use of barrage AAA and visual firing of SAMs; Coalition use of airborne decoys.

and F-105.[5] So individual platforms cannot be meaningfully categorized as "strategic," "operational," or "tactical" in themselves, and, if they cannot, then it is hard to see why individual munitions or targets should be so categorized.

Granted, it has long been common practice to label some targets *strategic* and others *tactical*. In the case of Desert Storm, electric power plants, transportation, and the Iraqi air force readily come to mind as examples of classic *strategic* targets, whereas individual tanks or artillery pieces in the Kuwaiti theater of operations (KTO) have usually been considered *tactical*. Under what conditions might this sort of usage make sense? The answer implied in the table is that calling an individual, isolated target *strategic*, *operational*, or *tactical*–or, for that matter, *political*–makes no more sense than pigeon-holing an F-111F or F-117A as a "tactical" fighter-bomber.

Nonetheless, a portion of the Desert Storm air campaign will be referred to throughout this report as *strategic*, and the core target systems involved will be called, as they were by those who conducted the Coalition air campaign, *strategic target categories*. The justification for this usage that emerged during the preparation of this report was that once a group of interrelated or similar targets had been pulled together into a coherent target system or category and linked to at least one strategic *objective*, it did make sense to refer to this *collection* of targets as "strategic."

In its most fundamental sense, therefore, the meaning attached to "strategic" for purposes of this report will be that of focused attacks on selected "vital" (or "strategic") target systems such as national-level command and control, electric power, weapons of mass destruction, and transportation. In this sense, "strategic" should be associated with actions or operations that fundamentally have to do with the connection of military means at the highest level with political ends, and strategic actions become those able, more or less directly, to satisfy overarching political-military objectives. This interpretation of the term basically recalls the older, pre-Hiroshima understanding of strategy evidenced by military

[5]Among others, Air Force Chief of Staff Gen Merrill McPeak has repeatedly stressed this particular example from Rolling Thunder ("McPeak: Maneuverability, Precision Munitions, Stealth Are Top Hardware Goals," *Inside the Air Force*, 22 Feb 1991, p 9).

leaders such as Generals George C. Marshall, Dwight D. Eisenhower, and Henry H. Arnold during World War II.[6] It also implies a parallel understanding of the term "operational," loosely circumscribed by the concrete examples in the table, based on linking certain groups of actions, targets, or missions with operational-level objectives.

The levels-of-war taxonomy then did suggest some useful insights, including defensible meanings of the terms *strategic* and *operational*. Equally important, it provided a systematic way of initially bounding the subject of this report. But, like any other tool, it also had limitations. The principal limitation that emerged during the preparation of the present report was that the seemingly clear line between operations and tactics implied in the table did not ultimately appear to be as sharp or precise as was hoped initially. Strategic- and operational-level actions or decisions also have tactical aspects, and, inevitably, these tactical aspects tended to blur the division between operations and tactics if one pushed too hard on the taxonomy. Put another way, the levels-of-war taxonomy constituted, at best, a blunt instrument for analysis.

To elaborate, the further the authors of this report dug into the details of what occurred during the Desert Storm air campaign, the more it began to appear that the four-level taxonomy of levels of war might fit large-scale land warfare better than contemporary air warfare. One impetus behind this hypothesis was a growing awareness of the ease with which Brig. Gen. Buster C. Glosson[7] had been able to move back and forth between strategic, operational, and tactical decisions–an ease that

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[6]This pre-Hiroshima view of strategy is evident, for example, in Eisenhower's view, during World War II, that a "large-scale invasion" of the Fortress Europe would be "exceedingly risky" unless "accurate daylight bombing was feasible" [Dwight D. Eisenhower, *Crusade in Europe* (Garden City, NY: Doubleday, 1948), p 65]. Not only did Eisenhower view daylight precision bombing of the German war industry as "the keynote" of the Normandy invasion plan, but he insisted on keeping control of the Strategic Air Forces because he believed, based on experience at Salerno, that these powerful assets had to be available to him at critical points for "tactical" application if the broader "strategic" purpose was to be assured (*ibid*, pp 65 and 222).

[7]From late August 1990 to the beginning of Desert Storm, Gen Glosson was the chief air-campaign planner for offensive operations against Iraq. During the war he not only retained his planning function but also served as commander (with operational control) of the 14th Air Division, which contained all the US Air Force fighter and fighter-bomber units operating from the Arabian peninsula.

seemed inherently less feasible for a division or corps commander in multicorps operations. Another concern was that the basic taxonomy had, to a fair extent, originally been borrowed from Soviet military writings, and Soviet distinctions between the strategic, operational, and tactical levels of war were firmly rooted in the epic struggle between the German *Wehrmacht* and the Red Army over the vast expanses of the Eastern Front during World War II. And, upon reflection, it became less and less obvious that what had worked well for thinking about large-scale land warfare in the past could be just as readily applied to air warfare in the present or the future. For both reasons, uneasiness about the fit between our taxonomy and what actually occurred in the Desert Storm air campaign tended to grow as work on this report progressed.

Despite this uneasiness, the basic levels-of-war framework was retained as a point of departure for analysis of Coalition air power's effectiveness in the Gulf War. Even though it was eventually recognized that tactical aspects of the air campaign can seldom, if ever, be completely excluded, the intended focus was, and remained, on operational and strategic effectiveness, and the hierarchy did appear applicable insofar as differentiating political, strategic, operational, and tactical objectives was concerned. The issue of an alternative framework that might be better suited to the dynamics of a modern air campaign–or, for that matter, to small-scale ground operations–was left an open issue for future investigators of air power and the Gulf War.

Historical Functions of Air Power

The structure of the present report has been shaped in part by a particular view of the *primary combat functions* that air power has performed in modern warfare. Reflection upon historical air campaigns from World War II to the present suggested that air power has generally been called upon to do three things:

(1) achieve control of the air;

(2) apply air-delivered firepower against surface forces; and,

(3) exploit air power's reach and lethality to achieve operational or strategic effects on the adversary by striking key elements of the enemy's society, will, or overall national power.

From the standpoint of the political and strategic aims of a conflict, *control of the air* has always been a means to enable air power to perform its other two functions. For example, the April 1943 plan for the Combined Bomber Offensive from the United Kingdom portrayed the destruction of German fighter strength in Western Europe as an "intermediate objective second to none in priority."[8] Yet this objective was not sought for its own sake but as a means to other ends. As the German Air Force proved in October 1943, when the U.S. Eighth Air Force tried to demonstrate that its heavily armed bombers could attack targets in Nazi Germany *beyond* the range of escort fighters,[9] some degree of local air superiority by American long-range fighters turned out to be "an absolutely necessary prerequisite" in order for daylight, precision bombing to be sustainable without unacceptable bomber losses,[10] and, at the strategic level, allied air superiority over northern France was recognized by senior American and British military leaders as an absolute prerequisite for the Normandy landings to have had any reasonable chance of success.

Air attack of surface forces has tended to be equated by members of the U.S. Air Force with close-air support (CAS) and tactical, or, at most, operational-level interdiction. But this use of air power can also be applied to the support of naval forces by both land- and sea-based aircraft. During World War II, radar-equipped B-24s of the Army Air Forces Antisubmarine Command were employed in the Bay of Biscay on sea-search-attack missions against German U-boats;[11] B-29s were used

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[8]US Eighth Air Force, "The Combined Bomber Offensive from the U.K.," 12 Apr 1943, Record Group 218 (US Joint Chiefs of Staff), box 594, US National Archives, p 3. The CBO plan's "principal objectives" of progressively destroying and dislocating German military, industrial, economic, and strength by attacking vital target systems like oil and ball bearings were portrayed as "dependent upon a prior (or simultaneous) offensive against the German fighter strength" (*ibid*, pp 1 and 3).

[9]Maj Gen W. E. Kepner, *Eighth Air Force Tactical Development: August 1942-May 1943* (Eighth Air Force and Army Air Force Evaluation Board, 9 Jul 1945), p 116.

[10]Gen Carl A. Spaatz, "Strategic Air Power in the European War," *The Impact of Air Power*, ed Eugene M. Emme (New York: D. Van Nostrand, 1959), p 231. Spaatz's article originally appeared in the April 1946 issue of *Foreign Affairs* under the title "Strategic Air Power: Fulfillment of a Concept."

[11]Arthur B. Ferguson, "The Antisubmarine Command," *The Army Air Forces in World War II*, ed Wesley Frank Craven and James Lea Cate, Vol 2, *EUROPE: TORCH to POINTBLANK, Aug 1942 to Dec 1943* (Washington, DC: US Government Printing Office, 1983 new imprint of 1949 original), pp 377-78 and 381-83.

extensively during that conflict to mine Japanese-controlled waters;[12] and, in Desert Storm, naval and other Coalition aircraft were used to eliminate the Iraqi naval threat in the Persian Gulf. This last example highlights in particular the degree to which the primary missions of U.S. naval aviation have long included the air attack of naval forces, primarily by carrier aircraft. As we will see, a question raised by the Gulf War is the extent to which it remains sensible or useful to view air-attack operations against enemy surface forces as necessarily being *in support of* friendly surface forces.

Since World War II, *strategic air operations* directed against vital elements of the enemy's society, will, or military power have undoubtedly been the most controversial function of air power. As originally conceived at the Air Corps Tactical School during the 1930s, the essence of the American view of this "strategic" function of air power is not difficult to describe. As General Arnold, who commanded the U.S. Army Air Forces throughout World War II, summarized the basic idea in November of 1945:

> The Strategic Theory, as applied to the United States air warfare concept, postulates that air attack on internal enemy vitals can so deplete specific industrial and economic resources, and on occasion the will to resist, as to make continued resistance by the enemy impossible.
>
> To accomplish the strategic purpose, it is necessary to destroy only a small proportion of industry, probably not more than a fraction of the total required to conduct modern warfare on a large scale. Indiscriminately widespread destruction of enemy industry is simply a waste of effort.
>
> Examination of any national economy will disclose several specific industries or other national activities without which the nation cannot effectively carry on modern warfare. It is conceivable that there will always be one industry, such as the oil industry in Germany, so neces-

[12]James Lea Cate and James C. Olson, "The All-Out B-29 Attack," *The Army Air Forces in World War II*, ed Wesley Frank Craven and James Lea Cate, Vol 5, *The Pacific: MATTERHORN to Nagasaki, Jun 1944 to Aug 1945* (Washington, DC: US Government Printing Office, 1983 new imprint of 1953 original), pp 662-74.

sary to all phases of the national war-making ability that its destruction would be fatal to the nation.[13]

In Desert Storm, the overarching objective of the strategic portion of the air campaign was somewhat different from that articulated by General Arnold in the World War II case. Instead of attacking vital elements of war production in hopes of gradually stopping the flow of military equipment, munitions, and fuel to Germany's military forces, the principal thrust of the "strategic" effort against Iraq seems to have been to inhibit and paralyze the very functioning of the Iraqi government and its military forces. Electricity, for example, was attacked not to inhibit Iraqi war production but to introduce friction and disorganization into the Iraqi system especially at the national level. Modern, computerized command and control systems require electricity, and it was hoped that forcing such systems abruptly onto back-up power, in conjunction with attacks on leadership, telecommunications, and other targets, shock and paralysis could be induced and the normal functioning of military activities like air defense rendered far more difficult.

Again, the terms "control of the air," "strategic air attack," and "air attack of surface forces" were chosen simply to reflect, as dispassionately as possible, the primary *uses* that have been made of air power as far back as World War I. No doctrinal or other implications about the ultimate efficacy of air power were intended, and none should be drawn from the terms themselves.

Report Issues and Themes

Four overarching themes concerning the operational-strategic effectiveness of Coalition air power in the Gulf War emerged during the preparation of this report. Expressed as questions, these four themes can be summarized as follows:

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[13]Gen Henry H. Arnold, "Third Report to the Secretary of War by the Commanding General of the Army Air Forces," 12 Nov 1945, *The War Reports of General of the Army George C. Marshall, Chief of Staff, General of the Army H. H. Arnold, Commanding General, Army Air Forces, Fleet Admiral Ernest J. King, Commander in Chief, US Fleet and Chief of Naval Operations* (New York: J. P. Lippincott, 1947), pp 456-57.

1. What were the effects of Coalition air power on the will and capability to fight of the Iraqi field army in the KTO, as well as on other forces deployed there, prior to the beginning of the ground campaign on 24 February 1991? How were these effects achieved, and how did they accumulate over time?

2. Does the combination of technological capabilities embodied in advanced strike platforms such as the F-117, together with the operational concepts used to structure the air campaign, reflect a revolutionary advance in warfare? In Desert Storm the ability to deliver ordnance with great precision at night from medium altitudes, combined with operational concepts such as great emphasis on targeting for functional effects[14] rather than physical damage, produced remarkable results against entire target categories, often in very short periods of time. Should such success be attributed to the continuation of earlier trends and the unique circumstances of this particular war, or to fundamental changes in the nature or efficacy of air power?

3. What limits to strategic air attack with modern, survivable delivery systems, if any, are suggested by Desert Storm? Various forces and factors–among them, enemy reactions and countermeasures, foreign and domestic political constraints, and the recurring frictions of war–limited the effectiveness of Coalition air efforts in ways that suggest parallels to earlier strategic bombing campaigns, including the Anglo-American bomber offensive against Nazi Germany during World War II. To what extent did comparable problems recur in Desert Storm?

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[14]The earliest evidence of a conscious focus on functional effects by Desert Storm air planners dates from early August 1990, when the Instant Thunder air-campaign concept was being worked by the Air Staff (Lt Col David A. Deptula, Personal Log, 9 August 1990 to 20 August 1990, entry for 11 August). The last column in the partial attack-flow plan reproduced below, which is a composite of sketches Lt Col Deptula made on 11 and 12 August 1990, illustrates this focus. This diagram is also a prototype for the daily Master Attack Plans that were used during the war.

DAY	Time	Mission	Aircraft	Base	TARGET	DESIRED EFFECT
1	Night	OCA	8 F117	XYZ	Air Def Hdqs	Render Ineffective
1	Night	OCA	3 B52	DG	Airfield	Render Ineffective

4. Finally, what can be concluded about air power as a political instrument from the Gulf War? Desert Storm air commanders and planners hoped that air power might be able to force some fundamental change of the regime in Baghdad; they also hoped that air power might be able to achieve the political aim of forcing the Iraqis out of Kuwait without requiring a ground campaign. Were such goals feasible even in circumstances as unconstrained and conducive to the effective application of air power as existed in this particular conflict?

It would be getting ahead of the evidence and arguments that will constitute the body of this report to suggest definite answers to any of these questions at this early juncture. Nevertheless, a few observations can be made without completely prejudging the answers suggested in the concluding chapter. The comments that follow have been chosen to give the reader a sense for some of the initial impressions and working hypotheses entertained by those who worked on this report and to highlight some of the key research issues pursued.

To start with the effects of Coalition air power on the Iraqi field army in the KTO, it seems fairly clear that thirty-nine days of intense, focused air operations did create the *preconditions* for one of the more rapid and crushing combined-arms, ground campaigns in twentieth-century military history. Within a scant one hundred hours, a forty-plus division force was either destroyed in place or compelled to flee Kuwait, and at a remarkably low cost in Coalition dead and wounded. Hence, the main questions did not concern the fact or the magnitude of air power's achievement in the Kuwaiti theater but rather those of how and why this remarkable result was achieved. Without getting too far ahead of the story, it can be said that the picture of air power's effects on the Iraqi army in the KTO that finally emerged turned out to be somewhat different, and certainly more complex, than that anticipated at the outset by those who planned and ran the air campaign. To cite an obvious example, the use of laser-guided bombs against individual tanks was not even anticipated in the prewar planning of the air campaign.

Turning to the issue of whether Desert Storm revealed any revolutionary advance in aerial warfare, one early impression, unquestionably borne

out by subsequent research, was that at the tactical level of squadrons and wings, this war was not noticeably less confused or chaotic than most other wars.[15] Individual aircrews and mission commanders were seldom able to discern the broader patterns and purposes of the missions they flew; the missions themselves were disrupted time and again by last-minute changes, adverse weather, or a lack of coordination with tanker or other mission support; preflight intelligence on the location or nature of targets or aim-points proved inadequate on many occasions; Iraqi reactions were often surprising or unexpected, as was the Coalition's decision to forego considerable accuracy with nonprecision-guided munitions by raising bomb-release altitudes to medium altitude; and, to touch on the category of uncertainty deeply felt by individual aircrews, timely bomb damage assessment was, as in most past air campaigns, a recurrent problem. Yet, at the level of General Glosson and his special planning group (alias the Black Hole) in Riyadh,[16] there was a strong impression that some revolutionary advance in aerial warfare had been witnessed during Desert Storm. In this regard, the ability of the F-117 and other advanced platforms to hit so many key aim-points during the initial hours

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[15]Jeffrey Record's assessment immediately after Desert Storm "that this was probably the most frictionless war we have ever fought" was not borne out by the evidence available to GWAPS ("Jeffrey Record: Defense Analyst," *Defense News*, 18 Mar 1991, p 46). Aircrew mission reports and operator assessments consistently supported precisely the opposite conclusion insofar as tactical-level friction was concerned and pointed strongly to the implication that friction was not limited to the tactical level in this conflict, especially on the Iraqi side. Indeed, it was striking to discover how often commanders, planners, and aircrew who participated in Desert Storm fell back on the concept friction in discussing various aspects of the campaign. Not only were participants, from Generals Horner and Glosson to line aircrews, keenly aware of frictional impediments to their own plans and goals, but their explanations of why many things had been done as they had during the war were, in more than a few instances, motivated by a conscious desire to structure their operations so as to drive up Iraqi friction.

[16]After the reorganization within the headquarters of Central Command Air Forces (CENTAF) in December 1990, the Special Planning Group (SPG) became the Iraqi or Strategic planning cell in the GAT (Guidance, Apportionment, and Targeting) organization under Gen Glosson, who was the Director of Campaign Plans. The GAT contained KTO, IADS (Integrated Air Defense System), and NBC (Nuclear, Biological, and Chemical) cells, as well as a Battlefield Coordination Element. It was the SPG and, later, the larger GAT organization of which the SPG became a part, that was referred to as the "Black Hole" during Desert Shield and Desert Storm.

and days of the campaign was frequently mentioned, and even Lt. Gen. Charles A. Horner, the Joint Forces Air Component Commander, remarked midway through the campaign that he himself had "underestimated the efficiency of [modern] air power."[17] Thus, despite the obvious persistence of the usual tactical frictions, there was a strong inclination to look for some combination of precision weaponry, stealth, and operational concepts that might substantiate a revolutionary advance in air power's effectiveness. Nevertheless, the further the research and writing by GWAPS personnel progressed, the more evident it became that justifying use of the term "revolutionary" would demand more than simply pointing to these sorts of things.

Regarding the prospective limits of strategic air attack as *military* instrument, the strategic portion of the air campaign appears, as was just indicated, to have witnessed no shortage of the usual uncertainties and frictions. The inability of Coalition air power to destroy Iraq's capability

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[17]Walter V. Robinson and Peter G. Glosselin, "US Officers Hope to Avoid a Ground War," *Boston Globe*, 4 Feb 1991, National/Foreign, p 1. At the core of the sense among American participants that something revolutionary was observed in Desert Storm seems to be the temporal compression of bombing results; high-value point targets that had often required thousands of sorties over periods of weeks or months in World War II were frequently destroyed during Desert Storm by one or two bombs from an F-117 or F-111F. When weather permitted target acquisition, F-117 pilots dropping laser-guided munitions had, on average an 80% probability of hitting their aim-point (SMsgt Harold P. Myers and SMsgt Vincent C. Breslin, "Nighthawks Over Iraq: A Chronology of the F-117A Stealth Fighter in Operations Desert Shield and Desert Storm," History Office, 37th Fighter Wing, Special Study 37FW/HO-91-1, 9 Jan 1992, p 4). By contrast, the CEP (circular error probable) for B-17s dropping *visually* with the Norden bombsight from 25,000 feet against German targets during World War II was, ignoring "gross-error" bombs outside 3,000 feet, in the neighborhood of 1,135 feet (United States Strategic Bombing Survey, *Bombing Accuracy: USAAF Heavy and Medium Bombers in the ETO*, Military Analysis Division Report No. 3, pp 2-3 and 5-6). Against a 50-by-100-foot factory building, calculations based on the Joint Munitions Effectiveness Manuals (JMEM) indicated that over 530 B-17s, each dropping a string of six 500-pound general-purpose bombs (for a total of over 3,100 bombs), would be required to achieve a 0.8 probability of destruction. Since the 1,135-foot B-17 CEP ignores the 20-50% of "combat box" formations whose bombs fell outside 3,000 feet, the JMEM result overstates the B-17's actual performance. Moreover, against a very hard target like Iraqi aircraft shelters, or a very small target like a fiber-optic-cable junction box, B-17s dropping unguided bombs would not really have had any serious capability whatsoever.

to launch of modified Scud missiles against Israel and Saudi Arabia right to the end of the conflict offers a straightforward instance of an operational problem that had antecedents reaching back to the Anglo-American Crossbow operations against German V-1 and V-2 sites during World War II. The recurrence of this evident limit to the efficacy of air power–notwithstanding the enormous advances in weaponry since 1918 and the near-ideal conditions in which the Desert Storm air campaign was waged–argues strongly that these limits may not be transitory problems but endemic to strategic air power itself.

As for the efficacy of air power as a political (rather than a military) instrument, the air planners in Riyadh clearly hoped, well into February 1991, that the air campaign alone might be able to force Iraq out of Kuwait–that is, achieve a major political objective directly. This hope seems to have been remarkably parallel to the hope of the air force planners during World War II that daylight, precision bombing might be able to force Nazi Germany to surrender without an invasion of northern Europe. This hope was not, of course, realized in the case of World War II Germany, and, despite the vastly greater efficiency of Coalition air power in the Gulf War, it was not quite realized in Desert Storm either–although there were indications, just prior to the beginning of the ground campaign, of stepped-up Iraqi efforts to find a last-minute political exit from Kuwait. The first-order question that arises from this historical comparison concerns how directly any use of the military instrument can promise or guarantee specific political results. Here the principal difficulties appeared, in the end, to be less those of platforms and ordnance than of the uncertain linkage between the use of military force *per se* and specific political outcomes. For instance, few, if any, of the U.S. commanders or planners involved in the conduct of Desert Storm seem to have anticipated that Saddam Hussein's regime might long survive a decisive battlefield defeat. Yet, as subsequent events turned out, Saddam Hussein managed to retain political power in Iraq longer than the American president who, in August 1990, drew a line in the sand and declared that Iraq's seizure of Kuwait would not stand.

Data Availability and Limitations

In the minds of the GWAPS director and task-force leaders, the model for the present survey was, from the outset, the U.S. Strategic Bombing Survey (USSBS) of the 1940s, which General Henry H. "Hap" Arnold had originally intended to be "a critical survey of the results of the Combined Bomber Offensive in Germany and the occupied countries."[18] The present report, because of its focus on operational-strategic effectiveness, ended up being closer in content and intent to USSBS volumes such as *Over-all Report (European War)* and *The Effects of Strategic Bombing on the German War Economy* than perhaps any other GWAPS reports. Nevertheless, there were some important dissimilarities between the two efforts, particularly regarding data and sources.

The most obvious dissimilarity between the U.S. Strategic Bombing Survey and GWAPS concerned the direct evidence available to the two surveys on physical bombing effects and enemy intentions. In the end, the USSBS published over two hundred reports on the war in Europe, the vast preponderance of which detailed the bomb damage and direct effects inflicted on individual targets based on site inspections by Survey field teams.[19] These field teams were often able to reach their "targets" soon after they fell into allied hands; four USSBS members were killed and another four wounded carrying out these field surveys.[20]

Although targets in Russian-held territory were not available to USSBS teams, close examination and inspection of several hundred plants, cities, and bombed areas constituted one of the three main sources of

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[18]David C. MacIsaac, *Strategic Bombing in World War Two: The Story of the United States Strategic Bombing Survey* (New York: Garland, 1976), p 40. The reference is to a 6 June 1944 memorandum, "The Results of the CBO," that Gen Arnold addressed to Adm William D. Leahy, Gen George C. Marshall, and Adm Ernest J. King; according to Arnold's annotations, he received verbal approval from Gen Marshall and Adm King to go ahead with what eventually evolved into the USSBS (*ibid*, pp 40 and 184).

[19]United States Strategic Bombing Survey, *Index to Records of the United States Strategic Bombing Survey* (Washington, DC: USSBS, Jun 1947), pp 2-4.

[20]MacIsaac, *Strategic Bombing in World War Two*, p 94.

information used by the World War II survey.[21] The other two primary information sources for the USSBS were (1) the masses of statistical records, company and city reports, and high-level German government documents acquired by field teams and (2) interrogations of thousands of Germans, including top-level political leaders such as Albert Speer who, from February 1942 to the end of the war in Europe, served as Adolf Hitler's *Reichminister* of Armaments Production.

GWAPS, by contrast, lacked the full range of information available to the U. S. Strategic Bombing Survey. Site inspections were limited to Kuwait and the portion of southern Iraq occupied by Coalition ground forces at the end of the ground campaign. The few on-site inspections that were conducted appeared, moreover, to have been somewhat sporadic because there was evidently no high-level planning for systematic site surveys. For example, ad hoc teams surveyed Kuwaiti air bases such as Ali Al Salem and Ahmed Al Jabar,[22] as well as the Iraqi Air Force bases at Tallil and Jaliba southeast in southern Iraq.

The first air-oriented group into Kuwait and occupied southern Iraq was an eight-man DIA/DNA (Defense Intelligence Agency/Defense Nuclear Agency) team, which began working on 6 March 1991.[23] This joint team focused mainly on the physical effects of air-delivered ordnance against various targets, especially structures like hardened aircraft shelters. Accompanying the DIA/DNA team, but operating separately, was a seven-man team of U.S. Air Force Systems Command personnel from the weapons development and test center at Eglin Air Force Base in Florida. Both of these teams conducted their in-theater data collection during March 1991. In April 1991, another air-oriented team of seventeen, sponsored

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[21]Franklin D'Olier, George W. Ball, John K. Galbraith, Paul H. Nitze, et al, *Over-all Report (European War)* (Washington, DC: United States Strategic Bombing Survey, 30 Sep 1945), p ix.

[22](S/NF/WN) Lt Col Allan W. Howey, AF/XOX-G, "Trip Report AF/XO Strategic Assessment Mission, Kuwait Theater of Operations, 14-29 Apr 1991," 9 May 1991.

[23](S) DIA/OB-6, "Munitions Effectiveness Assessment Exploitation Team Trip Report," 28 Mar 1991.

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by the Air Staff, was sent to survey bomb damage from an operations perspective. The Air Staff team, though, was restricted to sites in Kuwait. In addition, at least two ground-force or army-oriented teams conducted surveys in the former theater of operations after the war ended,[24] and some ground units conducted brief battlefield surveys within their areas of operations. However, no systematic effort to survey accessible targets and battlefields throughout the KTO was undertaken by U.S. Central Command, and the physical surveys were limited in scope and duration. Field inspections of bombed facilities in Iraq had to be conducted in the short period of time before Coalition forces withdrew. Similarly, in Kuwait itself, the large amounts of unexploded ordnance limited off-road travel, and efforts to begin cleaning up the bomb damage were undertaken while the DIA/DNA and Eglin teams were still in the theater.[25] So the limited site inspections made immediately after Desert Storm were not at all as comprehensive as those made of Germany and Japan by the World War II U.S. Strategic Bombing Survey.

Iraqi documents and interrogations available to GWAPS, too, were rather limited compared to the wealth of high-level German documents and leaders that ultimately became available to the USSBS. In general, the documents the Coalition acquired were lower-level papers,[26] and enemy prisoner of war interrogations were constrained by timetables on processing and repatriation. Hence, only fragments of the three basic sources of

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[24]A ten-man American-Canadian team, led by Mr Robert Talbott of the US Army's Foreign Science and Technology Center, inspected some 163 tanks [(S) Robert L. Talbott, Jr, "Attached Interim Joint Intelligence Survey Team (JIST) Report," 14 Jan 1992, GWAPS. NA-167]. The US Marines sent a four-man team that focused on armor (Marine Corps Research Center, "Armor/Antiarmor Operations in Southwest Asia," Research Paper #92-0002, Jul 1991, p ii).

[25]At Ahmed Al Jabar air base alone, the contractor in charge of the cleanup estimated that more than 70,000 tons of ordnance and debris had to be removed (Edward H. Kolcum, "GPS, Other New Technologies Help Clear Ordnance From Kuwaiti Desert," *Aviation Week and Space Technology*, 27 Apr 1992, p 54).

[26]In the time since the Gulf War ended, only a fraction of the Iraqi documents captured by Coalition forces have been translated into English.

information exploited by the World War II survey in the case of Nazi Germany were available to GWAPS.

Without a doubt, the most crucial blind spot stemming from these data limitations concerned GWAPS' understanding of Iraqi plans and intentions, both before and during the Gulf War. It is sobering in this regard to reflect that in all the years since the 1975 fall of Saigon to North Vietnamese forces, our understanding of enemy plans and intentions in that conflict has remained limited to what little the government in Hanoi has been willing to publish for its own purposes. The reader should be aware, therefore, that much of what will be said in this report regarding Iraqi intentions, goals, and plans during the Gulf War will, unavoidably, be based on plausible inferences from mostly circumstantial evidence.

On the other hand, the lack of extensive site inspections and Iraqi war-production, planning, and other higher-level documents was offset by a number of mitigating factors. In the first place, the bulk of the Coalition's bombing campaign against Iraq, in contrast to the industrial focus of the Combined Bomber Offensive, did not have as a primary aim constricting Iraq's armaments production during the conflict itself. Desert Storm was planned from the outset to be a relatively short and militarily overwhelming campaign, which it arguably was, and the elimination of Iraqi weapons-production capabilities such as the nuclear program were largely pursued as postwar objectives. Hence the sorts of detailed armaments-production data that were of central interest to the U. S. Strategic Bombing Survey were not particularly relevant to assessing the operational-strategic effectiveness of Coalition air power in Desert Storm.

Next, U.S. capabilities during Desert Storm to monitor the continued functioning of many strategic targets–individual electric power plants, air-defense sector operations centers, telecommunications facilities, and so on–were orders of magnitude better than they had been during World War II. Satellites and advanced airborne platforms such as the Joint Surveillance and Targeting System (JSTARS) aircraft were illustrative of the dramatic advances in collection since the 1940s. Such systems greatly reduced the need for on-site inspections as compared with that era.

Lastly, more than a half century after the end of World War II, knowledge of nonnuclear weapons has expanded immensely compared to what was available in 1941 or even 1945. Having thoroughly tested weapons like the laser-guided, 2,000-pound, hard-target-penetrating GBU-24A/B and GBU-27 munitions,[27] and having surveyed what these munitions were able to do against various targets at places like the Iraqi air base at Tallil, it seemed reasonable to conclude that surveying another 10 or 20 Iraqi airfields would probably not have yielded any major discoveries about the effects of these weapons on specific targets. When this knowledge was combined with coverage of Iraqi targets by airborne and space-based imaging platforms before, during, and since Desert Storm, there appeared to be a sufficient empirical basis for undertaking assessments of operational-strategic effects, if not of effectiveness. Moreover, since the war additional information has been gathered by various international teams that have had access to bombed sites in Iraq, as well as to Iraqi officials. For example, the International Study Team that sought, in the summer of 1991, to assess the impact of the air campaign on the health and welfare of the Iraqi population provided some of the most detailed data available on the bombing of Iraq's electric power system. And, by the time that GWAPS went to work, United Nations Special Commission and International Atomic Energy Commission inspections teams, operating under Security Council Resolution 687 (3 April 1991), were well on their way to building up a fairly comprehensive picture of Iraq's nuclear, chemical, biological, and ballistic-missile programs.[28] So

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[27]Both the GBU-24A/B and GBU-27 utilized the same BLU-109, or "I-2000," penetrating bomb body. With the addition of a laser-guidance kit, they become guided-bomb units. The main difference between the GBU-24A/B used by planes like the F-111F during Desert Storm and the GBU-27 was that the latter had been modified for carriage inside the F-117. The F-111Fs also carried the GBU-24A/B, which utilized an Mk-84 warhead.

[28]The IAEA (International Atomic Energy Commission) teams concentrated on tracking down and destroying Iraq's nuclear-weapons program. The UNSCOM (United Nations Special Commission) teams focused on eliminating Iraq's other "weapons of mass destruction" and long-range delivery means, including their means of production. To give a sense of the level of activity during the first six months (May through Oct 1991), eighteen United Nations Special commission missions, which included eighteen UNSCOM and six IAEA teams, were sent into Iraq [Security Council, Rolf Eheus (UNSCOM Executive Chairman) Report S/23165, 25 Oct 1991, p 18].

GWAPS' information shortfalls compared to the U.S. Strategic Bombing Survey's did not ultimately appear to be so severe or limiting as to preclude reasoned judgments in most areas about the operational and strategic effectiveness of Coalition air power during Desert Storm.

As a final comment regarding data, it would be a mistake to assume that the information on the Coalition's own air operations available to GWAPS had no holes or other limitations. By far, the U.S. F-117 wing kept the best data on its own operations of any Coalition air unit that flew in the war. Those data, summarized in the appendix, not only enabled day-by-day tracking of sorties against each target category, of weapon hits and misses, and of the impact of weather on F-117 operations but were sufficiently detailed and unambiguous to permit tracking on the basis of individual bombs.

As the available data on other Coalition weapons and aircraft began to be examined, however, it soon became apparent that this level of clarity and detail was the rare exception. Even the F-111 database was less detailed as compared with that provided by the F-117 wing. There appeared to be greater uncertainty in the F-111 data over the target categories actually bombed, as well as over the numbers of bombs dropped per aim-point on many targets prior to the commencement of "tank plinking"–attacks against "revetted" Iraqi vehicles in the KTO with 500-pound laser-guided bombs–during the second week of February 1991. With other platforms, especially those that were heavily involved in either chasing Iraqi mobile missiles or delivering nonprecision weapons into KTO "kill boxes," information such as the precise target attacked, the weapons utilized, or even whether the planned sortie had been flown at all, was not only uncertain but was often impossible to clarify or refine. Hence, beyond aggregate data on the numbers of sorties flown and total munitions expenditures, GWAPS encountered a considerable amount of uncertainty and confusion about the Coalition's own air operations during Desert Storm, and some details may never be known.

Report Overview

The rest of this report has been organized into seven chapters. Chapter 1 (How to Think About Effects and Effectiveness) will discuss the problems of measuring air power's effectiveness. Its main concerns will be to differentiate air-power effects from effectiveness, to explain how difficult the problem of measurement at the operational and strategic levels has been and remains, and to provide some historical benchmarks for assessing air power's effectiveness in the Gulf War.

Chapter 2 (Objectives, Target Sets, and Execution) will lay out the goals that the Desert Storm air campaign was intended to achieve, both politically and militarily; describe the target systems that were developed to achieve those goals, and how those target systems evolved during the war; and, briefly trace the course of the campaign. The principal analytic aim of this chapter will be to outline the expectations, desires, and goals of those who planned and executed the Coalition's air campaign, thereby providing a contemporary yardstick against which to judge the effectiveness of Coalition air power in the Gulf War. In addition, it will attempt to give the reader a feel for the magnitude and complexity of the operational and strategic tasks undertaken by air power in Desert Storm.

Chapters 3 through 6 will then offer accounts of what Coalition air power accomplished during Desert Storm partitioned loosely using the three functional areas–air superiority, air attack of surface forces, and strategic air attack–delineated in the previous section. Chapter 3 (Attacking Iraq's Integrated Air Defenses and Air Force) will examine the effectiveness of Coalition efforts to gain early control of the airspace over Iraq and Kuwait by attacking the command and control system (KARI) for Iraq's strategic air defenses, suppressing Iraq's strategic surface-to-air missile batteries, bottling up the Iraqi air force on its airfields with aggressive fighter sweeps, and, eventually trying to destroy the Iraqi air force by systematically attacking hardened aircraft shelters and bunkers. Chapter 4 (Attacking Iraq's Ground Forces and Navy) will be devoted to the application of Coalition air power against the Iraqi navy and field army in the Kuwaiti theater prior to the commencement of the ground offensive on 24 February 1991, including interdiction against lines of

communications to and within the KTO. Chapter 5 (Attacking Moving or Engaged Iraqi Ground Forces) will deal with air support of Coalition ground forces during the Khafji incursion of late January 1991 and the one-hundred-hour ground campaign of 24-28 February. Chapter 6 (Attacking the Core of Iraq's Military Power) will explore the operational-strategic effectiveness of Coalition efforts against the eight target categories–leadership; telecommunications and command, control, and communications; nuclear/biological/chemical capabilities; ballistic missiles (or modified "Scuds"); electricity; refined petroleum (or "oil"); military "storage" facilities; and railroads/bridges–that the air planners saw as the "core" of their "strategic" air campaign against Iraq.

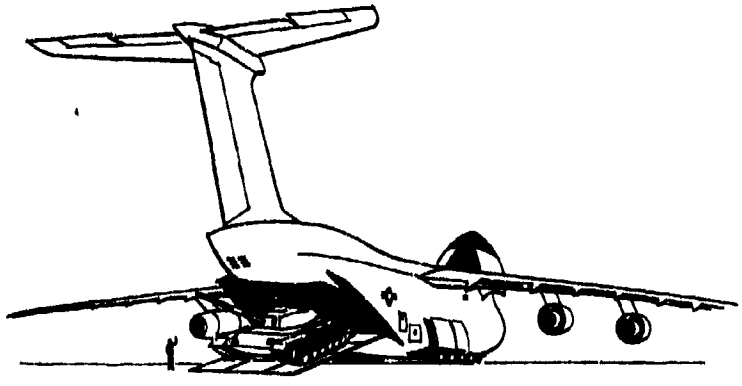
One deviation from strict adherence to the functional divisions previously described should be noted. While the Coalition's efforts to destroy Iraq's mobile ballistic missiles probably ought to be viewed conceptually as a part of gaining control of the air, we decided to cover this target category in Chapter 6 rather than Chapter 3. The main reasons for this decision were two. First, because these weapons were only employed with high-explosive warheads, they did not appear to be militarily significant in the outcome of the war. Second, since those who prosecuted the air campaign had viewed them as a strategic target category rather than a control-of-the-air problem, covering the anti-Scud campaign in Chapter 6 seemed to fit better with the outlook of the operational commanders and air planners during the war.

A potential inconsistency posed by this line of reasoning concerns the Republican Guard units in the Kuwaiti theater. The theater Commander in Chief, Gen. H. Norman Schwarzkopf, insisted on designating the Republican Guard as a "strategic center of gravity," and during the war these units were handled as a strategic target category by General Glosson and the Black Hole. Hence a case could be made for pulling this target category into Chapter 6 as well. Doing so, however, would have limited Chapter 4 to dealing with only a portion of the efforts mounted by Coalition air forces in the Kuwait theater against Iraqi ground forces. Hence, the authors chose to treat air attacks against the Republican Guard together with those against other Iraqi ground forces.

Lastly, Chapter 7 (Conclusions) will do two things. First, the judgments regarding the operational-strategic effectiveness of Coalition air power during the Gulf War reached in Chapters 3-6 will be briefly summarized, and second, extended discussions will be given of the four themes raised earlier in this introduction.

Recapitulation

The aim of this report, once again, will be to assess the operational-strategic effectiveness of Coalition air power, construed very broadly, in the Gulf War of January-February 1991. As noted, many of the uncertainties, difficulties, and frictions that manifested themselves during Desert Storm would be familiar to airmen who saw combat in World War II, Korea, or Vietnam. But there were other aspects of the air power's role in the Gulf War that struck at least some participants as being a significant step forward, if not revolutionary. To condense the four main themes that will be pursued throughout this report to a single question: How much of a change in the fundamental character of air warfare was manifested in Desert Storm? In many respects this question is the unifying issue to which we will return time and again in what follows.



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How to Think About Effects and Effectiveness in Desert Storm

In the air, Operation Desert Storm pitted more than 1,800 combat aircraft from twelve Coalition countries against an Iraqi air force of over seven hundred combat aircraft, backed by strategic and tactical air defenses in Iraqi and the Kuwaiti Theater of Operations (KTO). Over the course of the Gulf War (17 January-28 February 1991), Coalition air efforts included between 900 and 1,850 fixed-wing combat sorties a day.[1] Limited numbers of "airstrikes" were also carried out by attack helicopters, cruise missiles fired from both naval combatants[2] and aircraft, as well as the U.S. Army's Joint Tactical Missile System (JTACMS). Except for the Iraqi army's brief and ill-fated incursion around Al Khafji late in the second week of the war, the first thirty-nine days of operations consisted of an intense, prolonged air campaign in which Coalition air forces quickly established air superiority and began systematically attacking a wide range of strategic, operational, and tactical target sets throughout Iraq and the KTO. Then, during the one hundred hours of ground operations that made up the final four days of the war, Coalition forces swiftly crushed and expelled Iraq's forty-three division field army from Kuwait. The liberation of Kuwait culminated one of the most lopsided and comparatively bloodless theater campaigns in modern military history.

In retrospect, it seems hard to dispute the conclusion that the thirty-nine days of air operations preceding the commencement of the

[1]Department of Defense (DOD), *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, DC: Government Printing Office, Apr 1992), p 101.

[2]A total of 282 Tomahawk Land-Attack Missiles (TLAMs) were successfully launched during Desert Storm from 8 cruisers, 5 destroyers, 2 battleships, and 2 submarines [(S) Rpt, Frank Schwamb, et al, *Desert Storm Reconstruction Report*, Vol. 2, *Strike Warfare* (Alexandria, VA: Center for Naval Analyses, Oct 1991), p 8-6]. The USS *Fife* (DD-991) fired 58 Tomahawks altogether, the most launched by a single vessel (Cmdr Steve Froggett, "Tomahawk in the Desert," *U.S. Naval Institute Proceedings*, Jan 1992, p 71).

Coalition's ground offensive on 24 February 1991 largely created the circumstances in which this military triumph was possible. Whatever qualifications historians may eventually append in light of the longer-term political and strategic consequences of Desert Storm, it seems likely that this first-order judgment regarding air power's overall *military* effectiveness during Desert Storm will stand. This broader perspective should be kept in mind throughout this report as a counterbalance to detailed discussions of those aspects of the air campaign that fell short of desired goals and objectives in one way or another.

Given this overall perspective, how should more detailed judgments about the effectiveness of air power in the Gulf War be approached? To provide an initial feel for how difficult the problems of assessment are, consider the following comparisons. On the one hand, Coalition aircraft downed thirty-three Iraqi fixed-wing aircraft, but lost some thirty-eight of their own combat aircraft to Iraqi air defenses.[3] Judged exclusively (and absurdly) by this measure (aircraft attrition), the Desert Storm air war would appear to have been more or less a draw. On the other hand, Coalition air forces eventually carried out over 42,000 air-to-ground strikes against targets in Iraq and Kuwait, whereas the only two air-to-ground strike sorties known to have been attempted by Iraqi aircraft during the campaign resulted in two Coalition air-to-air kills prior to the Iraqi aircraft being able to release their ordnance. This second comparison reveals the Coalition's overwhelming dominance in the air but fails to provide any sense of what the large number of air strikes conducted actually accomplished. Both comparisons, while based on accurate information, give rather divergent impressions concerning the effectiveness of Coalition air forces during Desert Storm. The selection of appropriate measures, as well as their proper use, will therefore both be crucial issues for the present report.

This chapter discusses the main conceptual obstacles that complicate evaluations of air power's effectiveness at the operational-strategic level, whether in the present case of the Gulf War or in other conflicts. It will begin by describing the principal problems involved. They will then be illustrated with concrete examples from both Desert Storm and previous conflicts, including World War II, the Vietnam war, and Israel's incursion

[3]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, pp 160 and 178.

into Lebanon in the summer of 1982. These historical examples were selected not only to furnish some insights into how the operational-strategic effectiveness of air power has been evaluated in the past but to provide some explicit historical benchmarks for assessing airpower effectiveness in the case of Desert Storm.

The Main Problems of Effectiveness

The conceptual problems of assessing the operational-strategic effectiveness of Coalition air power in the Gulf War can be reduced to establishing two causal linkages. The first is the connection between employment actions such as flying air-to-air combat sorties or delivering air-to-surface ordnance on targets and any immediate, physical, or direct effects those actions may inflict on the opposing military forces or enemy targets. The second linkage is the connection between these outward effects and the operational-strategic purposes, if any, that the missions actually achieved.

Perhaps the simplest illustration of the first "link" in this "causal chain" would be whether a given strike sortie or mission package manages to put its ordnance on the desired targets and aim-points and targets. If the weapons all miss, then the appropriate "bomb damage" assessment is fairly obvious and there is no reason to move on to the second link in the causal chain. If, however, the ordnance hits the intended aim-points and targets, then the issue becomes accurately assessing the immediate, direct, or physical effects inflicted (although, as we shall see, accurate bomb damage assessment can be quite difficult).

The second link in the causal chain of effectiveness can be illustrated by briefly considering some of the prospective outcomes of, so to speak, "putting a bomb in Saddam Hussein's lap" for the purpose of bringing about a dramatic change of leadership in Baghdad prior to G-Day. Assume that the first link has been closed: by virtue of an intelligence coup and the use of precision munitions, the Coalition managed to put a 2,000-pound bomb inside a facility occupied by the Iraqi leader and kill him. Does operational or strategic effectiveness necessarily follow because the desired physical effects were achieved? Not necessarily. If, for example, the reins of power happened to be immediately and decisively seized by a successor whose ideas and political aims corresponded exactly with Saddam Hussein's, then it is entirely possible that his death would

fail to bring about the strategic aim of a voluntary withdrawal of Iraqi forces from Kuwait in accordance with United Nations' resolutions. Indeed, it would not be beyond the realm of possibility for Hussein's death to have the unintended but, from the Coalition's perspective, counterproductive consequence of galvanizing the Iraqi people behind the occupation of Kuwait by providing them with a martyred leader. In that case, this militarily "successful" air strike could have the unfortunate consequence of later significantly increasing Coalition casualties on the ground due to its impact the morale and resolve of Iraqi forces throughout the Kuwaiti theater.

A break in either major link of this causal chain can lead to the judgment that the sorties, mission packages, engagements, operations, or campaigns in question were, ignoring indirect and unintended consequences, either ineffective or failed to achieve their intended results. Indirect and unintended consequences can, of course, be positive, negative, or a mixture of both. On the positive side, such consequences may well be the most significant results achieved; on the negative side, they can so undermine the broader objectives of ongoing air operations as to jeopardize attainment of the very aims for which a particular application of military force was undertaken in the first place.

Assessments of military effectiveness cannot, therefore, be reduced to the amounts of physical damage or destruction inflicted on targets, the quantities of military equipment damaged or destroyed, or even to the numbers of combatants directly wounded or killed. Instead, issues of operational-strategic effectiveness will also necessarily involve human plans, intentions, psychology, political ends, and other hard-to-quantify factors and considerations. This conclusion follows directly from war's necessary subordination to political ends.

By way of emphasizing this last point, consider the deep disagreement over the effectiveness of the strategic bombing in World War II that resurfaced in *The New York Times Book Review* between John Kenneth Galbraith and W. W. Rostow when Galbraith reviewed Albert Speer's *Inside the Third Reich* in 1971.[4] In the original book review, Galbraith

[4]During World War II, Rostow served as an economic analyst in the Enemy Objectives Unit that was established within the American embassy in London in September 1942; Galbraith headed up the Economic Effects Division of the US Strategic Bombing Survey; and Speer, of course, was Adolph Hitler's Minister of Armaments Production

formulated his indictment of the strategic bombing of Nazi Germany much more pointedly than he had done in *The Effects of Strategic Bombing on the German War Economy* in 1945.[5] At the core of this assessment were what he termed the "terrible figures on [German] aircraft output" during 1944. For although the German aircraft industry became the top-priority target of American daylight bombing in February 1944, when a number of German factories were hit, German fighter production subsequently grew from 1,323 in February to 1,830 in March and continued to climb to a peak of 3,538 in September.[6] In light of the "heavy" losses the American bomber forces suffered during the February raids,[7] Galbraith concluded that the bombing had been, at best, "a badly flawed performance."[8] Rostow's rebuttal to this interpretation was to argue that the war against Germany had been "a struggle against air forces and armies, not against index numbers of industrial production."[9] While acknowledging the growth in German fighter production after the raids of February 1944, Rostow went on to point out that they could not have given Speer any satisfaction when, by April 1944, he saw many American bombers, especially those of the Fifteenth Air Force in Italy, proceeding to industrial targets with "not a German fighter plane anywhere in

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from February 1942 through the end of the war.

[5]This volume, published by the US Strategic Bombing Survey in October 1945, was the principal product of Galbraith's Economic Effects Division on the strategic bombing of Germany.

[6]John Galbraith, "Albert Speer Was the Man to See," *The New York Times Book Review*, 10 Jan 1971, p 2. The fighter-production figures in Table 102 of *The Effects of Strategic Bombing on the German War Economy* are slightly different than those cited in Galbraith's 1971 book review: 1,104 fighters were produced in February 1944, 1,638 in March, and 3,375 in September (*The Effects of Strategic Bombing on the German War Economy*, p 277). These discrepancies do not, however, affect Galbraith's point.

[7]The US 8th and 9th Air Forces lost a total of 226 heavy bombers and 28 fighters during the Big Week (20-25 February 1944); roughly 2,600 crewmen were killed in action, missing, or seriously wounded [Arthur B. Ferguson, "Big Week," *The Army Air Forces in World War II*, ed Wesley Frank Craven and James Lea Cate, Vol 3, *EUROPE: ARGUMENT to V-E, January 1944 to May 1945* (Washington, DC: US Government Printing Office, 1983 new imprint of 1951 original), p 43]. The almost 10,000 tons of bombs delivered on German targets during the Big Week were roughly equal to the total effort achieved by 8th Air Force during its first years of operations (*ibid*).

[8]Galbraith, "Albert Speer Was the Man to See," p 2.

[9]W. W. Rostow, *The New York Times Book Review*, 4 Apr 1971, p 23.

sight,"[10] a situation that would be largely repeated when the allied armies went ashore at Normandy on 6 June 1944.[11]

For present purposes, there is no need to resolve the differences between these starkly opposing positions. Three broader points can be made relative to the problems of assessing air power's operational-strategic effectiveness. First, despite the decades that have passed since 1945, no obvious meeting of the minds on the efficacy of strategic bombing in World War II had emerged among participants who had originally taken opposing views. Second, it appears from the debate over the implications of German wartime production statistics that such numbers, far from speaking for themselves, have said altogether different things to different individuals. And, third, at the center of Galbraith and Rostow's disagreement is the issue of choosing *appropriate* effectiveness measures. Galbraith chose to try to hang everything on statistical indices. Rostow, by contrast, implicitly argued that there were broader, qualitative factors, such as the allies' imperative to gain daylight air superiority prior to the Normandy landings, that had to be duly considered in order to reach a balanced assessment of air power's effectiveness. All of these are issues to which we shall return time and again in this report.

Bomb Damage Assessment (BDA)

The first link in the causal chain of effectiveness assessment described in the preceding section concerned getting from sorties and missions to relatively direct and immediate effects such as shooting down an enemy aircraft or inflicting damage on a target. Setting aside the antecedent (but critical) issues of selecting target sets linked to operational-strategic objectives, this first linkage can be viewed in terms of bomb damage assessment

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[10] *Ibid.*

[11] Exclusive of flights to determine weather, drop leaflets, or continue reconnaissance, the US 8th and 9th Air Forces dispatched 8,722 aircraft on 6 June 1944 to support the Normandy landings; German statements and records indicate that German opposition that day was "pitifully low," with as few as 12 fighter-bomber missions being flown (all of which save 2 jettisoned their bombs prior to reaching the landing areas) and a total of only 250 sorties being "attempted" (Robert H. George, "Normandy," *The Army Air Forces in World War II*, ed Craven and Cate, Vol 3, pp 194-195).

(BDA).[12] While bomb damage issues per se were not a primary focus of the present report, the relation of BDA to the broader problems of assessing operational-strategic effectiveness does need to be described.

Assessing even the more direct and immediate effects of air-to-air engagements or air-to-ground attacks has been a perennial problem since the beginning of air warfare. A classic example from World War II would be the difficulties experienced in assessing bomb damage against industrial facilities which produced military equipment items such as combat aircraft. During the so-called "Big Week" of 20-25 February 1944, when American daylight bombers tried to cause a decisive reduction in German fighter production, "about 90 percent of German fighter production was attacked and 75 percent of the factory buildings were damaged or destroyed."[13] Given the amount of visible damage to so many factories, it is not surprising that, at the time, allied intelligence analysts were "grossly optimistic" in estimating the effects of these missions on German fighter production. For March 1944, the month immediately following the Big Week, actual German production of single-engine fighters "reached a monthly average of 1,581, whereas Allied intelligence estimated only 655."[14]

There were a number of reasons for the allies' overestimation of the effectiveness of U.S. bombing during Big Week. Perhaps the most crucial--and a fact not fully appreciated until after the war--was that the bomb damage to the machine tools inside the aircraft factories and plants attacked was less severe than that suffered by the buildings themselves. As a result, "a very high percentage" of the machine tools used by the German aircraft industry were salvaged and then rapidly dispersed in

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[12]The US Army prefers the intuitively broader term *battle damage assessment*, and that was the term used in the Defense Department's report on the Gulf War (DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, p 175). Given the air-power focus of the present report and the Coalition's near-exclusive reliance on air action during the first 39 days of Desert Storm, the decision was made to stay with the traditional US Air Force term.

[13]Galbraith, et al, *The Effects of Strategic Bombing on the German War Economy*, p 156.

[14]Ferguson, "Big Week," *The Army Air Forces in World War II*, ed Craven and Cate, Vol 3, p 45.

order to minimize the effectiveness of subsequent bombing.[15] Thus, despite the best efforts of everyone involved in the BDA process to be as objective as possible, the potential divergence between the actual damage achieved and that estimated to have occurred based on aircrew observations and poststrike reconnaissance can be substantial, and in this instance was. Further, such discrepancies do not appear to be completely soluble by either more-timely or better-quality poststrike reconnaissance. In the case of the more direct effects of the Big Week, it was precisely what was most visible–extensive damage to factory buildings–that concealed the more critical facts that the machine tools inside were largely undamaged and salvageable.

Bomb damage assessment problems, then, have been around since aircrews started delivering ordnance from aircraft. Indeed, it would be fair to say they that have persisted in every major conflict in which aircraft and aerial weapons have been applied on any significant scale. Despite enormous technological advances since 1945 in reconnaissance capabilities, as well as continuation of the research and test tradition on the physical effects of munitions begun during World War II, BDA has remained a perennial problem in the application of air power, and the Gulf War was no exception. What may be less evident, however, is the degree to which some of the newer weapons employed in Desert Storm, together with the targets against which they were applied, made this perennial problem, if anything, even more acute.

Among the largely (but not entirely) unanticipated BDA problems that cropped up during Desert Storm were those stemming from Coalition efforts to damage or destroy very hard Iraqi targets employing 500- to 2,000-pound high-explosive bombs delivered from medium altitudes. Facilities such as Iraqi hardened-aircraft bunkers[16] and hardened intercept

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[15] *Ibid*, p 44; Galbraith, et al, *The Effects of Strategic Bombing on the German War Economy*, p 156.

[16] The difference between hardened *shelters* and *bunkers*, as these terms have come to be used by American weapon-effects specialists, can be summarized as follows. A hardened aircraft *shelter* is a manmade structure designed to provide both environmental protection as well as a degree of protection from attack. An example would be the "TAB VEE" Theater Air Base Vulnerability Shelters constructed at most US air bases in central Europe since the late 1960s. With a quonset-type shape covering a floor area of 48 by 120 feet, the TAB VEEs consisted of a corrugated steel lining reinforced (or covered) with 2 feet of concrete; their fronts had steel doors that could be opened by one man, and their rears contained ports to funnel jet blast to the outside [Michael Skinner, *USAFE: A Primer*

operations centers had been designed to withstand conventional bombing. Most observers believed, prior to the war, that structures this hard were more or less impervious to conventional bombing. Because the combination of accuracy and bomb-penetration capability necessary to breach or seriously damage such facilities appeared to be difficult to achieve on any consistent basis with unguided weapons, those unfamiliar with ongoing American weapons developments, including the Iraqis, were inclined to assume that hardened structures would be relatively immune to traditional bombing attacks such as the Israeli raid on the Iraqi nuclear facility at Al Tuwaitha in 1981 or the kinds of attacks mounted by the Iranian air force during the Iran-Iraq war. Sheer luck might, on occasion, produce the dead-center hit necessary to take out hardened structures of these sorts with a single bomb, but such occurrences would be exceedingly rare.

However, during Desert Storm Coalition platforms like the F-117 and F-111F, dropping laser-guided bombs (including GBU-24s and GBU-27s utilizing the 2,000-pound BLU-109 bomb body, designed to penetrate hardened structures), proved able to achieve the requisite combination of accuracy and bomb penetration on a regular basis at night from medium altitude. But in doing so, they also precipitated BDA problems that Coalition air planners and intelligence specialists had not fully foreseen.

Attacks on hardened aircraft bunkers (HABs), aimed at eliminating the Iraqi air force, can be used to illustrate some of these problems. Since weapons using the BLU-109 (or "I-2000") warhead were designed to penetrate reinforced concrete structures, it was not uncommon for a GBU-24A/B or GBU-27 to produce little exterior damage beyond a small, neat hole where the bomb penetrated the exterior "blaster slab."[17] From

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of Modern Air Combat in Europe (Novato, CA: Presidio, 1985), pp 28-29]. A hardened aircraft *bunker* of the sort common in Iraq and Kuwait, by contrast, consisted of a concrete inner shelter covered by a layer of soil and, on top of the earth or rock layer, concrete slabs (Defense Intelligence Agency, *Structures Identification Handbook*, DDB-2800-9-88, Oct 1988, Figure 104).

[17]Again, these bunkers typically had three layers. The innermost was a concrete shelter; the second layer consisted of several feet (and possibly more) of rock, dirt, or sand on top of the shelter; and the third, the "blaster slab," was usually made up of reinforced concrete blocks installed like a layer of bricks over the soil layer. The function of the blaster slab, of course, was to cause bombs to explode before reaching the shelter itself.

many angles a HAB penetrated cleanly by these munitions might appear intact and undamaged, even though the detonation of the weapon inside had rendered it unusable–that is, produced a "functional" kill. In such cases, imagery analysts were strongly inclined to err on the side of caution and assess slight or moderate damage in their BDA reports, particularly early in the conflict. In Washington, D.C., especially, few analysts had any knowledge, prior to 17 January 1991, of the kinds of visible effects such weapons might produce against various targets. From World War II through the Vietnam and Arab-Israeli conflicts, the norm for bomb damage assessment had been "sticks" or "trains" of unguided bombs. Moreover, having little insight into the purposes for which particular targets were being struck, or even foreknowledge of which targets might be struck next, it was difficult for many Washington-based imagery analysts to venture beyond describing the physical damage that they could see.[18]

On the other side of this same coin, against the harder to penetrate of the HABs attacked–the so-called Iraqi "Yugos" and the Kuwaiti "trapezoids"[19]–detonations prior to penetration could occur, and, in these instances, the damage visible on the outside could appear extensive. Yet, in at least one case at Ali Al Salem air base in Kuwait, inspection on the ground after the war revealed that the shelter's interior had suffered no apparent damage despite two direct, although well off-center, hits that failed to penetrate.[20] So with weapons like the GBU-24A/B and GBU-27, there was no tight correlation between the amount of physical damage visible on the outside and the structure's ability to perform its intended function of sheltering Iraqi aircraft. Granted, as the war progressed, ways of working around these uncertainties were found. Air planners in Riyadh soon realized that video imagery from F-117s and F-111Fs often revealed whether the bomb had detonated inside a given shelter. If the video indicated a detonation inside, then it seemed reasonable to infer that

[18]Prior to the war the Air Staff initiated efforts to raise the understanding of those Washington imagery analysts directly involved in the three-phase BDA process established to feed results from national systems to the theater. But even these analysts were, in many cases, initially reluctant to abandon Vietnam-era BDA norms that focused on the physical destruction of targets.

[19]The name "Yugo" was applied to shelters in Iraq that had been constructed by Yugoslavian contractors using a Belgian design. In the case of Kuwaiti shelters such as those at Ali Al Salem, "trapezoid" simply indicated that, viewed from the front at ground level, these shelters had a trapezoidal shape.

[20]See page 43.

the structure had been functionally "killed," any aircraft inside destroyed, and that this particular target need not be attacked again. Still, the very use of such "workarounds" confirms the unusual BDA problems that cropped up during Desert Storm when weapons like the GBU-24A/B and GBU-27 were used against structures such as hardened aircraft shelters.[21]

Similar problems surfaced with the use of 500-pound GBU-12 laser-guided bombs against tanks and armored personnel carriers in the KTO. The first experiment with what came to be known as "tank plinking" was carried out by F-111Fs on the night of 5-6 February 1991 (Air Tasking Order Day 20).[22] The idea was to see if the combination of the F-111F's infrared imaging system (PAVE TACK) and the accuracy of the GBU-12 would enable individual pieces of armor to be attacked in their berms with reasonable confidence of success at night. This initial trial proved encouraging, and the very next night the bulk of the F-111F effort went to tank plinking.[23] To be stressed is the innovative nature of this unanticipated use of the F-111F. A main battle tank is not only a very hard target but also considerably smaller than a hardened aircraft shelter. Consequently, prior to the Gulf War, most observers, including most American airmen, considered tanks to be relatively immune to bombing.[24]

BDA problems assessing the results of tank plinking included both underestimates and overestimates. In the case of a direct hit against a T-72 out in the open, the visible pieces of debris left from a catastrophic explosion were sometimes so small and scattered as to make imagery confirmation of the "kill" difficult even in the best of circumstances. In such cases the destruction of the tank was likely to be missed. On the other hand, video from the infrared imaging sensor on the F-111Fs was

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[21]The reluctance of many involved in bomb damage assessment during Desert Storm to embrace video imagery also illustrated the tenacity with which people cling to old ways of doing business.

[22]GWAPS Missions Database.

[23]Over the last three weeks of Desert Storm, about three quarters of the strikes recorded by F-111Fs consisted of tank plinking with GBU-12s.

[24]Gen Glosson indicated in postwar interviews that when the 48th wing was directed to load some GBU-12s on its F-111Fs to see if tank plinking might work, there was much initial skepticism in the unit (GWAPS intvw, 14 Apr 1992). Immediate success, however, quickly converted the 48th's commanders and crews into enthusiasts for this mission.

not always able to distinguish tanks from self-propelled artillery and trucks, or very-near misses from direct hits, due to the "blossoming" of the infrared image when the GBU-12 detonated. As a result, BDA based on the videos led aircrews and planners in the theater to conclude, during the campaign, that most GBU-12s had killed the "bermed" armored vehicles at which they had been aimed. Postwar reexamination of plinking against three Republican Guard divisions has indicated, however, that of the bomb craters that could be identified as having probably resulted from laser-guided bomb, only around thirty-five to forty-five percent could be correlated with destroyed or immobilized armored vehicles.[25]

While this data point should not be extended too far, it does pass the test of common sense. The circular error probable (CEP)[26] of the GBU-12 was roughly equal to the lethal radius within which the weapon would need to hit to kill a main battle tank out in the open. Against tanks in deep berms, therefore, a kill ratio approaching one-in-two would have been about the best one could have expected, and even one dead vehicle per three GBU-12s dropped would have been quite good given the one-milliradian jitter of the laser designator. Again, plinking tanks with laser-guided bombs was not envisioned as feasible by either side prior to the war. So a success rate of even one-in-three in a role heretofore not even thought feasible was a considerable tactical achievement in its own right. That said, the gap between in-theater assessments of bomb damage from tank plinking reached during the war and the more sober ones developed, with the aid of hindsight and additional data, long after the fighting had ended provides one further example of the unexpected but significant BDA problems encountered during Desert Storm.[27]

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[25](S/NF/WN) Hank Malcom, Office of Imagery Analysis, Central Intelligence Agency, OIA/TWMD 0000/92, 14 Sep 1992. The 35-45% figure excludes the 15-20% of the GBU-12s released that hit wide of their intended targets due to various system malfunctions or post-release weather problems.

[26]The CEP of a weapon is the radius of a circle around an aim-point within which 50% of the bombs would be expected, on average, to hit given a large number of drops.

[27]In fact, this gap was surfaced by Central Intelligence Agency (CIA) imagery analysts prior to the beginning of the ground campaign. In early February, CENTCOM was holding much higher totals of tanks, armored personnel carriers, and artillery having been destroyed by Coalition aircraft in the KTO than CIA could confirm. Since the timing of G-Day was predicated on destroying 50 percent or more of the Iraqi armor and artillery in the KTO, CIA's surfacing of these discrepancies around the second week in February 1991 created perhaps the major BDA controversy of the air campaign. This subject will

For an American intelligence community long accustomed to relying primarily on imagery for BDA, nonexplosive warheads posed an even more perplexing challenge. For example, members of the international study team that visited Iraqi during the period 23 August-5 September 1991 to survey the effects of the war on the health and welfare of the Iraqi population reported that on the first day of Desert Storm "metallic threads" had shorted and disabled the switchyard and transmission lines at the Dhaura thermal and gas-turbine power station in south Baghdad, thereby forcing the plant to shut down.[28] The BDA problem posed by this sort of munition was, of course, that it would not necessarily produce the visible damage associated with traditional explosive munitions. True, the desired functional effect–shutdown of Iraq's electric power grid–could be loosely verified by observing that the lights in Iraqi cities had gone out and stayed out. But aircrews and weather satellites reporting a mostly darkened Iraq on subsequent nights constituted, at best, circumstantial evidence that the desired effects had been achieved. This ambiguity provides some insight into why many power plants in Iraq were also hit with high-explosive munitions. Doing so provided direct confirmation that the targets in question had been successfully attacked.

Because all the examples discussed so far in this section have focused on illustrating the more novel and unexpected sorts of BDA problems encountered during Desert Storm, it seems best to conclude with at least one example in which the problem had been encountered in past wars. Within the area of hardened targets, perhaps the most straightforward case would be trying to attack structures that existing bombs could not penetrate. This particular problem has clear antecedents as far back

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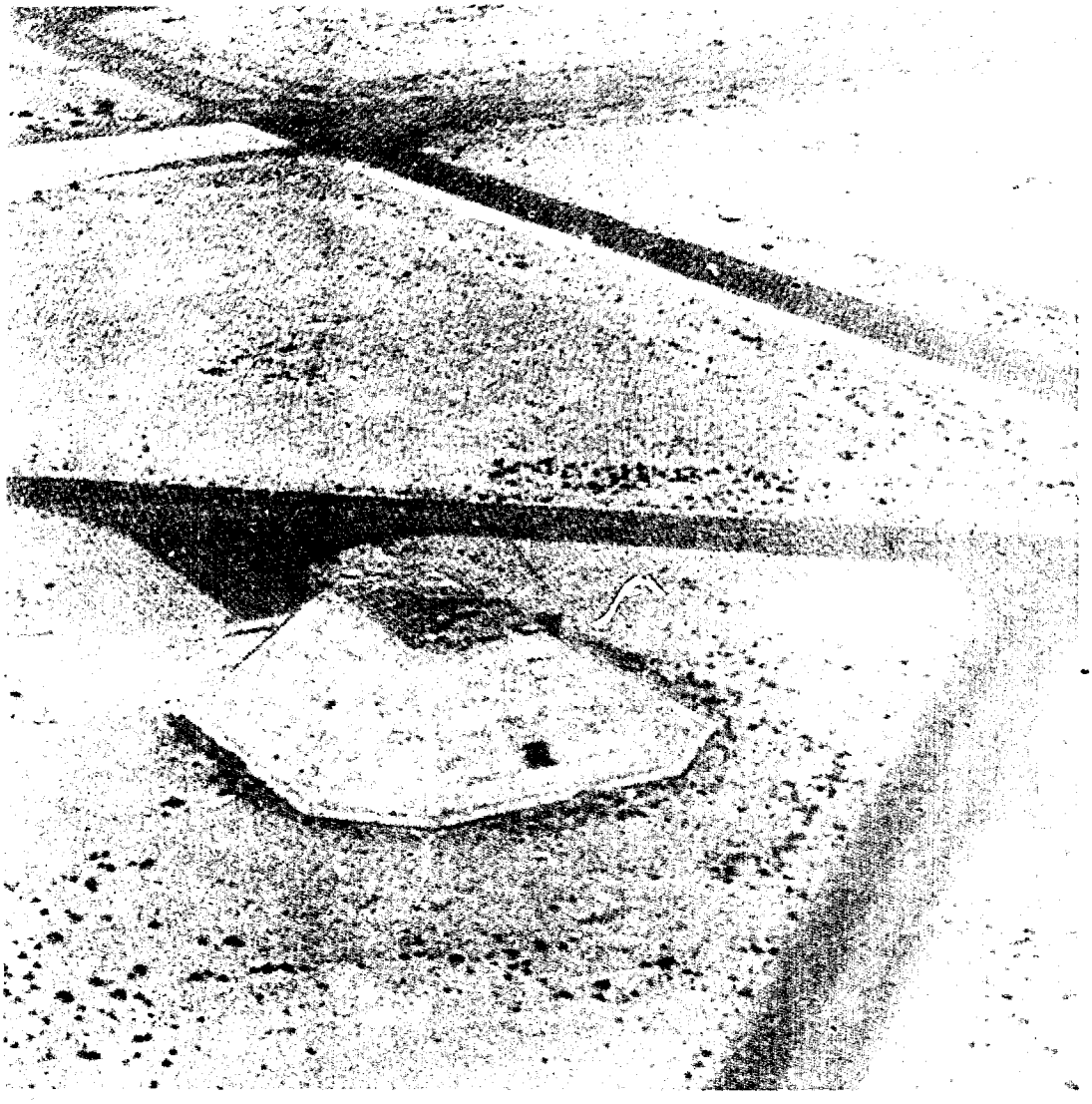
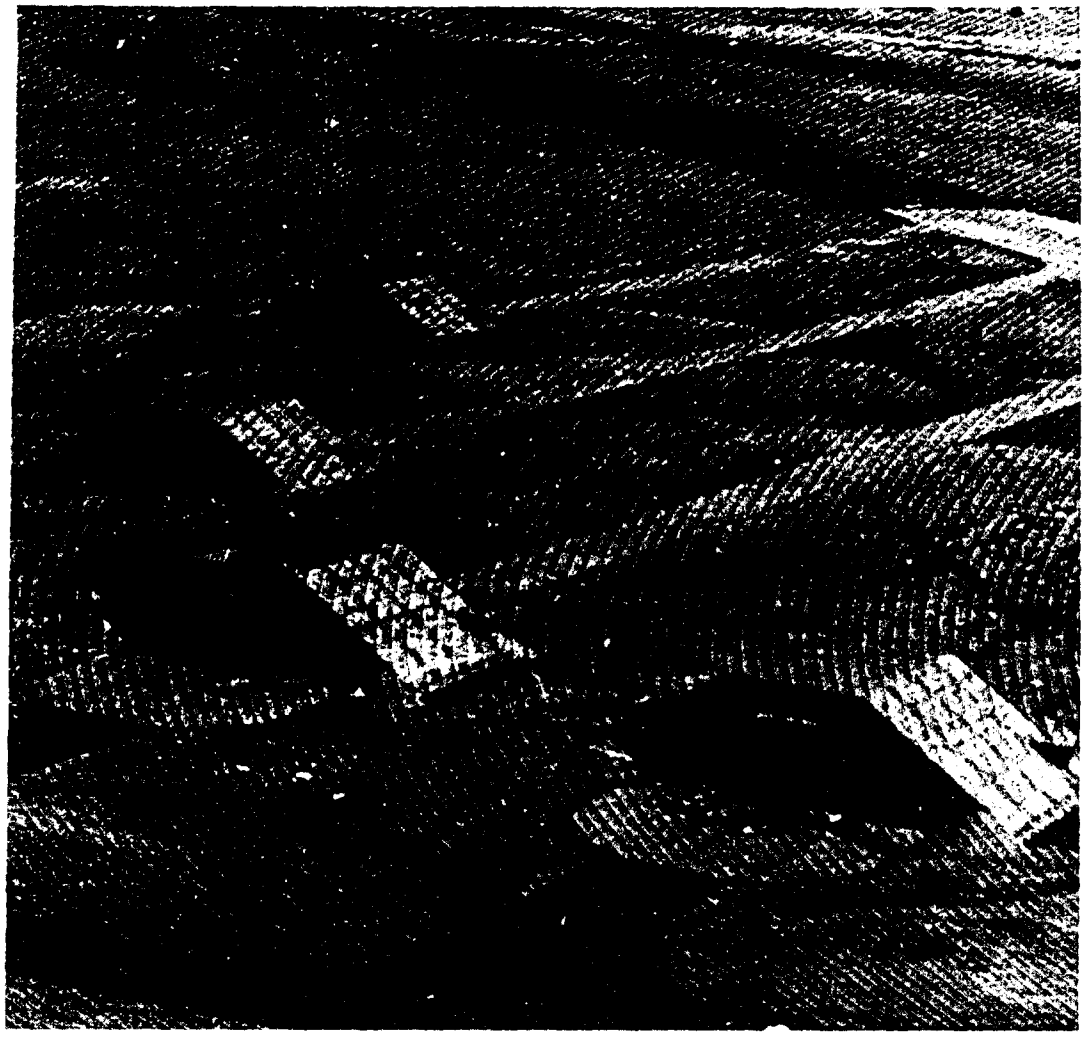
be covered in more detail in Chapter 4 of the present report.

[28]Walid Doleh, Warren Piper, Abdel Qamhieh, and Kamel al Tallaq, "Electrical Facilities Survey," International Study Team, Oct 1991, p 9. *Aviation Week* subsequently reported that the use of warheads filled with a special carbon-fiber wire had caused massive short circuits when dispensed on switching facilities and their associated high-power lines at Iraqi electric power plants (Douglas A. Fulghum, "Secret Carbon-Fiber Warheads Blinded Iraqi Air Defenses," *Aviation Week & Space Technology*, 27 Apr 1991, p 18).



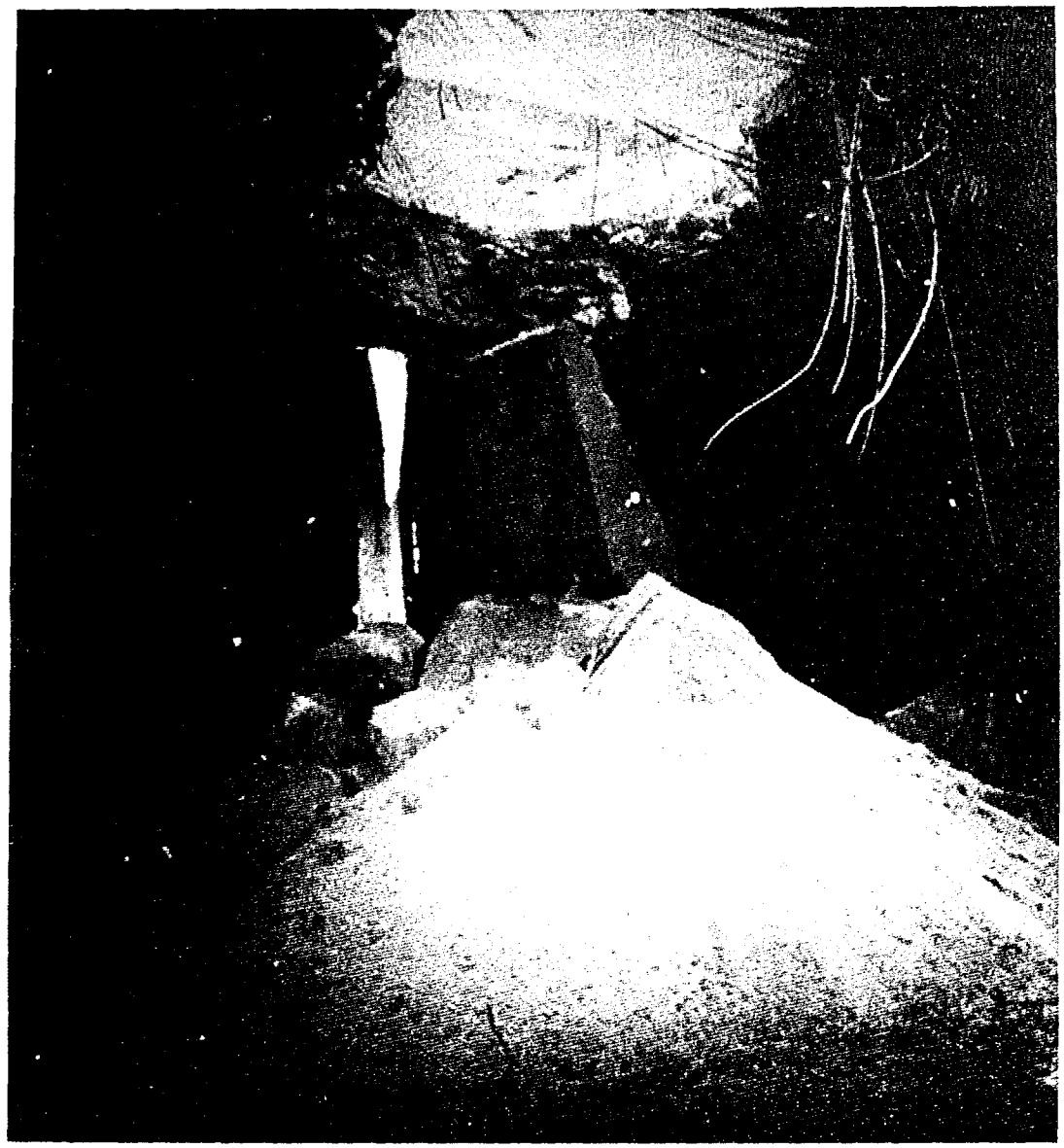
Hardened Aircraft Bunker at Al Jaber Airfield in Kuwait.

A direct hit on the top of this HAB is plainly visible in this photograph, which was taken by a GWAPS team from a helicopter on a visit in July 1992. From this angle, it is unclear whether the bomb penetrated the inner shelter beneath the middle layer of fill and the outer layer of concrete "blaster slabs." No penetration hole is visible and the rest of the structure appears to be intact. Particularly early in the Desert Storm, BDA analysts would have probably assessed, at most, light damage to the structure based on imagery from this perspective. If the bomb penetrated the inner shelter and exploded inside, however, the likely damage to any aircraft inside would have been catastrophic despite the absence of visible damage on the outside of the HAS.



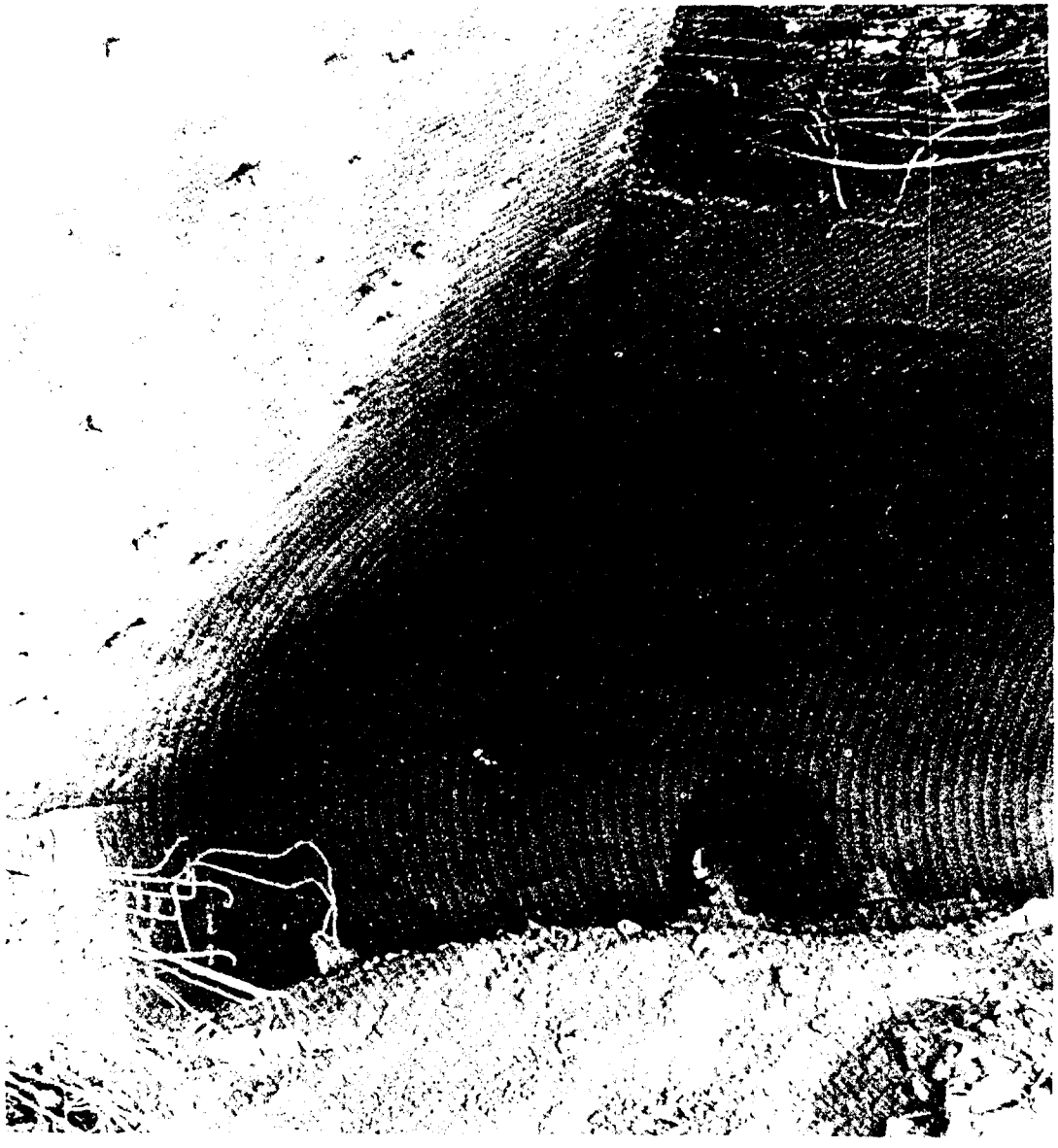
Hardened Aircraft Bunkers at Al Jaber.

Close inspection of the areas in front of the two closest HABS reveals that their doors have been blown off, indicating that bombs probably penetrated the inner bunker itself prior to detonating. Bomb damage is also visible on the top of the left-hand shelter in this pair. Against these kinds of structures, most 2,000-pound, precision-guided bombs dropped by Coalition aircraft detonated in the soil layer between the outer "blaster slab" and the bunker roof rather than completely penetrating the inner shelter itself prior to detonation. Even so, the damage and debris caused inside by such detonations was often sufficient to render the HAB unusable and any aircraft within unflyable. As a related observation on effectiveness, the aircraft shelters in Kuwait did not contain aircraft when they were hit. This photo was taken by GWAPS personnel in July 1992.



Interior Damage to HAB at Ali Al Salem Airfield in Kuwait.

This photo was taken by the Air Force (AF/XO) inspection team led by Lt. Col. Allan Howey in April 1991. It illustrates the amount of debris and damage left inside a hardened aircraft shelter after being breached by a 2,000-pound bomb. Yet, if the doors were not blown off and the penetration hole was relatively small, the functional kill of the shelter might be difficult for bomb-damage assessment analysts to judge, even though the damage to the shelter doors alone often left the shelter effectively inoperable.

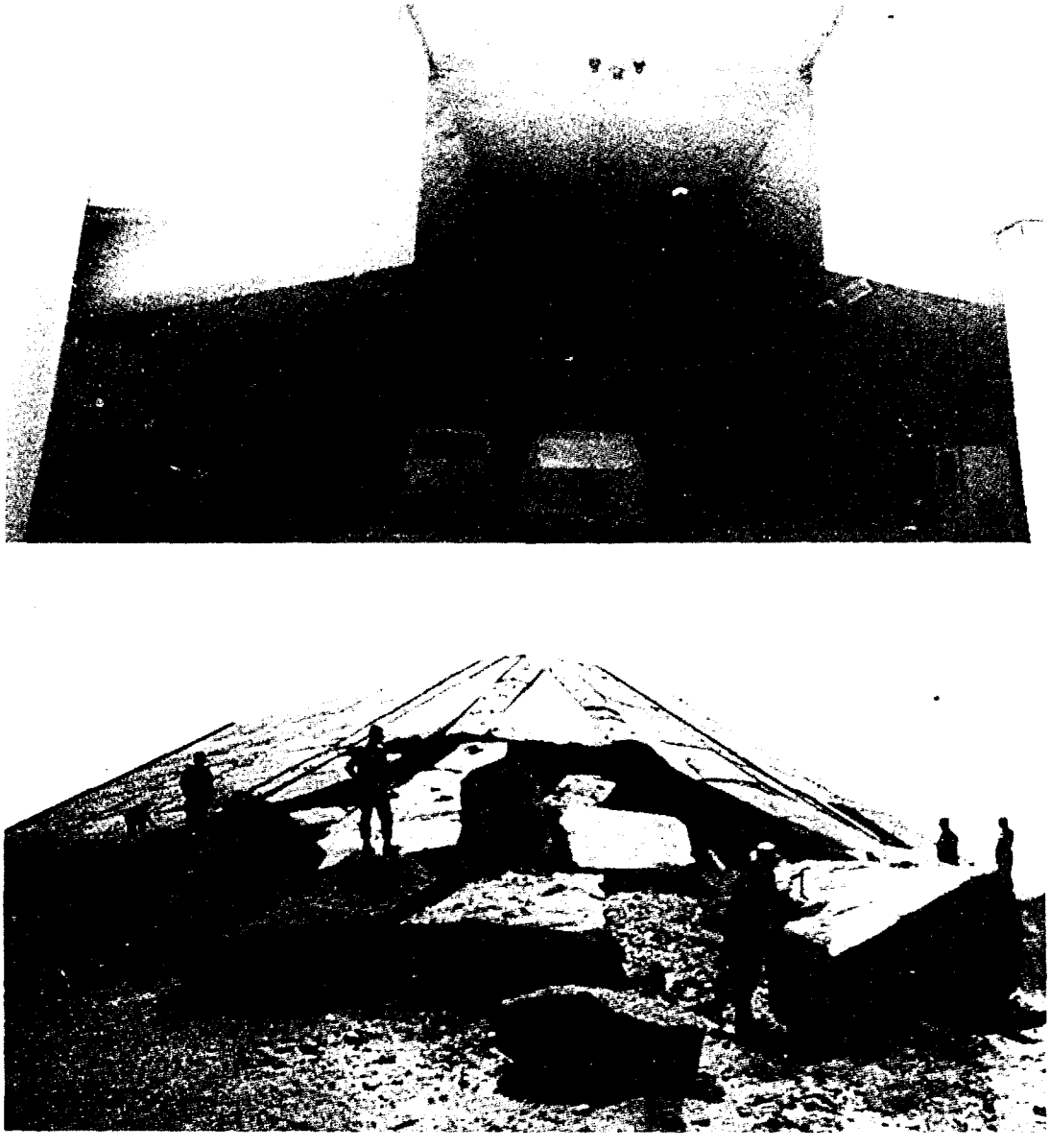


Drive-In HAB at Tallil Airfield in Iraq.

This photo was taken by a member of the DIA/DNA (Defense Intelligence Agency/ Defense Nuclear Agency) team that visited facilities in both Kuwait and southern Iraq immediately after the Gulf War. The photo shows the inside of an Iraqi HAB that was hit multiple times by U.S. Air Force aircraft with laser-guided, 2000-pound bombs. The ejecta from the bomb impacts filled almost half of the shelter. At least one aircraft was buried beneath the debris in this shelter, and possibly a second. Some of the later attacks on this HAB were unnecessary to achieve severe functional damage of the structure and its contents.

Exterior View of HAB Penetration at Ali Al Salem Airfield in Kuwait.

This photo shows a penetration hole from a laser-guided bomb. The hole is about a yard across. Also visible are the three layers of the shelter (the exterior blaster slab, the middle layer of sand fill, and, underneath both, the reinforced-concrete inner shelter). This Kuwaiti shelter at Ali Al Salem was assessed after the war to be as resistant to bombing as the hardest of the Iraqi shelters, the so-called "Yugos."



HAB #20 at Ali Al Salem Airfield in Kuwait.

The top photo shows the undamaged interior of HAB #20 at Ali Al Salem. The bottom photo shows one of the two bomb hits this shelter took. Both bombs hit on the back side of the HAB. Lt. Col. Allan Howey's team initially approached this shelter from the front and ate lunch in it. Only afterwards did team members walk around this shelter and discover that it had survived two hits. Both bombs impacted far enough off center that there was no visible damage to the shelter's interior. Even the fluorescent light bulbs inside appeared undamaged when Howey's team inspected it in April 1991.

Destroyed T-72.

This photo shows the remains of a T-72 tank that was completely destroyed. The best guess by the Air Force (AF/XO) inspection team was this tank had taken a direct hit from a precision munition, most likely from a laser-guided bomb. Since this particular tank was caught out in the open, rather than hit in a revetment, imagery analysts would have been hard pressed, looking at shot of the area, to notice that it contained a destroyed tank. The kettle in the foreground gives an idea of just how small the remaining pieces were.

as the Second World War, and, as we shall see, the line of solution selected by the U.S. Air Force in 1991 was identical to that taken in the early 1940s.

Starting in late October 1942 and continuing until June 1943, German U-boat bases on the coast of occupied France became the primary concern and highest priority for U.S. Eighth Air Force heavy bombers operating from the United Kingdom. American bombers began attacking the U-boat yards in daylight even though there was doubt from the outset that the dozen or more feet of steel-reinforced concrete which formed the roofs of these facilities could be penetrated with any bombs then available.[29] In the end, this concern over the ability of existing bombs to penetrate proved well-founded. "Not only were the pens themselves impervious" to the bombs Eighth Air Force's B-17s and B-24s were able to deliver through mid-1943, but bombing the areas adjacent to the pens had no effect on submarine operations either because, as the German U-boat fleet commander revealed after the war, the pens themselves "housed virtually all necessary repair and maintenance facilities."[30]

This inability of daylight bombing to impede U-boat operations can be seen, in retrospect, to have been rooted in the inability of the bombs available through mid-1943 to breach the U-boats' protective shelters. So long as the U-boat yards had all their essential facilities under a thick concrete roof, and so long as the roofs themselves could not be breached, bombing could do little to impede the repair, refurbishment, and launching of U-boats from these yards. The obvious solution was to build bombs that could penetrate, and the Royal Air Force eventually fielded a 12,000-pound, general-purpose bomb (Tallboy) that, in the later stages of the war, was able to penetrate enough steel-reinforced concrete

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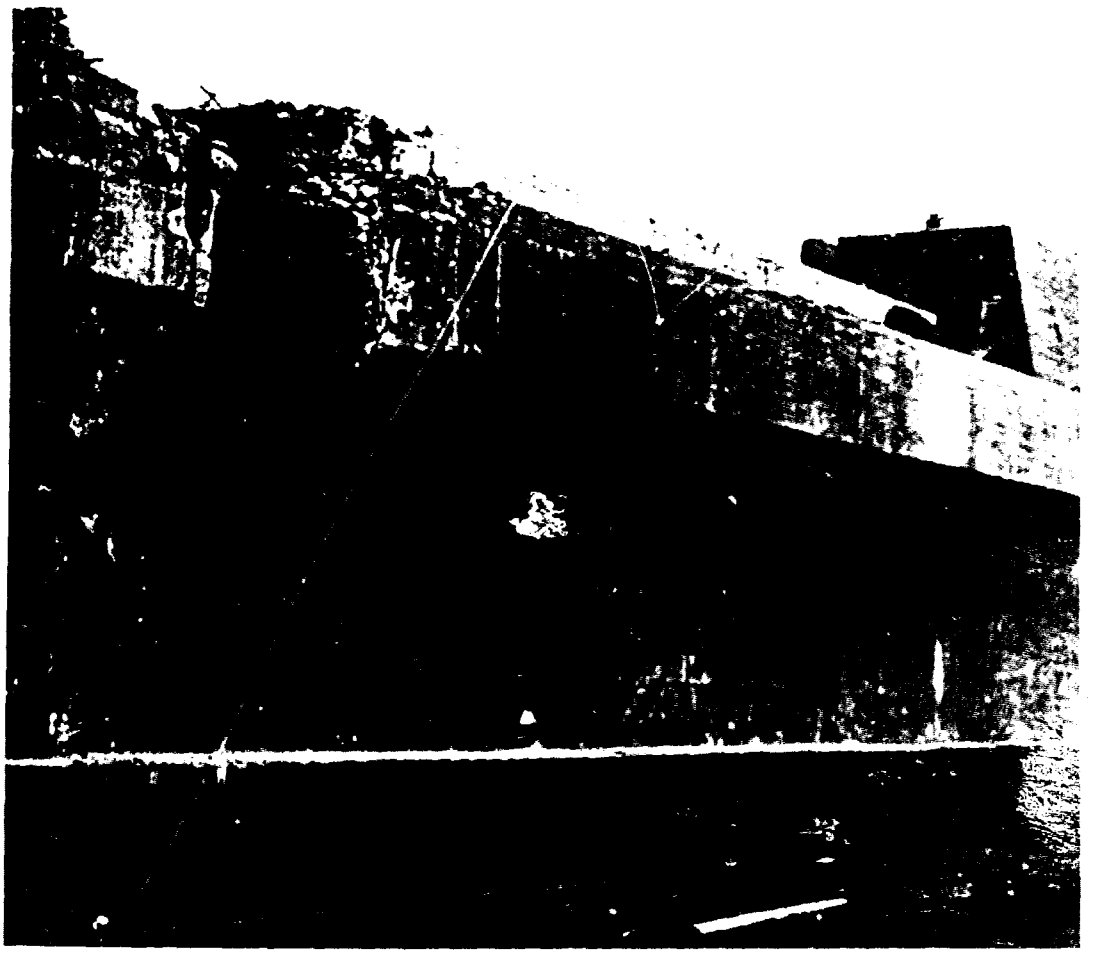
[29]Arthur B. Ferguson, "The War Against the Sub Pens," *The Army Air Forces in World War II*, Vol 2, p 245.

[30]Ferguson, "The War Against the Sub Pens," p 254. The U-boat commander cited was Grand Admiral Karl Doenitz.



Bomb Damage to U-Boat Pens at Brest, France.

This photo is from the report of the Physical Damage Division of the U.S. Strategic Bombing Survey. It shows one side of the U-boat pens at Brest, France. Visible is the exterior wall of Pen A with a flak tower at the far (righthand) corner of the roof. The area covered by the concrete roof was approximately 600 by 1,200 feet. By the time this submarine pen was attacked with 12,000-pound Tallboy bombs, the original 13-14 foot-thick roof had been increased to roughly 19 feet. The original roof and the added layer are both visible in the photo. The bomb damage to the edge of the roof (left of center) was caused by a Tallboy dropped on 12 August 1944 from an altitude of 17-18,000 feet with a fuse delay of 0.5 seconds.

to breach the Germans' submarine shelters.[31] Unfortunately, "by that time the antisubmarine war had been won, and by other means than strategic bombing."[32]

During the Gulf War, Coalition air forces encountered basically the same problem with some of the deeper Iraqi underground facilities. For example, the facilities at Taji in Iraq included a deep command bunker that was assessed to be beyond the penetration capabilities of the 2,000-pound BLU-109 warhead. A crash program was initiated to develop a 4,700-pound, laser-guided bomb using old artillery tubes as the casing for the munition. After a successful test drop from an F-111 on the range complex at Nellis Air Force Base, Nevada, two of these GBU-28 weapons were then delivered to the F-111F wing at Taif, Saudi Arabia, and one was successfully dropped on the Taji command bunker on Day 42 of the war.[33] Not only did the World War II problem of encountering targets that existing munitions could not penetrate reoccur in Desert Storm, but the same line of solution–building bigger bombs–was also followed.

Again, the problems of bomb damage assessment per se–whether old or new, anticipated or not–were not a primary focus of the present report. Some coverage of these perennial problems seemed necessary, nonetheless, for two reasons: first, to make the reader aware of the uncertainties affecting the present report stemming from GWAPS' inability to examine firsthand the bomb damage inflicted on most targets in Iraq during Desert Storm and, second, to lay the tactical foundation on which the broader problems of operational-strategic effectiveness rest.

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[31]Physical Damage Division, *Submarine Pens: Brest France* (Washington, DC: USSBS, 2d ed, Jan 1947), pp 6-7; Vannevar Bush, James B. Conant, and E. Bright Wilson, Jr., *Effects of Impact and Explosion*, Vol 1, *Summary Technical Report of Division 2, NDRC [National Defense Research Committee]* (Washington, DC: Office of Scientific Research and Development, 1946), p 449. The British also fielded a 22,000-pound bomb.

[32]Arthur B. Ferguson, "Over Germany." *The Army Air Forces in World War II*, Vol 2, p 316.

[33]Col Richard S. Mather, 57th Test Group, briefing to GWAPS on 57th's mission and contributions during Desert Storm, Nellis AFB, 28 Jan 1992; GWAPS Missions Database; DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, p 165-166.

Distinguishing Effectiveness from Effects

Generally speaking, the effectiveness of air power has been more difficult to assess than that of surface forces. There are, after all, certain elementary differences between seizing, controlling, or defending a piece of terrain with land forces and the comparatively fleeting, harder-to-measure consequences, direct as well as indirect, of air attacks against a target, or set of targets, over time. Territory seized or successfully defended, especially by an army, can be readily depicted on a map. There is also a sequential, step-by-step pattern evident in surface campaigns such as the U.S. drive westward across the central Pacific during World War II or the advance of allied forces from the beaches of Normandy into central Germany during the period June 1944-May 1945.[34] Such campaigns consist of a series of discrete and sequentially interdependent steps leading to the overall objectives. From a strategic standpoint, each step in the sequence can be grasped ahead of time, appraised in terms of its expected results, weighed against objectives, and, once taken, used as a basis for determining the next step in the sequence.[35] For these reasons alone, the basic accomplishments and unfolding of surface campaigns aimed at seizing, controlling, or holding territory have tended to be comparatively clear-cut and readily understandable, even to observers lacking in military experience.

By contrast, the cumulative ramifications of trying to achieve operational-strategic objectives by striking various sets of targets deep in enemy territory, possibly hundreds of miles or more behind the front lines and at diverse points in time and space, have seldom been direct, clear-cut, or obvious. As Adm. Joseph Wylie originally observed in 1952, there is a different strategic pattern in what he termed "cumulative" campaigns such as the strategic bombing of Nazi Germany in World War II or the Western allies' struggle against the German U-boats in the north Atlantic during 1940-1943.[36] In such cases, the overall or "cumulative" result is made up of a collection of lesser actions, many of which may not be sequentially interdependent and whose contributions to the overall result

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[34]Rear Adm Joseph C. Wylie, "Excerpts from *Military Strategy: A General Theory of Power Control*," *The Art and Practice of Military Strategy*, ed George Edward Thibault (Washington, DC: National Defense University, 1984), p 200.

[35]*Ibid.*

[36]*Ibid*, pp 200-201.

sought seem much harder to evaluate even long after the fact, much less to forecast in advance. During World War II, General "Hap" Arnold had considerable personal experience–and frustration–with these unruly characteristics of American strategic-bombing efforts. As he wrote afterwards in his third report to the Secretary of War:

> The real effect of our strategic air assaults, unlike that of tactical air attack, was seldom immediately apparent. Its effect was more like that of cancer, producing internal decay ultimately resulting in death.[37]

These problems of comprehending and assessing the broader achievements of strategic bombardment lay at the heart of the disputes, which have persisted right down to the present day, over the findings of the U.S. Strategic Bombing Survey (USSBS). As David MacIsaac, perhaps the foremost historian of the original survey, has written, what its directors and sponsors hoped to find was "some precise measurement of the *effectiveness* of strategic bombing as an instrument of final victory"; what they actually found, and had to settle for, however, was a measure of "*effects* rather than effectiveness."[38] The reasons for this untidy outcome can be readily comprehended in the following thought experiment:

> Suppose a decision is made to take out a plant producing ball bearings; suppose one hundred bombers are despatched and succeed in utterly demolishing the plant. So far as the commanders and crews are concerned, the effectiveness of this mission is taken for granted to be 100 percent–the given target was attacked and destroyed. But suppose, also, that the ball bearing output of the destroyed plant is never missed by the enemy throughout the remainder of the war–either because of huge stockpiles or alternative sources of supply. In such a case, the effectiveness of the mission in speeding up victory drops to zero; indeed, the question then arises, when one asks how the one hundred sorties might otherwise have been applied, whether or not the mission's effectiveness should be described as a negative (or minus) value.[39]

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[37]Arnold, "Third Report to the Secretary of War by the Commanding General of the Army Air Forces," 12 Nov 1945, p 457.

[38]David C. MacIsaac, *Strategic Bombing in World War Two: The Story of the United States Strategic Bombing Survey* (New York: Garland, 1976), p 161.

[39]*Ibid*, pp 161-62.

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In short, the more direct, physical, or immediate *effects* of a given mission or series of missions are one thing. But their operational or strategic *effectiveness* can, for complex reasons that may not even be immediately obvious to the airmen who planned or flew the sorties in question, be altogether different.[40]

This worry about effectiveness versus effects is not a matter of mere academic concern. Explicit instances of precisely the sort of problem described by MacIsaac occurred during the Gulf War. The Umm al Aish radio-relay facility in Kuwait is perhaps the clearest case in point. Based on postwar examination by an Air Force ground team, the facility, including its two large satellite dishes, was heavily damaged by Coalition airstrikes during the war. However, the ground team concluded that the facility had been stripped of essential equipment *prior* to being hit. The giveaway was that in the control building, the marks made when the Iraqis pulled the disconnected electronics gear out through holes cut in the building's walls were *underneath* all the bombing debris.[41] It is unknown as to whether the facility was stripped before the beginning of the air campaign on 17 January 1991. But the physical evidence at the Umm al Aish, along with wartime reconnaissance imagery, makes it clear that the facility ceased functioning prior to being bombed.

From an effectiveness standpoint, it may be tempting to conclude at once that this facility need never have been bombed. The argument would be that doing so not only wasted sorties and unnecessarily risked crews and their aircraft but destroyed a facility that the Kuwaitis would probably have preferred kept intact. Like most real-world cases, however, the situation is not that clear-cut–not even in retrospect. One possibility would be that the likelihood of Coalition air forces attack Umm al Aish prompted the Iraqis to strip the site prior to it being hit by Coalition aircraft. If so, then the prospect of bombing could be interpreted as

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[40]In general, the criteria that drove aircrew reports of *successful* versus *unsuccessful* results on individual missions during Desert Storm focused on whether the aircrews involved had met specified release parameters relative to assigned aim-points. The correlation between these reports and even the direct effects sought against particular targets was not always strong.

[41]Review of videotape taken inside the Umm al Aish radio-relay facility with Lt Col Howey, who was a member of the team that inspected this facility after the war, 10 Aug 1992.

having imposed a form of virtual attrition on the Iraqis, and the net effectiveness of Coalition strikes against the site would not necessarily be zero, much less a negative value. But an alternative interpretation would be that the Iraqis simply looted the site for its equipment independent of the threat pose by Coalition air forces.

Besides illustrating some of the more subtle difficulties of assessing operational or strategic effectiveness, the ostensibly "unnecessary" Coalition airstrikes against the Umm al Aish radio-relay facility suggest at least two broader points. First, while judging the relatively direct effects of particular sorties or missions in actual situations is hard enough, evaluating operational-strategic effectiveness appears even harder. Second, the notion of virtual attrition suggests that any adequate assessment of effectiveness will need to consider the widest possible range of indirect and second-order consequences.

The April 1942 raid on Japan led by Lt. Col. James H. Doolittle illustrates both virtual attrition and second-order strategic consequences. On the morning of 18 April 1942, sixteen B-25s were launched from the carrier *Hornet* at a distance of around 700 nautical miles from Tokyo.[42] The B-25s, each armed with four 500-pound bombs and machine guns, attacked a variety of targets, including military barracks, docks, and factories, in Tokyo and other Japanese cities.[43] Fifteen of the planes are believed to have dropped their demolition and incendiary bombs on Honshu, and some strafed targets as well. But the damage inflicted by these aircraft was neither extensive nor militarily significant. A school was "inadvertently struck, and a total of twelve people killed, fifty houses

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[42]Kramer J. Rohfleisch, "Drawing the Battle Line in the Pacific," *The Army Air Forces in World War II*, ed Craven and Cate, Vol 1, *Plans and Early Operations: January 1939 to August 1942* (Washington, DC: US Government Printing Office, 1983 imprint of 1948 original), p 441. Note that the use of the Doolittle raid first appeared in James G. Roche and Barry D. Watts, "Choosing Analytic Measures," *The Journal of Strategic Studies*, Jun 1991, pp 184-191.

[43]"Assessment of Damage–Tokyo Raid," Alfred Simpson Historical Research Center, Maxwell AFB, AL, File 142.034; also, from same file, "Special Aviation Project No. 1," pp 33-34 and memorandum concerning the Doolittle raid to Gen Arnold from Col A. W. Brook, Jr., 1 Oct 1943, pp 9-10.

Bomb Damage to Umm al Aish Radio-Relay Station In Kuwait. The top photo shows the interior of the control facility at Umm al Aish. The bomb debris observed by Lt. Col. Howey's team on top of the marks made when the Iraqis removed the electronic equipment from this facility indicated that it had been rendered inoperative *before* it was bombed. The left photo shows bomb damage to one of the two large satellite reception antennas at the Umm al Aish ground station. These dishes, over 100 feet in diameter, were too large to be moved before the facility was bombed, although two smaller dishes were removed.

and shops demolished, and the bow of a warship [the carrier *Ryuko*] in drydock damaged."[44] Judged by such criteria as directly destroying any appreciable amount of Japanese combat power or eliminating a vital element in Japan's war industry, the raid was ineffective. Indeed, balanced against the fact that the U.S. Pacific Fleet had to sail two of its four remaining aircraft carriers into Japanese waters in order to bring Doolittle's B-25s within range, it is possible to argue that the raid, though daring, was "not commensurate" with the risk.[45]

Nonetheless, in hindsight, the Doolittle raid proved remarkably effective in other, less obvious but far more important ways. Besides raising American morale in the dark days immediately after the Japanese attack on Pearl Harbor, it produced long-term effects on Japanese forces and strategy. As the official Japanese history of the Second World War has concluded, Doolittle's raid caused Japanese military leaders to lose face because they had promised that the home islands would *never* be bombed; led to diversions of Japanese forces; prompted the Japanese army to jump on the bandwagon for the planned Midway operation, at which the Japanese navy would suffer a major strategic defeat; and, aligned the Imperial General Headquarters unreservedly behind the Combined-Fleet's Midway-Aleutians plan, which later resulted in a further dilution of Japanese naval strength at the crucial battle of Midway.[46] Thus, the second-order psychological and strategic consequences of the April attack on the Japanese home islands by Doolittle's sixteen B-25s were far-reaching and profound.

By comparison, the Coalition's attacks on the Umm al Aish radio-relay station during the Gulf War did not manifest anywhere near as profound a gap between effects and effectiveness as is evident in the Doolittle raid. A case from Desert Storm that does manifest such a gap is the Coalition's wartime efforts to eliminate Iraq's nuclear weapons program with bombing. The objective, in this instance, was quite differ-

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[44]Rear Adm Edwin T. Layton with Capt Roger Pineau and John Costello, *"And I Was There": Pearl Harbor and Midway–Breaking the Secrets* (New York: Quill, 1985), p 387.

[45]*Ibid.*

[46]*Senshi Sosho [War History Series]* (Tokyo: Defense Headquarters History Office) as paraphrased in Layton, Pineau, and Costello, *"And I Was There,"* pp 387-388.

ent from that presumably pursued at Umm al Aish. Whereas the radio-relay station was attacked in order to cut Iraqi communications *during* the conflict, Coalition attacks on targets like the Al Tuwaitha Nuclear Research Center were intended to inhibit Iraqi efforts to field an initial nuclear device *after* the war. As a result, the possibility of a functional kill against the intended target system without physically eliminating necessary program elements--isotope-separation equipment, weapons-grade nuclear material, key scientists and engineers, etc.--was essentially nil. As long as the requisite pieces remained in existence and under Iraqi control, the program, even if temporarily disrupted, could be put back together.

To get a sense of the effectiveness problem that emerged regarding the attacks on the Iraqi nuclear-weapon program, it will suffice to examine what occurred at Al Tuwaitha. Located seventeen miles southeast of Baghdad, Al Tuwaitha was the most well known nuclear-research facility in Iraq. Surrounded by a massive earthen berm and security fences, this complex contained over eighty buildings, structures, and facilities. It was first attacked by the Iranian Air Force in late September 1980; a second strike was carried out by the Israeli Air Force on 7 June 1981.[47] The Israeli attack was by far the more effective of the two. The pilots of the attacking Israeli F-16s put fifteen of sixteen 2,000-pound Mk-84 high-explosive bombs through the dome of the French-built Osirik reactor, and the Iraqis did not subsequently rebuild it.

The 1981 Israeli attack against the Osirik reactor ended Iraqi hopes of fielding a nuclear weapon during the 1980s. However, it also had at least one second-order consequence that would prove less benign during Desert Storm. Recognizing that key weapons programs and military capabilities were vulnerable to accurate bombing, the Iraqis subsequently initiated a national program to reduce such vulnerabilities in the future.[48] Embracing Soviet *maskirovka* doctrine (meaning the aggregate of camouflage, concealment, masking, and deception measures aimed at misleading the

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[47]"Iron Bombs Used in Iraq Attack," *Aviation Week & Space Technology*, 15 Jun 1981, p 32.

[48]Air Directorate, Iraqi Air and Air Defense Command, "Study and Analysis of the Zionist Raid on the Tammuz Nuclear Reactor," in Arabic, 9 Jul 1981. This document contains the lessons that the Iraqis drew from the Israeli attack on the Osirik reactor in June 1981.

adversary about friendly capabilities, plans, and dispositions[49]), the Iraqis took systematic steps to achieve passive protection against bombing, including developing false targets and decoys, dispersing some capabilities to facilities that lacked the obvious signatures of a facility like Al Tuwaitha, and building in redundancy by pursuing parallel developmental paths and buying duplicates of key pieces of equipment.[50]

[DELETED][51] Al Tuwaitha assumed sufficient urgency in the minds of Coalition air planners to warrant attacks by F-117s on the second night of Desert Storm. Over the course of the forty-three day campaign, various structures and aim-points within the complex were attacked on more than a dozen occasions. While most of the strike packages involved consisted of small numbers of F-117s dropping 2,000-pound laser-guided bombs at night, one large package of some fifteen F-111Fs (also dropping precision-guided munitions) was sent against Al Tuwaitha on the night of ATO Day 19 (although only a few actually dropped), and some daytime attacks were carried out during the first week of the war by F-16s dropping unguided munitions.[52]

The physical damage inflicted by these strikes on nuclear and other weapons facilities at Al Tuwaitha was, for the most part, precise and heavy enough to damage seriously, if not destroy, the targeted structures. These assessments of bomb damage were supported during the war by videotapes from F-117s and F-111Fs that attacked Al Tuwaitha, as well as by poststrike imagery from various reconnaissance systems. After the

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[49]Marshal N. V. Ogarkov, chairman main editorial board, et al, *Voyennyi entsiklopedicheskii slovar' [Military Encyclopedic Dictionary]*, (Moscow: Voyennoye Izdatelstvo, 1983), p 430; Foreign Broadcast Information Service, *Military Encyclopedic Dictionary*, JPRS-UMA-86-010-L, Vol 5, *M-N*, 15 Jul 1986, p 1774. DIA eventually confirmed the presence of Arabic translations of standard Soviet *maskirovka* manuals in Iraqi hands.

[50]It should be remembered that these measures were enacted during the Iraqi war with Iran

[51](S/NF/WN) AFIA/INKS, "Point Paper on Iraq--The Tuwaitha Nuclear Facility," 6 Sep 1990, CI, folder for target C11.

[52]GWAPS Missions Database.

war, on-site inspections conducted by International Atomic Energy Agency (IAEA) teams operating under United Nations (UN) Security Council resolution 687 (1991) added conclusive confirmation of heavy damage to targeted structures and the reactors at Al Tuwaitha.[53]

In light of such well-confirmed physical damage, how could there be any significant gap between effects and effectiveness? The short answer is that vital elements like electromagnetic isotope separation components and even nuclear materials themselves, which U.S. air campaign planners hoped to destroy inside buildings at complexes like Al Tuwaitha, were probably removed either before they were subjected to Coalition bombing or soon after they were initially attacked.[54] The strongest confirmation of this conclusion came from what was learned about the nature and extent of the Iraqi nuclear program by IAEA inspectors operating under UN auspices after the war. Besides capturing Iraqi documents detailing scope and extent of the prewar program, United Nations inspectors encountered clear and recurring efforts by the Iraqis after Desert Storm to conceal and preserve those elements that survived the fighting. In one instance, the Iraqis hid reactor fuel by driving it around a reactor site on a truck about two hundred yards ahead of the UN inspectors; at Al Atheer, a facility whose involvement in Iraq's nuclear program was not suspected by Coalition air planners until after the fighting began,[55] the Iraqis went so far as to tear out concrete floors and electrical hookups to prevent the inspectors from determining which machines had been used there.[56]

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[53]International Atomic Energy Agency, "Consolidated Report of the First two IAEA Inspections under Security Council Resolution 687 (1991) of Iraqi Nuclear Capabilities," report S/22788 (English), 11 Jul 1991, p 5.

[54]"Consolidated Report of the First two IAEA Inspections under Security Council Resolution 687 (1991) of Iraqi Nuclear Capabilities," 11 Jul 1991, p 5; IAEA, "Report on the Seventh IAEA On-Site Inspection in Iraq under Security Council Resolution 687 (1991)," report S/23215 (English), 14 Nov 1991, p 21. [DELETED]

[55]Al Atheer was not in the Black Hole's master target list on the opening day of the war [(TS/LIMDIS) BH, Master Target Folder, Box 2, Folder 23, master target list dated 1/16/91]. It was eventually picked up as C-30, a "suspected" nuclear research center near Baghdad.

[56]Gary Milhollin, "Building Saddam Hussein's Bomb," *New York Times Magazine*, 8 Mar 1992, pp 30 and 32.

In hindsight, therefore, the causal linkage between heavy physical damage to structures at places like Al Tuwaitha and Iraq's postwar capability to develop nuclear weapons was not as straightforward as Coalition air planners assumed going into the war or as poststrike imagery seemed to indicate during the conflict. To a surprising extent, air strikes against identifiable nuclear facilities like Al Tuwaitha amounted to bombing fixed structures from which the real objects of the attacks had almost certainly been removed or had been duplicated in one way or another elsewhere. Granted, Coalition air strikes probably managed to inflict serious inconvenience on Iraq's nuclear-weapons program by causing the people involved, along with the key equipment, records, and nuclear materials, to be dispersed and hidden. Yet it also seems relatively certain, given what UN inspectors have uncovered in Iraqi since the war, that Coalition bombing failed to achieve the desired effectiveness against the Iraqi nuclear program as a target system.

To reiterate, effects are quite different from effectiveness, especially at the operational-strategic level. Determining the effects of bombing in actual situations is hard enough; assessing operational-strategic effectiveness is even harder.

The CBO as a Benchmark

The remainder of this section will consider how air-power effectiveness has been assessed in past conflicts. The aims will be twofold: first, to develop some historical benchmarks and, second, to highlight some of the dissimilarities between the Desert Storm and earlier air campaigns such as the Combined Bomber Offensive (CBO). Because the U.S. Strategic Bombing Survey provided the model for the present survey, it seems especially apropos to look first at how the strategic bombing of Nazi Germany was assessed.

As already mentioned, the aggregate effects of American and British bombing on German war production lie at the heart of most assessments–as well as most disputes–regarding air power's effectiveness in the European theater during World War II. Broadly speaking, what the USSBS' Economic Effects Division found was that as the tempo and scale of bombing rose, German war production, far from declining, continued to increase well into late 1944.

The summary statistics bearing on the case of German aircraft production–Galbraith's "terrible figures"–are shown in Table 2. Since it was the German fighter arm that most concerned allied air commanders from mid-1943 through mid-1944, the monthly breakout for fighter production for 1944 is shown in Table 3. As can be seen, German fighter production peaked at 3,375 aircraft in September of that year. In fact, the figure for December 1944 (2,630 fighters), while down from the September peak, was still better than double the highest monthly total for any prior year (1,181 in October 1943).[57]

Two principal conclusions were drawn from these data in the overall report of Galbraith's economic effects division. The first was that the direct bombing of the German aircraft industry had not only destroyed some production capacity but, by stimulating rationalization and expansion, had "also increased it."[58] In other words, the direct destruction of capacity had been more than offset by rationalization and expansion elsewhere in the system. The second conclusion was that a lack of trained pilots, precipitated in part by the bombing of German oil production, had been mainly responsible for the decline in the fighting power of *Luftwaffe*'s fighter arm by the late spring of 1944; hence, the bombing effort to reduce aircraft output after the early months of 1944 had been "excessive" and "of little consequence."[59]

Does the fact of rising German aircraft production throughout most of 1944, despite roughly a fifteen-fold increase in the weight of

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[57]Galbraith, et al, *The Effects of Strategic Bombing on the German War Economy*, Appendix Table 102, p 277.

[58]Galbraith, p 157.

[59]*Ibid*, pp 159 and 162.

Table 2
German Aircraft Production 1939-1944[60]

Year	Fighter	Bomber	Transport	Trainer	Other	All Types
1939	1,856	2,877	1,037	1,112	1,413	8,295
1940	3,106	3,997	763	1,328	1,632	10,826
1941	3,732	4,350	969	889	1,836	11,776
1942	5,213	6,539	1,265	1,170	1,369	15,556
1943	11,738	8,589	2,033	2,076	1,091	25,527
1944	28,926	6,468	1,002	3,063	348	39,807
Totals	**54,571**	**32,820**	**7,069**	**9,638**	**7,689**	**111,787**

Table 3
German Fighter Production, 1944[60]

January	1,555	May	2,212	September	3,375
February	1,104	June	2,449	October	2,973
March	1,638	July	2,954	November	2,995
April	2,021	August	3,020	December	2,630

[60] *Ibid*, p 277. Not evident in Galbraith's "terrible numbers" are certain facts that mitigate their impact. Recent research has revealed that, by 1942, significant portions of German fighter production actually consisted of combat-damaged aircraft that had been returned to the factory for rehabilitation (Williamson Murray, "The Role of German Battle Damage Repair in the Luftwaffe's Conduct of the Second World War," Logistics Management Institute, Report RE602P1, Feb 1988, pp 2 and 15). Also, as late as 1944, portions of Germany's "new" fighter production were still being exported to various allies (*ibid*, p 23).

daylight bombing against the German aircraft industry compared to 1943, show that strategic bombing was *ineffective* in achieving daylight air superiority?[61] Certainly the statistical data uncovered by the USSBS show that daylight bombing did not have the *direct* effect, as envisioned by the CBO air planners, of cutting–or even seriously impeding–the production of replacement aircraft for *Luftwaffe* fighter and bomber units during 1944. Yet daylight air superiority was achieved over northern Europe prior to the Normandy landings. The crucial "bottleneck" proved to be, as Galbraith's report noted, not aircraft production but the Germans' inability to replace pilot losses with individuals having sufficient skill and training to compete with their allied opponents, especially those flying the long-legged P-51. As *General der Jagdflieger* and fighter ace Adolf Galland declared in a wartime report to the Reich Air Ministry, between January and April 1944 over 1,000 daytime fighter pilots had been lost, including some the *Luftwaffe*'s best squadron, *Gruppe* and *Geschwader* commanders, and each American incursion was costing some 50 aircrew if opposed.[62]

Daylight air superiority, then, which was the primary objective of the American strategic air forces from June 1943 to April 1944, was achieved not by bombing alone but by a combination of factors whose relative contributions are impossible to untangle and quantify individually. The B-17s and B-24s, by attacking selected targets like the German aircraft industry, forced the *Luftwaffe* to come up and try to defend the skies over Germany. In the long run, the Germans had no choice but to preserve their aircraft industry, and the heavy attacks during February 1944 precipitated a major dispersal of the industry. At the same time, the appearance of the P-51 enabled escort of the bomber formations all the

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[61]Col Carl H. Norcross, ed, *Aircraft Division Industry Report* (Washington, DC: USSBS, Jan 1947), summary graphic entitled "The German Aircraft Industry under Allied Air Attack." The majority of the bomb tonnage dropped on the German aircraft industry in 1944 by the US 8th and 15th Air Forces was delivered in the months of February, April, and August; bomb tonnage delivered during the first half of 1944 alone exceeded the total delivered by American bombers during all of 1943 by almost an order-of-magnitude (*ibid*).

[62]Cajus Bekker, *The Luftwaffe War Diaries*, translation by Frank Ziegler (New York: Doubleday, 1968) Chapter 1, p 351. Galland shot down just over 100 allied planes in the West during World War II [Edward H. Sims, *The Greates. Aces* (New York: Harper and Row, 1967), pp 189 and 277]. More recent examination of German records indicates that the *Luftwaffe* lost over 2,250 fighter pilots to all causes during the period January-May 1944 [Williamson Murray, *Strategy for Defeat: 1933-1945* (Maxwell AFB, AL: Air University Press, 1983). p 240].

way to the target by a fighter that was able to hold its own with the latest-model ME-109s and FW-190s. And, starting in January 1944, General Doolittle, then the Eighth Air Force commander, had ordered his fighters to go on the offensive rather than being tied to the bomber stream.[63] By March 1944, it was not uncommon for Eighth Air Force alone to put more than eight hundred P-38s, P-47s, and P-51s into the air over Germany on a single day, including 100-200 P-51s.[64] These fighters not only began enjoying greater success protecting the bombers but increasingly pursued the German fighters on the ground, by strafing their airfields, as well as in the air. Coupled with American attacks on German oil production, which by June 1944 had produced a precipitous drop in German production and stocks of aviation fuel,[65] it is easy see why German pilots, not German aircraft production, became the key to the battle for daylight air superiority in the spring of 1944.

The principal points that emerge from the Combined Bomber Offensive regarding operational-strategic effectiveness in Desert Storm would appear to be, for the most part, cautionary ones. Major operational-strategic results such as achieving daylight air superiority over Germany by May 1944 have rarely been the outcome of a *single* cause or condition. More generally, they have been the result of a *set* of conditions that, collectively, proved necessary and sufficient at a particular point in history and under specific historical circumstances. It is for this reason that the failure of daylight, precision bombing to arrest German aircraft production in the first half of 1944 does not necessarily entail the conclusion that daylight, precision bombing was ineffective in helping to achieve daylight air superiority over northern Europe. The doctrinal ideal of running the *Luftwaffe* out of airplanes by bombing the German aircraft industry was not achieved. Yet, in the end, another route to victory was patched together from the diverse possibilities and elements at hand–one which leaned more heavily on fighters than had prewar doctrine. Did

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[63]Both Doolittle and Galland considered Doolittle's decision, taken in January 1944, to unleash 8th Air Force's fighters to have been the key to the allies' achievement of daylight air superiority over Germany prior to the Normandy landings [Lt Gen James H. Doolittle with Col Beirne Lay, Jr., "Daylight Precision Bombing" in *IMPACT: The Army Air Forces' Confidential Picture History of World War II*, ed James Parton (Harrisburg, PA: Historical Times, 1979), Vol 6, pp xiii and xv].

[64]Roger A. Freeman, with Alan Crouchman and Vic Maslen, *Mighty Eighth War Diary* (New York: Jane's, 1981), pp 195, 197, 202, 203, 206, 207 and 210.

[65]*Oil Division Final Report* (Washington, DC: USSBS, 2d ed Jan 1947), Figures 2 and 3.

bombers or fighters make the greatest contribution to achieving daylight air superiority? The question is meaningful only if the relative contributions of each can be clearly separated. But they cannot be disentangled, and therein lies the point.

The other cautionary implication of the CBO case concerns indirect effects. Bombing the German aircraft industry had the indirect effect of tying up more and more wartime armament output in the production of defensive fighters that, due to the growing lack of skilled pilots, could not be effectively employed. When viewed in terms of this indirect effect, with its attendant opportunity costs, the production figures in Table 3 begin to take on a rather different meaning than they have when viewed strictly in terms of planned, direct effects. As Burton Klein, who served as Galbraith's deputy in the Survey's Economic Effects Division, wrote well after the war:

> The pre-invasion air raids, however, did affect the German war effort—and in a manner which has been little commented on even since the war. This was in causing the Germans to devote a very significant part of their war production effort and also a large number of highly trained military personnel to air defense. From 1942 to the first half of 1944 expenditures on air defense armaments—defensive fighter planes and their armament, antiaircraft weapons, and ammunition—nearly tripled, and at the time of the invasion amounted to about one third of Germany's entire munitions output. Indeed, in mid-1944 production of air defense armaments was at a higher level than was munitions output as a whole at the time Germany went to war with Russia. It can be seen, therefore, that where the pre-invasion attacks really paid off was not nearly so much the damage they did, but rather in the effect they had on causing the Germans to put a very significant part of their total war effort into air defense.[66]

The issue of adequately reflecting such indirect effects and second-order consequences is a major challenge for the present report if the focus is to be on operational-strategic effectiveness rather than effects. What makes this goal so challenging is the short amount of time that has passed since Operation Desert Storm officially ended. It is probably too soon after the events themselves to hope that a survey could capture all of the indirect effects and second-order consequences relevant to judging operational-stra-

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[66]Burton H. Klein, *Germany's Economic Preparations for War* (Cambridge, MA: Harvard University Press, 1959), pp 232-33.

tegic effectiveness. Nevertheless, given the neglect of such effects in parts of the World War II survey, it seemed incumbent to try.

Operation Linebacker II

The Linebacker II offensive of 18-29 December 1972 offers another useful benchmark for the present survey because of its broad similarities to the Desert Storm air campaign. In contrast to the gradualism of the protracted Rolling Thunder phase of the U.S. air war against North Vietnam (2 March 1965 to 31 October 1968[67]), Linebacker II involved a relatively brief but intense application of force in pursuit of fairly clear cut political objectives. It was also a round-the-clock campaign; the daylight force relied on F-4s and A-7s to carry out airstrikes against targets in North Vietnam, the night force on F-111s and B-52s.[68] In addition, Linebacker II saw some use of laser-guided munitions by U.S. Air Force F-4s, and targets were not exempted from attack during Linebacker II because they were located in or near the cities of Hanoi and Haiphong.

Like Desert Storm, Linebacker II grew out of overt territorial aggression. By January 1972, only 139,000 Americans remained in Vietnam, and that number would fall to 69,000 by April.[69] Sensing victory, General Vo Nguyen Giap launched, on 30 March 1972 (the Thursday before Easter), the initial prong of what developed, by late April, into a three-prong, twelve-division invasion of the South. The initial prong of this Easter offensive sent three North Vietnamese divisions, backed by 200 tanks and 130-mm heavy artillery, smashing directly across the Demilitarized Zone into South Vietnam's Military Region I.[70]

U.S. efforts during April to thwart this attack with air strikes (Operation Freedom Train) neither prevented nor dissuaded Giap from going ahead with the third prong of his offensive, a multidivision attack against Kontum, on 24 April 1972. By the beginning of May, the provincial

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[67]Gen William W. Momyer, ed Lt Col A. J. C. Lavalle and Maj James C. Gaston, *Air Power in Three Wars (WWII, Korea, Vietnam)* (Washington, DC: Government Printing Office, 1978), pp 18 and 29.

[68]Karl J. Eschmann, *LINEBACKER: The Untold Story of the Air Raids over North Vietnam* (New York: Ballantine, 1989), p 79.

[69]Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: The Free Press, 1989), p 149.

[70]*Ibid*, pp 152-153.

capitol of Quang Tri was in North Vietnamese hands, and, as national-security advisor Henry Kissinger later commented, it was evident that the North Vietnamese felt that they were so close to victory that they "no longer needed even the pretense of a negotiation."[71] This realization led directly to the Linebacker I air campaign (10 May to 23 October 1972). When President Richard Nixon suspended bombing above the 20th parallel, Linebacker I, together with mining of North Vietnam's ports, tactical air support in the South, and stiffening South Vietnamese resistance, had defeated Hanoi's conventional offensive and dramatically changed the atmosphere at the negotiating table.

Serious negotiations again ensued, accompanied by sporadic American bombing as the peace talks dragged on through the U.S. presidential election of 1972. During November 1972, B-52s flew almost 850 sorties against logistic and interdiction targets in the panhandle region of North Vietnam below the 20th parallel.[72] Nonetheless, negotiations broke down again on 13 December when the North Vietnamese suspended the deadlocked discussions and returned to Hanoi.[73] Faced with the likelihood that the newly elected Congress would tie his hands even further on Vietnam once it convened in January 1973, Nixon concluded that he had no choice but to resort again to military force. In a meeting on 14 December 1972 with Kissinger and (then) Maj. Gen. Alexander Haig, Kissinger's military assistant, Nixon sided with Haig's suggestion to resume large-scale B-52 strikes north of the 20th parallel on the grounds that anything less would "only make the enemy contemptuous."[74] The President then sent an ultimatum to the North Vietnamese to begin negotiating "seriously" or else; simultaneously he directed the chairman of the Joint Chiefs of Staff, Adm. Thomas Moorer, "to prepare massive air attacks against railroads, power plants, radio transmitters, and other installations around Hanoi as well as docks and shipyards in Haiphong."[75]

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[71] *Ibid*, p 156.

[72] Eschmann, *LINEBACKER*, p 62.

[73] Stanley Karnow, *Vietnam: A History* (New York: Viking Press, 1983), p 652.

[74] Clodfelter, *The Limits of Air Power*, p 182.

[75] Karnow, *Vietnam: A History*, p 652. Nixon is reported to have told Admiral Moorer "I don't want any more of this crap about the fact that we couldn't hit this target or that one. This is your chance to use military power to win this war, and if you don't, I'll hold you responsible" (*ibid*).

The North Vietnamese failed to respond, and Linebacker II commenced on the evening of 18 December 1972 with strikes by over 120 B-52s and a smaller number of F-111s; these strike aircraft were supported with defense-suppression and MiG combat air patrol sorties by F-4s, F-105/F-4C Wild Weasels, and EB-66s.[76] Ignoring the thirty-six hour standdown from midnight on December 24th to midday on the 26th, the operation ran 11 days. Over 720 B-52 strikes were carried out together with another 640 by F-111s, F-4s, and A-7s; over 15,200 tons of bombs, of which roughly two-thirds were dropped by B-52s, were delivered on fifty-nine targets; around sixty-one percent of the strike sorties focused on railroad yards and military-storage facilities; and, thirty-nine U.S. aircraft were lost, including fifteen B-52s.[77] The North Vietnamese, for their part, expended over 1,200 surface-to-missiles and later reported an official total for civilian fatalities of 1,318 people in Hanoi and 305 in Haiphong.[78] Unable to defend their country against further airstrikes by 29 December 1972, isolated from outside support, and having suffered extensive damage to their military infrastructure, the leadership in Hanoi agreed to return to the peace talks. Goaded by further bombing in January 1973 against Giap's battered army and the threat of renewed heavy bombing in the North, the North Vietnamese signed what Nixon called "an honorable agreement" less than a month after the last day of Linebacker II.[79]

How much credit should be accorded Linebacker II per se for this outcome has been a matter of debate among scholars. Guenter Lewy has argued that air power can only claim credit for forcing a ceasefire, not for bringing about a settlement that seriously disadvantaged the North Vietnamese.[80] Mark Clodfelter, on the other hand, has argued that air power was effective because of the "very limited" nature of Nixon's objectives.[81] Robert Pape, while not disagreeing with Clodfelter's conclusion that air power worked in Linebacker II, has gone on to add that in nonnuclear conflicts, coercion "is likely to be a function of military vulnerability and

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[76]Eschmann, *LINEBACKER*, pp 91-110 and 195.

[77]*Ibid*, pp 196 and 202-203.

[78]Karnow, *Vietnam: A History*, pp 653 and 654.

[79]Clodfelter, *The Limits of Air Power*, pp 195 and 198-199

[80]Guenter Lewy, *American in Vietnam* (Oxford: Oxford University Press, 1978), pp 414-415.

[81]Clodfelter, *The Limits of Air Power*, pp 174 and 204.

will be largely unaffected by civilian vulnerability."[82] Rolling Thunder, in Pape's view, had failed because it did not seriously jeopardize Hanoi's military capabilities and chances of eventual military victory, whereas the Linebacker campaigns did. The difference was that in 1972 North Vietnamese military success hinged on a massive conventional invasion of the South that was vulnerable to air attack, whereas air power had been unable to pose a comparable threat to Viet-Cong guerrilla operations in the South or to Hanoi's support of them during Rolling Thunder.

These readings of air power during Vietnam in general, and the Linebacker operations in particular, suggest several points bearing on judgments about operational-strategic effectiveness in Desert Storm. The most obvious concerns objectives. As will become evident in Chapter 2, the objectives of the Desert Storm air campaign, while reasonably well defined, were more ambitious than Nixon's immediate goal of forcing a negotiated settlement in Linebacker II. The Coalition's aim of using bombing to constrain Iraq's postwar threat to its regional neighbors certainly sought more than merely driving an intransigent adversary back to the negotiating table, and assessments of effectiveness must take into account such objectives.

A related point is that results in war are never final.[83] As Lewy and Clodfelter have both pointed out, the settlement to the Vietnam War signed by Washington and Hanoi in January 1973 did not, and could not, necessarily guarantee the long-term survival of a non-Communist South Vietnam. Rather, all it bought the South was additional time,[84] and, in the end, the interval between 1973 and 1975 did not prove enough for Saigon to gain the wherewithal to repel another conventional onslaught by the North Vietnamese on its own. This sequel highlights, therefore, a major limitation of the present survey: namely, that the longer-term and more subtle ramifications of Desert Storm may not yet be knowable.

Nonetheless, Linebacker II may still offer the closest historical analog to the strategic portion of Desert Storm air campaign in 1991. To repeat what was said at the beginning of this section, Linebacker II involved a relatively brief but massive application of force in pursuit of fairly

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[82]Robert A. Pape, Jr., "Coercive Air Power in the Vietnam War," *International Security*, Fall 1990, pp 144-145.

[83]Clausewitz, *On War*, p 80.

[84]Clodfelter, *The Limits of Air Power*, p 202.

clear-cut political objectives; it was also a round-the-clock campaign and saw some use of precision munitions; and, the selection of targets was relatively unfettered by political constraints beyond minimizing civilian casualties and avoidable collateral damage.

The Beka'a Valley, June 1982

At first glance, it may be tempting to see strong parallels between the initial days of the Desert Storm air campaign and the coordinated surprise attacks executed by the air arm of the Israeli Defense Force (IDF) against Syrian SA-6 surface-to-air missile (SAM) emplacements in the Beka'a valley on 9-10 June 1982. In both instances, a largely American-equipped, highly trained air force executed a well-planned but complex attack that swiftly neutralized what was widely perceived to be a Soviet-style air defense system. Both attacking air forces had overwhelming success in achieving their immediate objective of neutralizing ground-based air defenses while suffering almost no losses, and both heavily dominated the air-to-air combat that followed, thereby achieving air superiority. From this perspective, the Beka'a in 1982 appears to be a historical antecedent, if not a dress rehearsal, for the first two days of Desert Storm. On closer examination, however, this seemingly obvious parallel breaks down in some important ways.

Perhaps the principal dissimilarity between Israel's Lebanon campaign of 1982 and that of the U.S.-led Coalition against Iraq in 1991 concerns the clarity and feasibility of the political objectives pursued in the two conflicts. The immediate trigger of the Israeli incursion into Lebanon was the shooting in London on 3 June 1982 of Israeli Ambassador Shlomo Argov.[85] The next day, 4 June, Israel conducted a major air attack against Palestinian Liberation Organization (PLO) positions in southern Lebanon and Beirut, which evidently caused little damage.[86] This air attack was followed, on 6 June 1982, by the initiation of a major ground offensive involving some nine divisions and several smaller units. By 25 June, when the ground offensive finally ended, the Israeli invasion force had begun what would prove to be a protracted and unsuccessful siege of Beirut, gained control of the Beirut-Damascus highway as far east as the city of Sofar, pushed back the Syrians, and begun a period of

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[85]M. Thomas Davis, *40 Km into Lebanon* (Washington, DC: National Defense University Press, 1987), p 75.

[86]*Ibid*, p 76.

occupation that would entail a considerable number of troops and ongoing Israeli casualties from insurgents in Lebanon until Shimon Peres announced a unilateral withdrawal in February 1985.[87] Yet, to this day the precise nature of the political goals that Israel had in mind when it launched the attack is far from clear. When all was said and done, the PLO, though displaced and shaken, was hardly destroyed; the chaos in Lebanon, far from having been contained or ended, was intensified and perpetuated; considerable strain was put on U.S.-Israeli relations as well as the hard-won Egyptian-Israeli peace treaty; the massive Syrian losses of military equipment were not only replaced by the Soviets, but Syrian dependence on the Soviets was strengthened by the presence of Soviet advisors; and popular discontent in Israel over the campaign in Lebanon, which included some senior members of the Israeli military, precipitated a crisis of confidence in the Israeli government itself.[88] By comparison, the preeminent political aim of the U.S.-led Coalition in 1991–to free Kuwait from Iraqi occupation–appears to have been a model of clarity and restraint in not asking too much of military force compared to the ill-defined, open-ended goals of Israel's 1982 invasion of Lebanon. Granted, the Coalition's campaign in 1991 had other political objectives than the overarching goal of forcing the Iraqis from Kuwait. Among other things, the Coalition also sought to use military force to limit Iraq's postwar military threat to its regional neighbors, and force alone did not prove as successful in destroying Iraq's nuclear, chemical, and ballistic-missile capabilities as was hoped. Nonetheless, the political aims of Desert Storm exhibit a degree of clarity of purpose and realism about the limits of military force not evident in the ambiguous political motivations that prompted the Israelis' plunge into the morass of Lebanon in 1982.

Are the parallels between the two campaigns stronger if the focus is restricted to their military aspects, particularly in the air? Even then, there remain important asymmetries in the scale and scope of these two cases, especially regarding the relative weight placed on air power versus ground forces.

The Israelis' defense-suppression problem in the Beka'a involved trying to neutralize or destroy some nineteen SA-6 batteries deployed at several locations on an agricultural plain some ten miles wide and twenty-

[87] *Ibid*, pp 97 and 104.

[88] *Ibid*, pp 103-104 and 116-119.

SA-2 Site south of Al Jaber air base in Kuwait.

As the photo indicates, this SAM site was heavily attacked. The Air Force (AF/XO) inspection team found evidence that the site had been hit with repeatedly with a number of different kinds of ordnance (including HARMS, Rockeye, CBUs, and bombs). Discussion with Brigadier Glen Profitt in Riyadh after the ground inspection revealed that the site had been attacked for a number of days in succession because the holders of electronic order of battle had not been able to confirm its destruction by electronic means.

five miles long and flanked on both sides by ridge lines up to 6,500 feet in height.[89] In terms of geographic size, this area is less than half of any one of the thirty "kill boxes" in the Kuwait Theater of Operations used by Coalition air forces during Desert Storm.[90] By most accounts, the Israelis employed a combination of systems, including unmanned decoys, ground- and air-launched antiradiation missiles, both cluster munitions and conventional high-explosive bombs delivered by fighter-bombers, and artillery, to carry out the initial suppression raid in the Beka'a on 9 June 1992.[91] Much like the Coalition's defense-suppression efforts on the opening night of Desert Storm, the Israelis' initial attack against the Syrian surface-to-air missiles was highly successful. The Israelis are

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[89]Benjamin S. Lambeth, *Moscow's Lessons from the 1982 Lebanon Air War* (Santa Monica, CA: Rand, Sep 1984), R-3000-AF p 6.

[90]Each KTO kill box was a square 30 nautical miles on a side.

[91]Lambeth, *Moscow's Lessons from the 1982 Lebanon Air War*, pp 6-7.

thought to have destroyed seventeen of nineteen SA-6 sites in about ten minutes without losing a single aircraft, and the remaining sites, after some overnight replenishment, were destroyed the following day.[92] Without in any way diminishing the Israelis' achievement, however, the scale and complexity of the operational task in the Beka'a in 1982 were of different orders of magnitude than the defense-suppression problem faced by Coalition air forces on the first night of Desert Storm. In terms of radar-guided SAMs alone, Iraq's air-defense and ground forces possessed around ninety SA-2/3/6/8 batteries, plus a similar number of French-made Roland launchers.[93] While these systems were mostly concentrated around major cities and strategic military targets, they were distributed over a country some five hundred miles in width and length, augmented by some five hundred radars at about one hundred locations, and tied together with a French-built command and control system (KARI) that included computer data links, fiber optic cables, and hardened underground control centers.[94]

Next, the strategic circumstances surrounding the air-to-air combat that followed the Israeli air strikes in the Beka'a in 1982 and the initial air strikes of Desert Storm in 1991 were also considerably different. True, in both cases U.S.-equipped air forces racked up heavily one-sided scores. Over Lebanon, the Israelis are thought to have shot down nearly sixty-five Syrian aircraft without any losses by midday on 10 June 1982.[95] And, by the end of the campaign, the Israelis pushed their air-to-air tally to an impressive, if not unprecedented, eighty-five kills for zero losses.[96] The official box score immediately after the Gulf War for the Coalition air forces against Iraq in 1991 was similarly impressive: thirty-three kills of fixed-wing Iraqi aircraft against no Coalition losses, with fourteen of the kills (including five MiG-29s) occurring within the first three days of the conflict.[97] Yet, the context in which the Iraqis fought in 1991 was alto-

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[92]*Ibid*, p 8; Davis, *40 Km into Lebanon*, p 90.

[93]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, pp 12, 109 and 177.

[94]"Transcript of McPeak Briefing on Air Power in Iraqi War," *Inside the Air Force*, 22 Mar 1991, p 13.

[95]Davis, *40 Km into Lebanon*, p 92.

[96]Lambeth, *Moscow's Lessons from the 1982 Lebanon Air War*, p 9.

[97]DOD, *Conduct of the Persian Gulf War: Final report to Congress*, p 160. Note that the Defense Department conceded in the fall of 1992 that one F/A-18 may have been lost to an Iraqi MiG-25 ("Iraqis May Have Downed U.S. Jet in War," *Washington Post*, 16

gether different from that in which the Syrians fought in 1982. In 1982, the world was still in the grip of the U.S.-Soviet Cold War, and the Syrians, as a Soviet client, could reasonably expect that their equipment losses would be quickly replaced by the Soviets, which they were. By 1991, the Cold War had ended and the Soviets had sided with the Coalition against their former Iraqi client. As a result, the seeming reluctance of the Iraqis to give the Coalition as much of a fight in air-to-air combat as the Israelis got from the Syrians in 1982 reflected not only Saddam Hussein's desire to emerge from the war with his air force largely intact due to its political value[98] but the changed strategic circumstances of the post-Cold War era as well. Consequently, direct comparisons of the box scores obscures a profound asymmetry in the strategic circumstances in which the Syrians and Iraqis fought.

Finally, there is the simple fact that Operation Peace for Galilee was predominantly a ground campaign that was officially begun when IDF ground forces, organized into three groupings under generals Amir Dori, Uri Simchoni, and Avigdor Ben Gal,[99] pushed across Israel's northern border into Lebanon on the morning of 6 June 1982. This campaign was well supported by air, and the military results achieved by Israeli air forces in and over the Beka'a were nothing short of spectacular. However, the spectacular results in the air on 9-10 June were in some ways a secondary aspect of the campaign, even though the Israelis undoubtedly viewed early control of the air as essential to being able to minimize their losses on the ground. By contrast, the Coalition's campaign of 1991 consisted almost entirely of air operations for the first thirty-nine days, and the timing of G-Day itself was originally planned on the basis of Coalition air power attaining specified attrition levels against the Iraqi field army in Kuwait. Further, the round-the-clock nature of the Coalition air campaign, the extensive use of precision-guided munitions, and the sortie levels sustained over a period of six weeks have no real parallels in Operation Peace for Galilee.

Sep 1992, p A22).

[98]Based on Iraqi behavior during the Iran-Iraq war, the Iraqi view of air power seems to have been that it was more important to possess an air force for its political and deterrent value than to risk losing it in combat to achieve operational objectives [Major Ronald E. Bergquist, *The Role of Airpower in the Iran-Iraq War* (Maxwell AFB, AL: Air University Press, 1988), p 75].

[99]Davis, *40 Km into Lebanon*, p 77.

The temptation to see strong similarities between Lebanon in 1982 and Iraq in 1991 stems, therefore, from comparing the defense-suppression and air-to-air elements of these two campaigns more or less in isolation from the broader circumstances in which these conflicts occurred The apparent similarities hinge on ignoring profound differences in political aims and context, strategic and military circumstances, as well as the scale, scope, and character of the two air campaigns. For these reasons, the Israeli incursion into Lebanon of 1982 does not appear, upon close examination, to provide more than a superficial benchmark for judging the effectiveness of Coalition air power in the Gulf War.

Summary

The main aims of this chapter were, once again, to describe the principal problems involved in judging operational-strategic effectiveness and to consider some of the historical benchmarks for such judgments that might be borrowed from past conflicts for purposes of this report. As we have seen, establishing clear causal linkages between air-to-air sorties or airstrikes and the more immediate, physical, or direct effects of those missions on enemy forces and targets under conditions of considerable uncertainty is hard enough. Connecting those more direct effects with their broader, longer-term, indirect, or second-order consequences, if any, in order to reach defensible judgments about operational-strategic effectiveness is even more challenging.

As for historical benchmarks, the closest precedents of those examined for assessing air power's effectiveness in Desert Storm appear to lie in the Linebacker II campaign of December 1972. The happy fit between ends and means in that conflict is certainly something to consider carefully in examining the Gulf War. Also, the temptation to apply effectiveness measures from earlier conflicts without regard to differences in context, scale, and circumstance would certainly be ill advised in light of the Combined Bomber Offensive and Lebanon in 1982. German indices of armament production during World War II and air-to-air box scores from the Beka'a both illustrate these pitfalls.

Another lesson suggested by the historical cases is the importance of understanding *contemporary* benchmarks in the sense of the aims, hopes, and desires of those who planned and executed the Desert Storm air campaign. Exploring these potential measures of operational-strategic effectiveness will be a major task of the next chapter.

2

Objectives, Targets, and Execution

The United States and the Coalition counted on air power to play a dominant role in a war against Iraq. The specific operational concepts, plans, and methods of employment were fashioned over several months' time, but conditions clearly favored the extensive use of air power to attain the objectives sought. Air power was the only force capable of dealing with the Iraqi threat to Saudi Arabia in August and September 1990, and even as ground forces built up during the fall of 1990, air power continued to be the prime U.S. strength and the prime Iraqi vulnerability. During the early months of the land force build-up, the Coalition's only options for slowing an Iraqi Army invasion of Saudi Arabia or for responding to Iraqi destruction of oil wells or killing of American hostages involved the use of air strikes. In addition, some of the most feared elements of the Iraqi offensive capability, the nuclear, biological, and chemical research, production, and storage sites, could only be attacked effectively by air power.[1] With the bulk of the Iraq's army occupying Kuwait, air power was also counted on to inflict massive attrition on the occupying Iraqi ground forces so that Coalition forces could expel them without incurring heavy losses themselves. Because of the number of objectives and the extensive expectations set for air power before the war, as well as the disputed claims concerning effects and effectiveness made during and after, assessment of air power's effectiveness must be informed by a clear sense of what employment was anticipated, what was actually attempted, and what results were expected. This chapter addresses these issues. Subsequent chapters will primarily examine how effective Coalition air power was relative to these contemporary benchmarks or measures.

[1][DELETED]

Political Objectives

The stated political objectives were as follows:

1. To effect the immediate, complete and unconditional withdrawal of all Iraqi forces from Kuwait;
2. To restore Kuwait's legitimate government;.
3. To protect the lives of American citizens abroad; and
4. To promote the security and the stability of the Persian Gulf.[2]

These objectives stated in August 1990 and continually reiterated, set the basis from which the military objectives would be derived, with political objectives 1 and 4 being the most pertinent for military operations. From objective 1, air power's roles became the strategic air attacks on Iraq, as well as the attrition of Iraqi ground forces and the support of the ground invasion of Kuwait and Iraq.

Objective 4 (security and stability of the Persian Gulf) translated into two actions. First, the destruction of Iraq's nuclear, biological, and chemical weapon capabilities and its ballistic missile capabilities–an action to be achieved by air attack; second, the reduction of the Iraqi Army so that it would no longer pose an offensive threat to Iraq's neighbors. This latter action aimed at something more debilitating than a forced withdrawal from Kuwait as objective 1 required. In the vivid words of the Chairman, Joint Chiefs of Staff, Gen. Colin Powell in referring to that army, "I don't want them to go home–I want to leave smoking tanks as kilometer posts all the way to Baghdad."[3] The former action, using air power to destroy nuclear, biological, and chemical capabilities, was essentially the use of preemptive strikes against weapons of mass destruction and their carriers. Such an employment suggested a different but not unanticipated application for U.S. air power, given the increased attention to the dangers of nuclear and chemical weapons proliferation in the 1980s and with the precedent of the Israeli attack on the Iraqi Osirik nuclear reactor in 1981 as a way of dealing with such a

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[2]"Address to the Nation Announcing the Deployment of United States Armed Forces to Saudi Arabia," 8 Aug 1990, in *Public Papers of the Presidents of the United States: George Bush, 1990* (Washington, DC: GPO, 1991), p 1108.

[3](S) Memo for record, Lt Col Ben Harvey, subj: Instant Thunder Briefing to CJCS, 11 Aug 1990, GWAPS, CHP 7-4.

threat. In this war, however, air power was called on to do something much more complex: not just to strike a single target–a reactor–but destroy what were essentially large, specialized industries for production and storage of these weapons of mass destruction. Moreover, in the wake of Osirik, Iraq had consciously dispersed and hardened these industries, making them as resistant to bombing as possible.

Of the political constraints communicated to the U.S. military for force employment, two proved particularly important to air power employment. These were:

(a.) minimize U.S. and Coalition casualties and reduce collateral damage incident to military attacks, taking special precautions to minimize civilian casualties

(b.) the United States will discourage the government of Israel from participating in any military action.[4]

Condition (a) appears at first glance as standard admonitions given (or implied) in the planning of military operations. Put another way, it would have been more significant if the instructions were *not* to minimize casualties and collateral damage. [DELETED].[5] A separate but related issue involved efforts to minimize Coalition aircrew casualties by employing higher (and, for most of the aircraft, less accurate) bombing altitudes, but this decision was made in the theater for military, not political, considerations. Finally, the number of anticipated Coalition ground forces casualties was also a prime factor in deciding on the timing of the ground offensive (should one prove necessary).

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[4](TS) National Security Directive 54, 15 Jan 1991, pp 2-3, GWAPS, NA 247A.

[5](S) Intvw, Air Force History Office with Lt Gen Charles A. Horner, 4 Mar 1992; (S) Intvw, CENTAF History Office with Brig Gen Buster C. Glosson, 6 Mar 1991.

Condition (b) expresses one element of the larger political concern of keeping the Coalition together throughout the war. [DELETED]

[DELETED][6] [DELETED][7]

While attacking the Iraqi leadership was a military objective of the U.S.-only plan, the removal of Saddam Hussein was not stated as a political objective of either the United States or the Coalition. [DELETED][8] [DELETED][9]

[6](S) Intvw, authors with Lt Gen Charles A. Horner, 9 Mar 1992, Shaw AFB, SC.

[7](S) USCINCCENT OPORD 91-001 for Operation Desert Storm (hereafter referred to as CENTCOM OPORD 91-001), para 1D, contained in a message, USCINCCENT to CJCS, Washington DC, 161735Z Jan 1991, GWAPS, NA 357; Headquarters, US Central Command, Combined OPLAN for Offensive Operations to Eject Iraqi Forces from Kuwait (hereafter referred to as Combined OPLAN), pp 2-4, GWAPS, CHC 18-1.

[8][DELETED]

[9]What constituted a terrorist act and whether that element of the directive should have been invoked are key issues but clearly beyond the scope of this report.

Nevertheless, the policy involving replacement of the Iraqi leadership deserves further discussion because of the controversy surrounding it both during and after the Gulf crisis. Statements reported in the press made by then-Air Force Chief of Staff Gen. Michael Dugan in September 1990 concerning the direct targeting of Saddam Hussein were part of the controversy that resulted in Dugan's relief as Air Force Chief; controversy continued after the war, with questions raised as to why Saddam Hussein's removal had not been an explicit objective of the war, questions made more insistent by Saddam's continued belligerence toward the United Nations inspections regime and toward the United States in general. There is no doubt that a change in Iraqi leadership was desired, and possibly expected, as a consequence of the defeat of Iraq, and the targeting of possible locations of Saddam Hussein was done with that in mind. U.S. officials, however, mindful of the difficulties encountered in the hunt for Manuel Noriega in Panama the previous December, drew back from an objective that aerial bombing simply could not assure.[10] Thus, while Iraqi leadership became an objective for strategic targeting and described as a center of gravity, the replacement of the Iraqi leadership did not become the main focus of the military campaign or a condition of war termination–that focus was the liberation of Kuwait.

And finally, some brief mention is needed of the political/military relationship that existed, because of the importance of that topic in assessing the proper focus of the air campaign and attainment of the political objectives: Except for the equivocation on the policy objectives regarding the Iraqi leadership, political guidance provided clear guidance for the military objectives of the air campaign, and U.S. political leaders remained closely in touch with the military planning and operations. Both the President and the Secretary of Defense were briefed in considerable detail on the planned air campaign, both before and frequently during the

[10]Adopting such an objective would have also required convincing the Coalition to endorse actions beyond the enforcement of the United Nations resolutions. Robert Gates, in transcript, "The Gulf Crisis: The Road to War," Episode Three (TV program broadcast on the Discovery Channel, 31 Jan 1992), p 19; Gen Colin Powell, transcript from OSD (PA) News Briefing, 17 Jan 1991, p 6; and Gen H. Norman Schwarzkopf, in Hearings before the Committee on Appropriations, House of Representatives, *Department of Defense Appropriations for 1992*, Part 2, 102nd Cong, 1st Sess (Washington, DC: 1991), p 277.

war.[11] Just before the beginning of the war, Secretary of State James Baker and the Under Secretary of State for Political Affairs Robert Kimmitt examined the target list in the Pentagon along with Secretary of Defense Richard Cheney and Joint Chiefs of Staff Chairman General Colin Powell.[12] However, while the political leaders remained closely in touch with the air campaign, its objectives, and results, there are no recorded instances of them directing changes to any military operations or disagreeing with military objectives.

Military Objectives

Military objectives were made explicit in two documents drawn up immediately prior to the beginning of the air campaign, the previously mentioned Combined Operations Plan for Offensive Operations to Eject Iraqi Forces from Kuwait (short title, Operation Desert Storm) and the U.S.-only document, USCINCCENT OPORD 91-001. The objectives, campaign overview, and designated centers of gravity were as follows, with the wording from the U.S.-only document given in parentheses, when that wording is different:

Operational Campaign Objectives

1. Destroy Iraq's military capability to wage war.
   (Attack Iraqi Political/Military Leadership and Command and Control)
2. Gain and maintain air supremacy.
   (Gain and maintain air superiority)
3. Cut Iraqi supply lines.

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[11](S) Paper copies of briefing viewgraphs, Brig Gen Glosson Briefing to the President on the Offensive Air Campaign (the copies have annotations on the principals involved and the dates presented), 11 Oct 1990, and Lt Gen Horner Briefing to Secretary Cheney, 20 Dec 1990, in "General Glosson Briefs," GWAPS, BH 3-60. These instances of two formal briefings are given by way of example of the numerous briefings and intelligence updates that the political leadership received between August 1990 and March 1991. During the war, briefings were given in the White House, with eight principals normally in attendance: the President, Vice President, Secretary of State, Secretary of Defense, National Security Advisor, CIA Director, White House Chief of Staff, and Chairman, JCS [(S) Intvw, GWAPS personnel with National Security Advisor Brent Scowcroft, Washington, DC, 23 Sep 1992].

[12]Gen Colin Powell, in transcript, "The Gulf Crisis: The Road to War," p 4.

4. Destroy Iraq's chemical, biological, and nuclear capability.
5. Destroy Republican Guard forces.
6. Liberate Kuwait City with Arab forces.

Offensive Campaign Overview. The Offensive Campaign provides for the execution of operations in four phases. Although each phase has specific objectives, execution of the phases is not necessarily discrete or sequential; phases may overlap as resources become available or priorities shift.

(1) Phase I - Strategic Air Campaign
(2) Phase II - Air Supremacy in the Kuwait
Theater of Operations (Air Superiority in the OPORD)
(3) Phase III - Battlefield Preparation
(4) Phase IV - Ground Offensive Campaign

Enemy Centers of Gravity. Iraq has three primary centers of gravity: (1) leadership and C2 (OPORD stated "national command authority"); (2) chemical, biological, and nuclear capability; and (3) forces of the Republican Guard. The offensive campaign will focus on the operational objectives to ensure destruction, neutralization, elimination, or degradation of Iraq's centers of gravity.[13]

The objectives of the campaign, roughly in the same order laid out, were translated into the phases of the campaign, with three of the objectives also identified as centers of gravity. The air campaign was to be almost wholly responsible for Objectives 1 through 4, play a major part in Objective 5, and support the ground forces in Objective 6. No explicit priority was given to the objectives; rather, they were laid out in sequence (phases), with the operations order specifying numbers of days to accomplish the first two phases: [DELETED][14] The question quickly became moot, however, because the amount of available air power allowed the first three phases to be initiated almost simultaneously.[15]

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[13](S) Combined OPLAN, pp 2-4; (S) OPORD 91-001, paras 1D, 3A, and 3B.

[14](S) CENTCOM OPORD 91-001, para 3A, GWAPS, NA 357.

[15](S) Intvws, authors with Lt Gen Horner, 9 Mar 1992, Shaw AFB, SC; Maj Gen Glosson, 9 Apr 1992, Pentagon, DC; Lt Col Deptula, 21 Dec 1991. The CENTCOM OPLAN said that "although each phase has specific objectives, execution of the phases is not necessarily discrete or sequential; phases may overlap as resources become available

With less air power available or in other circumstances that would have required the phases to take place in sequence, the priority of objectives, the measures of effectiveness, and the timing of shifts from one phase to the next would have become critical operational decisions. As executed, however, the length of time allotted to each phase of the campaign played no part. The crucial decision became when the requirements of Phase III (preparing the battlefield) had been met so that the ground offensive could begin.

The expectations of air power's effectiveness in each of the phases of the campaign rested on the estimated capabilities of the platforms and weapons to be employed, and assumptions of the conditions under which these attacks would be carried out. When some of these capabilities or conditions differed from what was anticipated, air power's effectiveness suffered, sometimes dramatically. While detailed examinations of these operations are given in the succeeding chapters, some general comments here on the strategic attacks and preparation of the battlefield (Phases I and III) will help put these operations more in context.

The preeminence of strategic air attacks had been the basis of CENTAF's initial plan, developed in September 1990, approved by Gen. H. Norman Schwarzkopf, and briefed to the Chairman of the Joint Chiefs of Staff, General Powell. That plan, which endured as Phase I of the later CENTCOM plan, presented as its expected results the destruction of military capability, loss of government control, and general internal strife, resulting in a change in the leadership of the country–all that with only Phase I initiated.[16] General Schwarzkopf had endorsed this use of air power in the plan, but he was obviously not satisfied with the plan as an end-product for fighting the war. Note that his approval occurred at a

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or priorities shift." (CENTCOM OPLAN para 3.a., GWAPS, CHC 18-1.)

[16](S) Paper copies of briefing slides, 13 Sep 1990 brief to CJCS, in "General Glosson Briefs." Although Gen Schwarzkopf approved the plan, Gen Glosson noted that Gen Schwarzkopf had some doubt that the CENTAF plan would accomplish all that was stated ("Planning the Air Campaign: Early Interviews with Brig Gen Buster C. Glosson," USCENTAF Office of History, 28 Feb 1991. Intvw recorded 17-27 Oct 1990, GWAPS, CHP 5A).

time when he had few ground troops to give him other alternatives. When ground forces did become available in the fall of 1990, particularly after the decision to send a second corps to the theater, the CENTCOM plan he developed saw strategic air attacks as only the first step of a more comprehensive and ambitious plan. By December 1990, air power had been blended into all four phases of the overall planning, beginning with strategic attacks in Phase I and concluding with the ground invasion of Kuwait in Phase IV. Phase I, in other words, was not expected to end the war, and its priority for sorties (against those for Phase III, for instance) and effectiveness levels anticipated were adjusted with these circumstances in mind. Significantly, however, the concept of employment, the basic target categories selected, and the objectives sought from the strategic attacks, as reflected in the initial CENTAF planning, did not change from the initial plan as published in September 1990 to the final plan executed in January 1991.[17]

While there were those in the theater who saw strategic air attacks as the centerpiece, the resulting theater operations plan set the objectives and measured success of those objectives with something else in mind. The strategic air attacks (Phase I) were undertaken as a way of disrupting the country and its leadership, paralyzing Iraqi industry and communications, and destroying Iraq's offensive capability, particularly the chemical weapons threat, in order to prepare for the ultimate invasion of Kuwait. After the first ten days of the air war, the desired results were thought to have been achieved, results not as specified in the CENTAF operations order but as sufficient to proceed to a concentration on Phase III. This was a judgement not just of CENTCOM Headquarters but also of the Joint Force Air Component Commander, Lt. Gen. Charles Horner, who at that time directed that, except for further work on Scuds and Iraqi airfields, a change in focus was to be made to attacking the Republican Guard divisions and other targets in the Kuwait theater.[18]

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[17](S) COMUSCENTAF Operations Order Offensive Campaign-Phase I, 2 September 1990, GWAPS, BH 15-5. Targets and available aircraft were of course added as the size of the force grew, but this operations order remained the basis for CENTAF planning.

[18]As early as 18 January, Lt Gen Horner was predicting that in only a few days "we will finish up valid targets in Iraq and begin to really shift our emphasis to military forces in Kuwait." Weather and the diversion to Scud targeting delayed the shift, but on 26 January, he gave his opinion that only airfields remained to be hit. The CENTCOM command briefing on that same day announced the "focus of the air campaign shifting a bit from strategic interdiction to battlefield preparation." (S) Text of CENTCOM Brfg, 26 Jan 1991, GWAPS, CHST 28; (S) Daily Comments by Lt Gen Charles A. Horner during

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The shift in emphasis from Phase I to Phase III of the air campaign would appear, on the surface, to reflect a rather traditional reading of where the truth lay in the long-standing debate over whether the primary role of air power should be to win the war directly by attacking strategic targets or to support the surface forces, ground forces in this instance. In this war, however, there emerged an intermediate proposition: employment of air power to win the war directly by destroying the ground forces. There were those in the Air Force who thought direct attack on strategic targets in Iraq would win the war; the initial Instant Thunder plan of August 1990, for instance, called for only attacks on strategic targets in Iraq, with no attention given to even the Republican Guard divisions. The planning that took place in the fall of 1990, however, focused not only on strategic attacks in Iraq but also on attacking the Iraqi Army. On this objective, too, the implicit assumption was that air power could not only be decisive, it could be a war-winner. Planning went forward on operations to reduce the Iraqi ground forces by fifty percent in major weapon categories (tanks, armored personnel carriers, and artillery), the agreed-upon attrition sought against the Iraqi forces during Phase III;[19] furthermore, it was projected as only a function of time, not capability, as to when those forces could be reduced by ninety percent or even more.[20] A popular saying during the war, in both Checkmate in Washington and the Black Hole in Riyadh, was "we are not preparing the battlefield, we are destroying it."[21] Putting aside the questions of achieving such high attrition levels or what level of attrition would be needed to destroy an army, there remains a difference in approach between attempting to destroy a battlefield as distinct from preparing it for a ground invasion.

When the focus of the air campaign shifted to support of the surface forces, preparing the battlefield and providing air support to the ground

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Operation Desert Storm, 17 Jan through 28 Feb 1991, transcribed by HQUSCENTAF Office of History, 20 Mar 1991 (hereafter referred to as Horner Comments), notes from 18, 20, and 26 Jan 1991, GWAPS, CHP 13B.

[19](S) CENTCOM OPORD 91-001, para 3. E.2.(b).(#3).

[20]Graphics of armor, artillery, and personnel attrition shown in briefings, 11 Oct 1990 Brief to the President and 20 Dec 1990 CENTAF/CC Brief to the SECDEF, in "General Glosson Briefs."

[21]Copy in GWAPS, CHST 22.

offensive, there were divergent views, not primarily on the priority of battlefield preparation over strategic attack but on how sorties directed against Iraqi ground forces could be most profitably used. Balance had to be found among the objectives of cutting the Iraqi supply lines to their ground forces, attacking the Republican Guard divisions, and attacking the frontline Iraqi divisions that would have to be breached during a ground invasion to liberate Kuwait. Where this balance ought to be, however, was obviously influenced by differing perspectives on whether or not the Iraqi Army could be destroyed from the air without a ground invasion being necessary. If air alone could accomplish the objectives, less attention was required on the frontline divisions and more on the most capable divisions, the heavy divisions that made up the theater and strategic reserves, particularly the Republican Guard divisions.

Additional weight had also to be given to the Republican Guard, since those forces had been recognized as a center of gravity, not just of the Iraqi Army but of the entire Iraqi regime. The Guard divisions were thought of as an important element keeping Saddam Hussein in power. Thus, the rout of the Republican Guard would not only assist in driving the Iraqi Army from Kuwait but would help ensure the stability of the region after the war. In selecting the relative weight of effort between targeting of the front lines and the strategic reserves, there was a tension between war and postwar priorities as well as between military and political goals.

By way of summary, Table 4 below presents the targets, phases, and centers of gravity matched against the three categories of air employment defined in the introduction to this report. Obviously, there is some overlap of objectives between categories as well as between phases, but the basic intentions are clear: control of the air over Iraq would be accomplished as part of Phase I and in Kuwait as Phase II; strategic air attacks would begin the air campaign and comprise Phase I but would continue at a reduced pace through all phases; the support to surface forces would constitute Phases III and IV but would begin almost simultaneously with Phase I. The support to surface forces in this war, of course, principally involved support to ground forces. Air power supporting naval forces was for fleet defense and for fulfilling the naval forces' tasks of "sea control and mine countermeasures operations in the North

Arabian Gulf."[22] There was some variance in language within the plans as to what degree of control of the air was called for, air superiority or air supremacy, but since the more complete control, air supremacy, was quickly achieved, this variance in wording never became an issue. Specific performance of air power in each of these categories will be the subject of the succeeding chapters.

Table 4
Air Employment and the Operations Plan

Categories	Objectives and Concepts
Control of the Air	Objective 2 Phase II and part of Phase I
Strategic Air Attack	Objectives 1 (as stated in the U.S.-only document) and 4 Phase I Centers of gravity 1 and 2 (leadership/C^2 and chemical, biological, and nuclear capability)
Support of Surface Forces	Objectives 3, 5, and 6 Phases III and IV Center of gravity 3 (Republican Guard)

Before moving to target sets, some mention is necessary of what were termed "centers of gravity." The plans referred to several of the target sets as centers of gravity, and the targets so designated varied during the development of the campaign plan. In the briefing to the President on 11 October, for instance, the centers of gravity were defined as leadership, military forces, and infrastructure.[23] At times the term was used as JCS Publication 3-0 defines it ("That characteristic, capability, or locality from which a military force derives its freedom of action, physical

[22](S) OPORD 91-001, para 3C4A.

[23](S) Paper copies of briefing viewgraphs, Maj Gen Glosson to President Bush, 11 Oct 1990. "General Glosson Briefs."

strength or will to fight. It exists at the strategic, operational and tactical levels of war."[24]), but in one case, the term refers to the accomplishment of a political objective not tied directly to the military operations to liberate Kuwait. For example, one could make a case for identifying the Republican Guard forces as a center of gravity: if they were destroyed, the defense of Kuwait would crumble. The same could be said for the Iraqi leadership and its command and control: destroy it and the resolve of the country to occupy Kuwait would crumble. There is no one, however, who made the case that destruction of Iraq's nuclear, biological, and chemical capability was in any way a linchpin for the military success of this campaign; it was an important Coalition objective, but accomplishing it was not vital to the attainment of other military objectives.[25] This center of gravity and, to a degree, the attacks on the Republican Guard and on Scud storage sites and production facilities had more to do with the stability and security of the region after the war than with the liberation of Kuwait. The measures of success of the attainment of the political objectives, in other words, had to include criteria other than the liberation of Kuwait. To take account of the special designation given these targets sets as centers of gravity, later discussion will evaluate the degree to which these three centers of gravity remained in fact the focus for operations and intelligence requirements.

Target Sets

The Guidance, Apportioning and Targeting cell of CENTAF Headquarters, the organization responsible for assigning targets to aircraft sorties during the air campaign, divided fixed targets in Iraq and the Kuwait theater of operations into twelve categories, listed below with their common alphabetic acronyms as they appeared in the planning documents:[26]

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[24]*Doctrine for Unified and Joint Operations*, test publication, Joint Pub 3-0, Jan, 1990, p ix.

[25]This statement is not made to denigrate the importance of attacks on the Iraqi chemical and biological weapons capability as a way to prevent the use of chemicals or biological agents in this war, but to emphasize the reason these weapons were cited as a center of gravity.

[26]These target categories were used in the CENTAF operations order, the air campaign briefings given to the political and military leadership, and on the master attack plans drawn up daily during the war. These categories were not used by the units reporting the air strikes, a problem of great proportion for those reconstructing the activity that took place but not relevant for this discussion. These twelve target categories also varied

Strategic Air Defenses (SAD)
Nuclear, Biological, and Chemical Research and Production (C)
Leadership (L)
Command, Control, and Communications (CCC)
Electric Power (E)
Oil Refining and Distribution Facilities (O)
Railroads and Bridges (RR)
Airfields (A)
Naval Forces and Port Facilities (N)
Military Storage and Production (MS)
Scud Missiles and Launchers, Production and Storage Facilities (SC)
Republican Guard Forces in the KTO (RG)

These sets were developed in August and September 1990 when the full extent of the air campaign was not known, and as a result, as more targets were added, the categories did not remain as distinct or as usable as planned. Some, such as electric power, oil refineries, airfields, or air defense systems, remained relatively coherent. Others underwent varying degrees of transformation: the Command, Control, and Communications category was first called Telecommunications; even after that adjustment, the Leadership category continued to include the command communications bunkers–the Al Firdos Bunker was one of these; the original Railroad category expanded to include bridges when it became obvious that they were an even more vital part of the transportation net; Naval Forces and Facilities began as ports and naval bases, then expanded to include Silkworm launch sites. At the beginning of the air campaign, two new sets were added: Fixed Surface-to-Air Missile Sites (SAM) in the Kuwait theater and Breaching sites for the ground offensive (BR).[27]

While the target sets themselves changed only little, the numbers of targets in each set increased steadily, both before execution and during the air campaign itself. The growth is depicted in Table 5, using some of the milestone dates. The listing uses the best available data, but there

somewhat from the categories in the Defense Intelligence Agency's Automated Intelligence Installations File (AIF). Since intelligence organizations used AIF categories, target cross-referencing between the two systems created some difficulty during the war.

[27]Information derived from data in "Evolution of 1st 24 Hour Master Attack Plan," Sep 1990 to Jan 1991, GWAPS, BH 1-1 and 2.

is a difference in criteria between the first five columns, covering 21 Aug-20 Dec 1990, and the three subsequent columns, 15 Jan-26 Feb 1991: the first five columns depict numbers of targets actually in the attack plans; the final three columns list total targets known, by category, without reference to whether they would be struck.

Table 5
Growth of Target Sets

Tgt Sets	21 Aug	2 Sep	13 Sep	11 Oct	20 Dec	15 Jan	17 Feb	26 Feb
SAD	10	39	21	40	27	56	73	85
C	8	15	15	15	20	23	23	34
L	5	15	15	15	27	33	37	44
CCC	19	27	26	27	30	56	84	146
E	10	17	14	18	16	17	22	29
O	6	9	8	10	8	12	12	28
RR	3	12	12	12	21	33	40	89
A	7	19	13	27	25	31	38	46
N	1	0	4	6	4	17	20	20
MS	15	35	41	43	46	73	77	102
RG	-	7	-	-	-	37	38	39
SAM	-	-	-	-	-	45	45	45
SC	-	-	5	5	13	48	52	59
BR	-	-	-	-	-	-	6	6
Totals	**84**	**195**	**174**	**218**	**237**	**481**	**567**	**772**

Dates used:
21 August–Instant Thunder plan
2 September–CENTAF Operations plan
13 September–briefing to Chairman, JCS
11 October–briefing to the President
20 December–briefing to the Secretary of Defense
15 January–beginning of the air campaign
17 February–later stages of the air campaign
26 February–final days of the war

The overall growth in numbers of targets resulted from several factors, in addition to the changed and new sets mentioned above. First, it reflected the increased knowledge of the Iraqi military forces, leadership

structure, and communications gained after the United States focused its reconnaissance assets on Iraq in the fall of 1990. Second, it came about at least indirectly as a result of the increased numbers of strike aircraft available and the consequent ability to target a larger portion of the Iraqi air defense and military support structure. Finally, continued growth of targets occurred throughout the war because the attacks on the originally identified target groups did not appear to have the desired results, circumstances that particularly apply to the attacks on command, control, and communications and on Scud facilities (CCC and SC). The Scud facilities category shows only modest growth, but the target totals only dimly reflect the attention given to targeting suspected Scud sites during the war. The targeting involved area searches, however, not fixed sites, so these targets numbers were not reflected on the target list. The other category that could be misconstrued is Republican Guard: the total of 39 shown comes nowhere near to reflecting the vast array of targets attacked in these units in the Kuwait theater.

Note that the numbers of targets in each set are cumulative. That is, once identified as a target, that site remained so identified in the target lists, even though it had been destroyed. Therefore, those numbers shown after 15 January indicate both those targets identified and destroyed as well as those left to be attacked. In other words, the planners would at any one time not have to be concerned with the entire target list but only with those targets then active (not yet destroyed). In addition, not all targets identified were in fact attacked.

The number of targets, which grew to 772 by the end of the war, in these categories does not, of course, represent the total number of targets attacked by air during the war. The total must include two other sources of targets: Kuwait theater of operations "kill boxes" and targets attacked as part of naval fleet defense operations.

The targets in the Kuwait theater, defined as the area north of the Saudi Arabian border, south of the 31 degree north latitude line, west of the Gulf and the Iran-Iraq border, and east of 45 degrees east longitude line, were of two kinds: the ones comprising the target sets just described (the twelve categories) and the more general military force targets throughout the theater, those that could relocate and thus could not be handled properly within the framework of a fixed target base. Targets in this latter group were not identified individually but by "kill box." Kill

boxes were derived from Saudi Arabian air defense map overlays (see Map 1), which divided the entire region into squares, thirty miles on a side, and gave each box a number and letter designation. The kill boxes were then divided into four squares, as depicted in Figure 1, fifteen miles on a side, and further designated as NE, SE, SW, or NW. Aircraft were directed to a fifteen-mile box to conduct strikes against the appropriate targets within the box (tanks, artillery, command posts, and so forth).[28] This report will use the weight of effort against the kill boxes as a measure of the bombing effort against the Iraqi military units located in the kill box area, a valid measurement in this war since the Iraqi units moved very little if at all once the air campaign began. The total number of targets attacked in the kill boxes is not known, but it was by necessity a large part of the total number of targets attacked during the war. As a method of approximation of the effort, note that more than half the Coalition's air attacks were against kill box targets.[29]

The final group of targets to note are those developed as part of fleet defense of Coalition naval forces in the Persian Gulf. These targets included ships and port facilities of the Iraqi Navy, as well as Silkworm sites, artillery positions, command posts, and threat radars close to the coast. Some, but not all, of these sites appeared as part of the Naval Forces and Port Facilities category (N) established by CENTAF; others, discovered during the war and struck by naval aircraft outside of those tasked by the daily air tasking order, were not recorded on the CENTAF targeting list. Helicopters and fixed-wing aircraft from aircraft carriers in the Persian Gulf, as well as land-based aircraft, took part in attacks on this target set and on other naval targets in the Gulf. Over 1,000 strikes by United States Navy fixed-wing aircraft were flown on these maritime missions attacking naval targets, so this category is more than just a footnote to the air campaign.[30]

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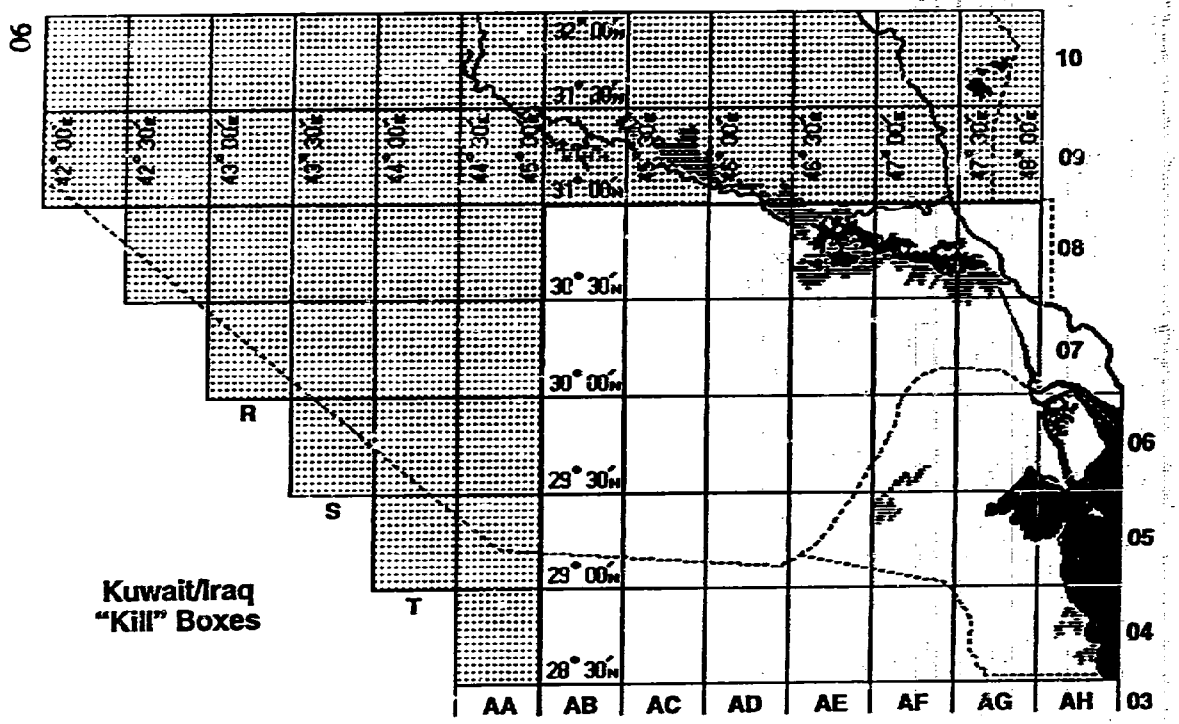
[28]The Marines, in addition, used designated maneuver boxes and fire-support boxes to direct their own aircraft sorties. See (S) John D. Parsons, Benjamin T. Regala, and Orman H. Paananen, *Marine Corps Desert Storm Reconstruction Report, Vol IV* (Alexandria, VA: Center for Naval Analyses, 1992) (hereafter referred to as *Marine Corps Reconstruction Report*), pp 51-54.

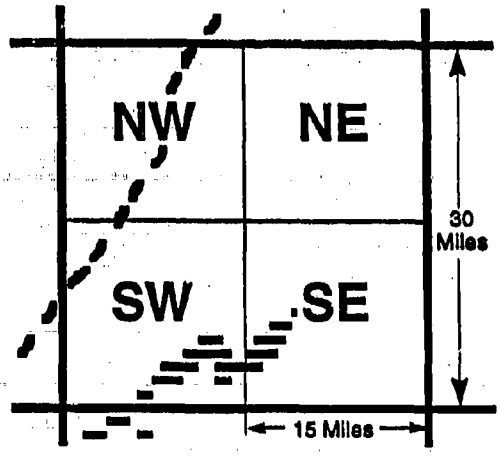
[29]GWAPS Database, Statistics report.

[30](S) Frank Schwamb, et al, *Desert Storm Reconstruction Report, Volume II: Strike Warfare*, (Alexandria, VA: Center for Naval Analyses, 1991), p D-2. Volume VI of the same series, on antisurface warfare, presents an account of the attacks against naval targets.



Map 1
KTO overlay with coordinates used, shaded area shows limits to KTO.

Figure 1
Enlargement of Area AF6 in northwest Kuwait, displaying kill boxes AF6NW, AF6NE, AF6SW, and AF6SE



The targeting scheme for the air campaign as a whole can be most readily understood in relation to the campaign's objectives. These linkages are shown in Table 6.

The target sets concerned with gaining control of the air are ones typically found in any war involving contested airspace: the air defense network, early warning sites, airfields, surface-to-air missile sites, and that part of the country's communications system that binds the parts of the air defense system together. While not targets for bombing in the usual sense, the analysis of effectiveness in controlling the air in this war must also consider the Coalition sorties employed in suppressing enemy air defenses, by electronic jamming aircraft, by aircraft shooting antiradiation missiles against missile, gun, and acquisition radars, and by drones that simulated a strike aircraft's radar cross-section, launched into the target area to spoof the air defense radars. The third part of this overall effort is the employment of air-to-air fighter aircraft, along with airborne warning and control system aircraft, against airborne enemy aircraft (by either combat air patrol orbits or sweeps through the contested region). These target sets and air operations were all a part of the extensive effort to gain control of the air over Iraq and Kuwait.

Table 6
Air Employment and Targeting

Categories	Objectives and Concepts	Operations and Target Sets
Control of the Air	Objective 2 Phase II and part of Phase I	SAD, A, SAM, a portion of CCC Suppression of enemy air defenses (SEAD) Combat Air Patrol (CAP). Sweeps
Strategic Air Attack	Objectives 1 and 4 Phase I Centers of gravity 1 and 2	L, CCC, C, E, O, SC, a portion of MS and RR
Support of Surface Forces	Objectives 3, 5, and 6 Phases III and IV Center of gravity 3	RG, Kill Boxes, N, MS, RR, BR a portion of CCC, O, A, and C Airborne surveillance and targeting operations

The gaining of air control has always been a first impulse in the application of air power, but there was a special importance in gaining a quick and total supremacy in this war. First, the overwhelming superiority of Coalition air forces over the Iraqi Air Force, both in quantity and quality, would make anything less appear a relative defeat. This was a test for high technology. Electronic countermeasures aircraft, airborne control aircraft, and antiradiation missiles had to perform as part of an integrated plan. Second, the imperative of keeping Coalition casualties low meant that Iraqi air defenses had to be prevented from causing anything further than incidental attrition to Coalition aircraft over the month or more that the air campaign needed to operate; if air attrition were higher, there would have been pressure for an earlier, higher-attrition ground offensive. And third, a degree of air control over the Kuwait theater was necessary so that not just high-performance aircraft could operate but that " . . . an environment [is provided] in which B-52s, tactical air, and attack helicopters can operate effectively," thus bringing more air power to bear.[31] Control of the air was one of the most basic roles for air power, and it assumed additional importance in these conditions.

[31](S) OPORD 91-001, para 3C4B.

The strategic target attacks comprised a more diverse list than the control of the air category. There were target sets that have been historically associated with strategic air attacks, but there were also some unique to this war. As the CENTCOM operations order stated, the attacks were to be against Iraq's "strategic chemical, biological and nuclear capability; leadership targets; command and control systems; RGFC (Republican Guard Forces Command) forces; telecommunications facilities; and key elements of the national infrastructure,such as critical LOCs (lines of communication), electric grids, petroleum storage, and military production facilities."[32] The more typical targets were the key elements of national infrastructure and the military production facilities, along with the late-twentieth century addition to national infrastructure, telecommunication facilities. Rather standard, too, were the targeting of leadership and command and control systems, items seen as of particular importance in a state such as Iraq. While more typical strategic targets, the results sought by the strategic air attacks on the national infrastructure and military production facilities were not typical of the results sought in other strategic air campaigns such as the attacks on Germany and Japan in World War II. Since the Coalition never envisioned the war as being of such duration to allow Iraq to use its infrastructure to regenerate or increase its in-place military capability, the attacks on the infrastructure were designed more to stun than destroy. Attacks on oil were confined to refining and storage, not production, facilities; attacks on electric power were, if possible, to avoid the components that would require years to rebuild–such restraint was a planning goal, but not in all cases was it achieved.[33]

The target sets that stand out as relatively unique to this war are the chemical, biological, and nuclear (NBC) capability, the Republican Guard, and, a set not noted in the CENTCOM statement, Scud sites and production facilities. The importance of the destruction of the Republican Guard and NBC capability in this war was reemphasized by their designation as centers of gravity. The Scuds were to emerge soon after the beginning

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[32]Parentheses added by author. (S) US-only CENTCOM OPORD 91-001, para 3.C.4.(a), GWAPS NA 357. The US-only OPORD is cited because it is more explicit on this statement. The Combined CENTCOM OPLAN states only "attack Iraq's war making capability." [Para 3.D.3.(a), GWAPS, CHC 18-1.]

[33]Chapter 6 will discuss the success of these efforts. The point here is to cite the planning to reduce damage to non-military economic infrastructure and energy-related facilities.

of the air campaign as an important strategic target. Scuds equipped with chemical warheads were one element of the dangers posed by NBC weapons. Scuds and NBC capability were a high priority in this war, and, with the increased proliferation of these systems, will no doubt continue to be a special subject of strategic air attack.[34] Republican Guard forces were treated by CENTCOM, to a degree, as a strategic target, but these forces can be dealt with more properly under the next category.

Air power received particularly specific criteria for its support to surface forces. In Phase I, air was to "cut key bridges, roads and rail lines immediately south of Basra to block withdrawal of RGFC forces. Cut bridges, roads and rail lines in the vicinity of An Nasiriyah to block reinforcement and/or resupply of Iraqi forces from the west and isolate Iraqi forces in the KTO;" in Phase III, air power, along with naval gunfire, was "to sever Iraqi supply lines, destroy Iraqi chemical, biological, and nuclear capability, and reduce Iraqi combat effectiveness in the KTO by at least 50 percent, particularly the RGFC."[35] In Phase IV, air power was tasked to accomplish the traditional missions of close air support and interdiction.

The fifty percent attrition sought was an overall attrition figure, not tied to any particular units of the Iraqi Army or any region of their deployment. The computations done by CENTAF in prewar planning had calculated attrition of armor, artillery, and personnel; during the war bomb-damage assessment (BDA) counts most often depicted numbers of tanks, armored personnel carriers, and artillery. As a result, the Iraqi heavy divisions, the location of the vast majority of the armor, became the greatest source of scoreable BDA. The Central Command Air Force calculations on attrition had estimated that the fifty percent attrition would be achieved within ten to twelve days overall, less time for the Republican Guard, but those figures were based on a greater number of sorties being available than was the case and a greater use of precision

[34]Scuds and NBC capability are, of course, not "new" strategic targets. One has only to refer to the attacks on the V-1 and V-2 sites during World War II or to the basic targeting categories of United States and Soviet strategic nuclear forces during the period of the Cold War to see the continuity. The new aspect is the proliferation of these systems to many countries and the increased importance of these weapons in more localized conventional, or unconventional, conflicts.

[35](S) US-only CENTCOM OPORD 91-001, paras 3.C.4.(c), 3.E.2.(b).(2) and (3), GWAPS, NA 357.

munitions and cluster bombs than actually took place.[36] These operations are discussed in greater detail in Chapter 4, but suffice it to say here that the combination of weather, lack of BDA information, and heavier use of nonprecision munitions detracted greatly from the anticipated results, and attrition counts did not increase significantly until the precision bomb-dropping aircraft were assigned to the task of equipment attrition.

As listed in Table 6, the target sets that apply to the support to surface forces category also include the naval ports and bases and Silkworm sites (N); the breaching sites (BR); that part of the CCC set linking Iraqi forces to Baghdad; and airfields with offensive aircraft capable of attacking surface forces. Far more important in considering the effects of the air campaign on surface forces, however, were not the relatively few number of fixed targets listed in the above target sets but the pressure applied throughout the Kuwait theater by the overwhelming number of sorties flown into the kill boxes described earlier and by the various airborne platforms used to secure rapid, or instant, targeting information on ground forces. The results sought in the support of the surface forces were as decisive as those sought in the other two categories and significantly more than had been asked of air power in previous conflicts–to reduce an enemy ground force by fifty percent, *before* the friendly ground force sustained any damage.

Air Campaign Overview[37]

Although Phases I through III of the air campaign were initiated almost simultaneously, the air campaign unfolded as planned in terms of the weight of effort applied, beginning with the strategic targets in Iraq and shifting toward attacking targets in the Kuwait theater. The campaign was not without its surprises, such as the required diversion of sorties to deal with the Iraqi Scud missile launches toward Israel and the refusal of the Iraqi Air Force to contest command of the air over Iraq, but

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[36](S) Briefing viewgraphs, CENTAF/CC to the SECDEF, 20 Dec 1990, in "General Glosson Briefs."

[37]This brief account of the air campaign is merely to set forth some of the pertinent milestones for putting the campaign in context and to describe some of the circumstances that had important implications for air power's effectiveness in the war. For a full operational account of the Desert Storm air campaign, see the GWAPS Operations report. Data used in this account are drawn from the GWAPS database as found in the GWAPS Statistics report, unless otherwise indicated.

the division of sorties between those for air control, strategic attack, and support for surface forces was as anticipated, though probably not for the specific target sets within those categories. What was perhaps most disconcerting in the air campaign's execution was an inability to determine, as the war progressed, what levels of effectiveness were being attained on the target sets, so that adjustments could be made.

The air war began with two days of preplanned operations. These two days were the most thoroughly planned and most complex air operations of the war. The complexity was in great part due to the attempt to dismember the Iraqi air defenses while at the same time attacking all the strategic target sets. For this endeavor, elements of air power ranging from attack helicopters, to drones, to Tomahawk land attack missiles, to virtually the Air Force's entire inventory of conventional air-launched cruise missiles were employed. Virtually every target set was struck on these initial strikes, although the heavy weight of the effort was against air defenses, airfields, and the command elements of the Iraqi regime. Sortie rates were to remain at similar levels throughout the war, but not again were the strikes so complex or so focused, nor perhaps did they need to be.

The air forces allocated to the task of air control, in addition to the wide variety of strike aircraft assigned to hitting airfields and air defense sites, included an array of specialized aircraft. There were air-to-air fighters, principally the F-15Cs and F-14s, along with the airborne warning, control, and intelligence aircraft (E-3 and RC-135), electronic jamming support aircraft (EF-111 and EA-6), and those aircraft firing missiles such as the high-speed antiradiation missiles (HARMs) at Iraqi radars (the F-4G and F-16 Wild Weasel aircraft, plus a number of other strike aircraft). In addition, two types of radar-decoy drones, launched from air and ground, stimulated Iraqi radar activity both to deflect attention from the strike aircraft and to ensure that Iraqi surface-to-air missile radars would be active and vulnerable to HARM missiles.

While air-to-air fighters and electronic support aircraft continued to accompany the attack aircraft throughout the war, the most important use of these assets occurred on the first night in pursuit of air superiority. On the first night, over ten percent of all high-speed antiradiation missiles fired in the war were expended, and most of the HARMs fired were in the first week of the war; after that, just the threat posed by the HARMs served to keep most Iraqi radars off the air. Decoys, too, were used principally during the first week of the war, most on the first night and

only sparingly after that, for the same reasons. And the bulk of Iraqi "shooter" sorties and air-to-air losses to Coalition fighters occurred during the first week of the war; subsequent losses occurred while the Iraqi aircraft attempted to flee to Iran, not while contesting for Iraqi airspace (control of the air subjects are dealt with in Chapter 3).

In addition to the concentration of force against the air defense network and airfields, strikes took place at the same time against Iraq's electric power system as well as what were deemed to be centers of gravity: leadership and its command and control system and Iraq's chemical, biological, and nuclear capability. The electric power system was quickly dealt with, but the latter targets required constant strikes throughout the war, with little precise information available as to the success of these strikes. The great majority of the targets so far described in this phase required precision-delivered weapons (with a capability to penetrate hardened buildings) to be successful; as a result, other target sets in Iraq, such as oil facilities, railroads, and bridges, saw a greater employment of free-fall bombs. The accuracy of these bombs was sufficient for the oil storage facilities, but bridges needed more attention, and it was not until the second week in the war, when precision bomb-dropping aircraft could be spared from other attacks, that bridges received increased attention with precision weapons–and these precision attacks continued until the end of the war.[38]

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[38]The terms "free-fall" bombs, unguided bombs, and "dumb" bombs are used in this report to mean bombs that fall ballistically after release from the aircraft, as opposed to those that can still be guided to a precise impact point after aircraft release ("smart" bombs). For the purposes of this report, precision bomb-dropping aircraft are those aircraft that had a laser-designating capability that could guide a bomb to a precise target. The following aircraft could guide such weapons (and did so in the war): F-117, F-111F, A-6, F-15E, French Jaguars, Saudi F-5s, British Buccaneers, and, later in the war, some of the British Tornados. The British Buccaneer aircraft were employed in the war to "buddy-lase;" that is, to laser-designate the target for precision bombs dropped by accompanying Tornado aircraft. The Buccaneers, F-5s, and Jaguars had this capability in daylight only. The following *strike* aircraft did *not* have the capability to drop and control laser-guided bombs during the war: F-16, F/A-18, B-52, A-10, AV-8B, A-7, F-111E (flown from Turkey), and other Coalition strike aircraft (A-4, British Jaguar, Tornado, except as indicated above). Note: several of the above aircraft had the capability to fire precision-guided air-to-surface missiles–the MAVERICK by the Air Force being the one predominantly used in the war; far fewer of the Navy Walleye were also employed (133). The A-10 itself fired over 5000 Maverick missiles during the war [(S) 23d TFW(P) and 354th TFW(P), "Operation Desert Storm A-10 Combat Recap," 17 Jan 1991 to 28 Feb 1991, GWAPS, NA 292]. The French Jaguar also employed a laser-guided missile, the AS-30, employing about 60 of these missiles in the war. The following are

A wide array of Coalition aircraft initially took part in the attacks against the strategic targets, including both aircraft carrying precision weapons and those dropping unguided bombs. In addition, the Navy's Tomahawk land-attack missiles (TLAMs) and the Air Force's conventional air-launched cruise missiles (CALCMs)—precision weapons—were also part of these attacks. The missile employment occurred only early in the war: the CALCMs only on the first day; of the TLAMs, 180 were launched in the first two days, with only another 102 employed during the remainder of the war; none were fired after 1 February.[39] During the course of the air war, fewer numbers and fewer types of aircraft took part in the strikes on strategic targets because of the increased attention to the Kuwait theater, but also because those aircraft only capable of dropping unguided ordnance proved too inaccurate for the pinpoint, often hardened, targets in Iraq. A number of those targets were also close to populated areas, further restricting the parameters for employing unguided bombs.

While strikes in Iraq were characterized by the use of precision weapons on fixed targets, the air attacks that began almost simultaneously in the Kuwait theater employed principally unguided bombs—general-purpose bombs or a variety of mines and cluster munitions. Many targets in the theater were well suited for these weapons—storage areas and troop concentrations called for area weapons instead of pinpoint weapons—but the choice of armaments was also based on the aircraft available for employment, and the aircraft used had only a limited capability to drop precision weapons. The air strikes in the Kuwait theater, made with less precision delivery but in far larger numbers than the strikes in Iraq, thus began a rather different process from the air attacks in Iraq: a more gradual reduction in the capabilities of the Iraqi Army and Navy, with sorties scheduled around the clock throughout the theater.

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other precision-guided missiles employed in the war that are referenced in this report: Tomahawk land attack missiles (TLAMs), launched from US Navy ships; HELLFIRE missiles fired from attack helicopters; the Army Tactical Missile System (ATACMS), a surface-to-surface missile; conventional air-launched cruise missiles, launched from B-52s on the first day of the war; antiradiation missiles, fired by F-4Gs, F-18s, F-16s, A-7s, Tornados, and EA-6Bs to destroy ground radars; and air-to-air missiles (US AIM-7M and AIM-9M) fired from Coalition air-to-air fighters.

[39](S) Peter P. Perla, *Desert Storm Reconstruction Report, Volume I: Summary* (Alexandria, VA: Center for Naval Analyses, 1991), p 44.

Nearly every type of Coalition strike aircraft took part in the Kuwait theater attacks. Within the theater, there was a division between the aircraft employed in the northern portion of the theater–the location of the Republican Guard–and the southern portion, near the front lines. F-16s, F/A-18s, F-15Es (F-111s and A-6s at night) flew against the more distant, better equipped, and better dug-in Republican Guard, while closer to the front lines, AV-8Bs, A-10s, and many of the other Coalition aircraft (F-5, Jaguars, A-4s) tackled the entrenched infantry. Army and Marine attack helicopters were available, but their main employment in attacking Iraqi forces came during the ground war, and the computations for attrition of the Iraqi forces during the air war did not include these aircraft (nor were they available to the Joint Force Air Component Commander for employment). B-52s conducted strikes throughout the Kuwait theater, dropping almost thirty-two percent of the bomb tonnage in the war, mainly in the Kuwait theater. While the B-52s were not counted on for equipment attrition, they were the prime resource for attacking areas targets (breaching sites, ammunition stockpiles, troop concentrations, or military field headquarter). Even without precision munitions, the B-52s became one of the most sought-after aircraft by the ground commanders for strikes against Iraqi ground forces. Attempts by the air planners to have the B-52s employed against targets outside of the Kuwait theater ran into much opposition from the CENTCOM leadership, particularly General Schwarzkopf.[40]

The decision to bomb from medium altitude affected the accuracy of nonprecision weapons. Prior to the war, planners anticipated using this tactic only for attacks during daylight. However, after three days of actual combat and the loss of several aircraft, commanders restricted all bombing missions to medium altitude. The intention was to neutralize the Iraqi surface-to-air missiles and aircraft threats, leaving only antiaircraft artillery, which was effective up to an altitude of 15,000 feet, as the threat to be dealt with. Moving the bombing aircraft above this altitude increased aircraft survivability, but it decreased the bombing accuracy. Given the conditions of this war and the need to minimize casualties, the move was a prudent tradeoff. A secondary consequence was the need for higher weather ceilings in order to bomb visually (the most accurate method); thus there was a higher-than-planned incidence of mission changes because of weather–in addition to the weather itself being far worse than anticipated. The Air Force estimated on 6 February, 3 weeks

[40](S) Intvw, GWAPS staff with Lt Col Deptula, 21 Dec 1991.

into the war, that approximately half of the attack sorties into Iraq had been diverted to other targets or cancelled because of weather-related problems.[41] The effects were cumulative: aircraft were less accurate in bombing; crews were too high to determine accurately the damage done by their strikes; and, as a further complication, overcast clouds often prevented satellite photography from revealing the true extent of damage.

Beginning on the second day of the air war, Air Force aircraft began flying strike missions from Turkey against targets in northern Iraq as a way of diverting the attention of the Iraqi defenses and pinning down Iraqi forces in that region. These aircraft, part of an organization named Task Force Proven Force, formed from units in Europe into a composite wing (fighters, tankers, reconnaissance, and electronic warfare aircraft) that flew fifty to sixty attack aircraft a day, launched in three waves (two day, one night), throughout the entire war. The strikes concentrated on air defenses, air fields, chemical, biological, and nuclear facilities, electric power, oil refining, and munitions storage in northern Iraq, moving down as far south as Baghdad late in the war when the focus of the other Coalition sorties was on the Kuwait theater. These aircraft played no part in battlefield preparation in Kuwait, so the aircraft continued attacking the same target sets throughout the war. Compared to the other Coalition air forces, however, Proven Force had two handicaps: it had no stealth aircraft and no aircraft capable of designating targets for laser-guided bombs. As a result, the hardened Iraqi air defense network presented a formidable obstacle before attacks on strategic targets could begin, and then the strikes against point targets recorded much less success because of the lack of precision weapons capability.[42]

There were two significant diversions to the planned execution of the air campaign, the first beginning on the third day of the air war when the first Scud missiles launched from western Iraq landed in Israel. The danger of Iraq attempting to split the Coalition by firing Scud missiles at Israel was anticipated before the war, and for that reason the fixed Scud sites in western Iraq were targeted on the first night's raid. These strikes failed to neutralize the true Scud threat, however: that of mobile Scuds capable of

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[41](S) Brfg viewgraph, prepared by AF/XOXWF for the Secretary of Defense, visit to Checkmate, 6 Feb 1991, GWAPS, CHC 1-6.

[42](S) CMSgt Jerome E. Schroeder and SMSgt Thomas L. Raab, *History of Joint Task Force Proven Force*, Hq, USAFE History Office, 1991, pp 45-70.

moving from hide sites, firing, then hiding before aircraft could attack them. Intensive operations began in attempts to find, destroy, or simply suppress the mobile missiles, and these activities continued throughout the war. The air effort included continuous airborne surveillance of western Iraq, the positioning of strike aircraft within Scud launch areas for more immediate targeting, attacks on communication circuits thought to be transmitting Scud launch authorization, and attacks on suspected Scud "hide" sites and production and storage facilities. The regions covered were both the western and southern regions of Iraq, the latter area containing the launch sites for Scud launches into the Arabian Peninsula. By war's end, nearly every type of strike and reconnaissance aircraft used in the war participated in the effort to bring this threat under control.

A second redirection of targeting involved digging the Iraqi Air Force out of its shelters. Subject to almost immediate engagement by Coalition aircraft ranging over their bases, the Iraqis elected not to contest control of Iraqi airspace and sought protection in hardened aircraft shelters that the Iraqis thought immune from Coalition attack. To remove the threat of these aircraft, on 23 January airfield attack operations shifted from runway attacks to the destruction of the aircraft shelters. Attacking the nearly 600 Iraqi shelters required a massive shift of resources, mainly F-117s and F-111Fs dropping laser-guided bombs. For two weeks F-111Fs devoted over forty percent of their strikes to these shelters, until they were drawn off for use against tanks and other ground force equipment. Meanwhile, F-117s devoted between eighteen and twenty-six percent of their strikes per week on shelter attacks. Twenty-eight percent of the total British precision bombing effort similarly went against hardened shelters.

The progression of activity in the air war from the second week on was for an increasing concentration of aircraft sorties to the Kuwait theater, with the notable exceptions of those aircraft engaged in Scud attacks and those precision bomb-dropping aircraft engaged in strikes in Iraq (and the Proven Force sorties). Strike operations in Kuwait were aimed at sealing off the area from resupply, attacking traffic within the area, and bringing about the equipment attrition of the Iraqi Army. At the same time, an intense effort was underway to use psychological operations in the form of leaflets and radio and loudspeaker broadcasts to encourage Iraqi soldiers to desert their positions. It was during this period of increased attacks in the Kuwait theater that the Iraqi Army attempted to prompt a ground war by attacking the Saudi Arabian town

of Al-Khafji (30-31 January 1991). The destruction of the attacking columns of armor by waves of air strikes made this attack the only such ground action by the Iraqis until the start of the ground offensive. At the same time, maritime strikes continued in the Persian Gulf to neutralize the Iraqi Navy so that the carrier battle groups could move further north in the Gulf and the naval forces could safely assemble off the coast of Kuwait to create the strategic deception of a planned amphibious assault.

By February, as CENTCOM's focus shifted to the Kuwait theater in preparation for the ground offensive, the success of aircraft in reducing the effectiveness of the Iraqi Army (planning was based on attriting 50 percent of Iraqi armor, artillery, and armed personnel carriers) came in for criticism. Washington and the theater disagreed over what level of success was being achieved, but a greater effort was clearly called for. To increase the lethality of the attacks, A-10s, thought to be the most effective aircraft against armor, decreased their attack altitude to between 4,000 and 7,000 feet.[43] A second adjustment, that led to far better results, was the employment of laser-guided bombs against Iraqi armor. F-111Fs conducted night tests during the first week of February using their infrared sensors to detect the hot skin of the tanks (or any other metal equipment) contrasted against the cooler sand that surrounded them. Following these tests, F-111F, F-15E and A-6 aircraft flew laser-guided bomb attacks against Iraqi armor in a procedure known as "tank plinking." From that point, the number of armor and artillery kills recorded climbed rapidly.[44]

During the later stages of the air attacks to prepare the battlefield for the ground attack, the weight of effort shifted from the Republican Guard and other heavy divisions in the theater reserve to more direct attacks on the Iraqi frontline divisions. More B-52 sorties flew against the frontline forces to effect breaching operations, BLU-82 (15,000 lb.) bombs were dropped from MC-130s to clear mine fields and support psychological operations. Following the loss of two A-10s 60 nautical miles north of Kuwait City in mid-February, which prompted General Horner to restrict A-10s to the kill boxes along the Saudi-Kuwait border in Kuwait, a

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[43]It was during this same period that the employment of F-16 killer scouts (Pointers) began, and F-16s were directed to release bombs below 8,000 feet (see Lt Col Lewis point paper, "Corps Air Support at Desert storm," 3 Jul 1991, GWAPS, CHST 22-15); (S) 23/354 TFW(P) "Battle Staff Directive No. 26," 31 Jan 1991, GWAPS Microfilm Roll 26554.

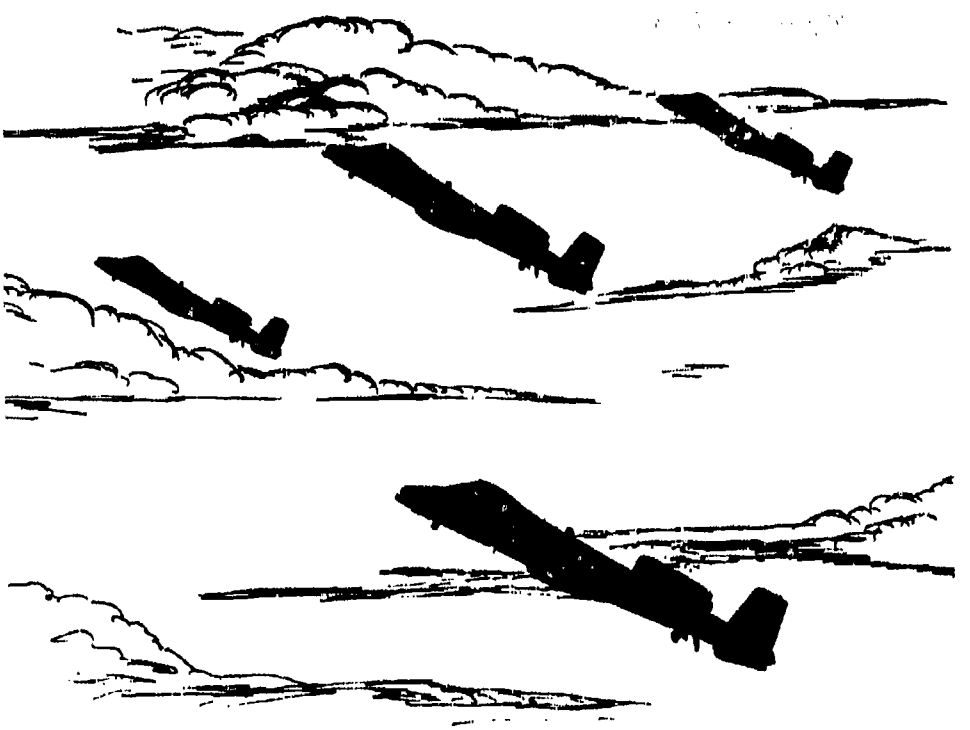
[44]See discussion in Chapter 3.

greater concentration of A-10s attacked the Iraqi regular army forces in the front lines. Specific objectives included preparing breaching sites in Iraqi defenses, destroying artillery in the breach areas, and bombing the pumps used to fill Iraqi fire-trenches. As air power began to focus on the upcoming ground campaign, the continuing strategic air campaign momentarily came to the fore with the attack on the Al Firdos bunker on the night of 13-14 February. The Coalition did not know that the bunker, a legitimate military target, had also served as a civilian shelter when F-117s struck it. The resulting controversy over the deaths of several hundred civilians resulted in tightened control from Washington of attacks into downtown Baghdad.

During the short phase of the ground offensive, close air support hardly had an opportunity to operate. For this phase, the restrictions on bombing altitude were set aside, but the onset of poor weather during this period often made visual bomb releases impossible, even from low altitude. In addition, the speed with which the ground offensive moved and the lack of resistance by the Iraqi forces made close air support little needed. A far greater number of sorties than necessary were available for such missions, but they most often overflew the area and engaged alternate targets well out ahead of the ground advance. While some close air support did take place, much more destruction was caused by aircraft attacking the heavy divisions in the strategic and theater reserves and the retreating columns of the Iraqi Army as it attempted to flee Kuwait. The highway proceeding northwest out of Kuwait City and al Jahra and over Mutla Ridge, the "highway of death," was one such bottleneck of traffic that came under attack during this retreat. The war ended with the Iraqi Army driven to a corner in southern Iraq, south of the Euphrates River and west of a canal near Basra, neither waterway being easily passable (this subject is discussed in Chapter 5).

In the later stages of the air attacks in Iraq, strikes supported both the Kuwait theater directly (destroying bridges to the theater, military support facilities, and communications with the theater) and the pursuit of the remaining Scud storage, chemical, biological, and nuclear sites that were still not destroyed or had been recently located by intelligence sources. Subsequent to the attack on the Al Firdos Bunker on 13 February, only a limited number of strikes were directed at the city of Baghdad until the final days of the war, during the ground offensive. During these last four days, renewed attacks on leadership and chemical weapons storage sites closed out the air campaign.

At the end of the war, there was no doubt that Iraq had suffered a crushing military defeat and that air power was the decisive factor in bringing that about. Also clear was that air power had not accomplished the effects sought on the timetable set prior to the war, and in some cases had not achieved the desired effects at all. Numerous factors, such as weather, weapon accuracy, lack of information on the targets, diversion of sorties, and enemy reactions and countermeasures, had affected the planned employment. What was not clear for many of the target sets was the degree of damage actually done and the relationship of that damage to the defeat of Iraq. The remainder of this report will look at the application of air power to (1) control the air, (2) attack strategic targets, and (3) support the surface forces in an attempt to determine air power's effectiveness in each area, beginning with control of the air.



3

Attacking Iraq's Strategic Air Defenses and Air Force

Overview: Attaining Air Superiority

Of the three historical functions of air power, control of the air seems, by far, the easiest and most unambiguous to assess in terms of operational and strategic effectiveness during Desert Storm. In an October 1990 estimate, the U.S. intelligence community identified Iraq's ability to defend its airspace against Coalition air forces as a significant vulnerability. In the event that conflict between Iraq and the U.S.-led Coalition occurred, the estimate assessed that the Iraqi Air Force would not be effective because it would either be neutralized quickly by Coalition air action or it would be withheld from action in hardened shelters.[1] By and large, this assessment proved accurate. When war came, Coalition air forces soon bottled up the Iraqi Air Force on its airfields and largely suppressed effective employment of Iraq's integrated air-defense system and radar-guided surface-to-air missiles. Save for low-altitude antiaircraft artillery and infrared SAMs in highly defended areas like Baghdad and the portions of the Kuwait theater occupied by Republican Guard divisions, Coalition control of the air was quickly attained. Air superiority–the ability of one side's aircraft to operate in selected airspace at a given time without prohibitive interference from the opposing forces–was achieved by the end of Air Tasking Order (ATO) Day 1; by 27 January 1991 (D+10 or ATO Day 11), Gen. H. Norman Schwarzkopf was able to declare air supremacy, meaning that the Iraqi Air Force was no longer a combat-effective force.[2] So complete did Coalition control of the medium and higher altitudes become during this period that, by the end of the second week of the war, U.S. Air Force tankers had penetrated

[1](S/NF/NC) *Iraq as a Military Adversary*, SNIE 36.2-5-90, Oct 1990, p vii.

[2]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, Apr 1992, pp 124, 127, and 129.

inside Iraqi airspace to accommodate F-117 strikes against targets in the vicinity of Mosul in northern Iraq.[3]

Perhaps the most straightforward evidence for the conclusion that Coalition air forces were unusually effective in gaining and maintaining control of the air stems from comparing the numbers of Coalition fixed-wing combat and combat-support sorties mounted during Desert Storm with those flown by the Iraqis. For most purposes, sorties are an input measure and cannot be taken as direct evidence of operational or strategic effectiveness. In the case of air superiority, though, the basic aim is to make use of the air by flying effective sorties while limiting, as much as possible, the numbers and effectiveness of adversary sorties. Hence a major asymmetry in combat sorties can, in and of itself, reflect one side or the other's dominance in the air.

Table 7 provides two basic comparisons for the two sides' fixed-wing assets during Desert Storm: Coalition versus Iraqi "shooter" sorties and Coalition combat-support sorties versus all the other sorties the Iraqis are thought to have flown during Desert Storm, whether explicitly for combat support in the sense indicated for the Coalition or not. Shooter sorties–including fighter sweeps, fighter escort, combat air patrol, air base attack, lethal defense suppression, interdiction, close air support, and the bombing of strategic targets–provide the most legitimate, "apples-to-apples" comparison.[4] The ratio of Coalition to Iraqi fixed-wing, shooter sorties during the forty-three days of Desert Storm was roughly 160-to-1. In other words, Coalition air forces averaged some 160 air-to-air and air-to-ground sorties for every "shooter" sortie flown by the Iraqis.

In absolute terms, the Coalition's average advantage of 160-to-1 over the Iraqis in fixed-wing shooter sorties during Desert Storm provides strong quantitative evidence that Coalition control of the air was a dominant operational-strategic aspect of the air campaign, if not of the conflict as a whole. In relative terms, however, it must be recognized that Coalition air forces enjoyed significant force-ratio advantages over Iraq. On

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[3]Maj Gen Buster C. Glosson, GWAPS Intvw, Pentagon, 14 Apr 1992.

[4]Comparison of Coalition combat-support with Iraqi nonshooter sorties leaves out, among other things, Coalition airlift, ferry, and redeployment missions during the Gulf War.

Table 7
Coalition versus Iraqi Fixed-Wing Sortie Comparisons
(17 Jan-28 Feb 1991)

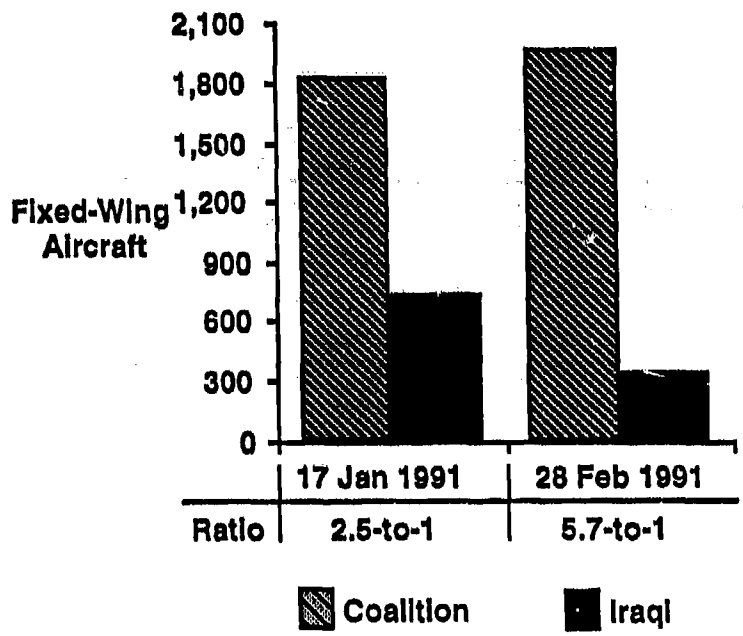
	"Shooter"* (OCA, INT, etc.)	Combat Support* (Recce, EW, etc.)	TOTAL
US Air Force	38,170	14,729	52,899 (57.2%)
US Navy	11,460	5,624	17,084 (18.5%)
US Marine Corps	8,977	980	9,957 (10.8%)
Royal Saudi Air Force	4,324	688	5,012 (5.4%)
Royal AF (Britain)	2,882	947	3,829 (4.1%)
Royal Canadian Air Force	885	64	949 (1.0%)
French Air Force	1,101	286	1,387 (1.5%)
Italian Air Force	135	89,224	(0.2%)
Kuwait Air Force	780	0	780 (0.8%)
Bahrain Air Force	288	1	289 (0.3%)
Qatar Air Force	43	0	43 (0.05%)
United Arab Emirates Air Force	58	6	64 (0.07%)
Coalition Sorties:	**69,103**	**23,414**	**92,517** (100%)
Iraqi Sorties:	**~430**	**~180**	**~610**

Shooter sorties included offensive counterair (OCA), DCA, interdiction, close air support, and combat air patrol (CAP). Coalition combat-support sorties included reconnaissance, air refueling, electronic warfare (EW), command and control, and special operations; the 180 Iraqi "combat support" sorties are simply all the other non-shooter sorties the Iraqis flew during Desert Storm. Sources: GWAPS, "Composite Sorties" Database, Oct 1992; DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, Apr 1992, p 152.

17 January 1991, Coalition air forces had more than twice the number of fixed-wing combat aircraft as Iraq, and the Coalition's advantage in available shooter assets grew as Iraqi aircraft were shot down, destroyed on

the ground, or flown to sanctuary in Iran (Figure 2). While these force-ratio differences obviously mitigate the magnitude of the Coalition's advantage in shooter sorties suggested by the 160-to-1 figure, the nearly twofold decline of Iraqi fixed-wing combat aircraft over the course of the

Figure 2
Coalition versus Iraqi Fixed-Wing[5] Combat Aircraft (Shooters)



[5]9th Air Force "Beddown" slides for Coalition forces as of 15 Jan 1991, provided to GWAPS during visit to Shaw AFB, NC, 9 Mar 1992; Gen Merrill McPeak, "The Air Campaign: Part of the Combined Arms Operation, or, 'The Mother of All Briefings,'" 15 Mar 1991, slide 4; DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, Apr 1992, pp 11, 85 and 154; GWAPS *Statistical Compenium*, (S/NF/W/NC) Table 4. The Coalition shooter counts in Figure 2 included Proven Force, B-52s as far away as Spain, and all allied assets in the Persian Gulf. The end-of-war figure for Iraq–350 fixed-wing aircraft–is a conservative estimate that only subtracts those aircraft that Coalition intelligence could definitely confirm as having been shot down, destroyed on the ground, captured by Coalition ground forces, or lost to Iran. Wartime data kept by CENTAF intelligence (discussed later in this chapter) suggested that the figure for the combat aircraft remaining in Iraqi hands by 28 February 1991 was about 325, and some in the intelligence community thought the figure may have been even lower.

war, together with growth in Coalition shooters, provides another indication of how completely and effectively Coalition air forces dominated the air during Desert Storm.

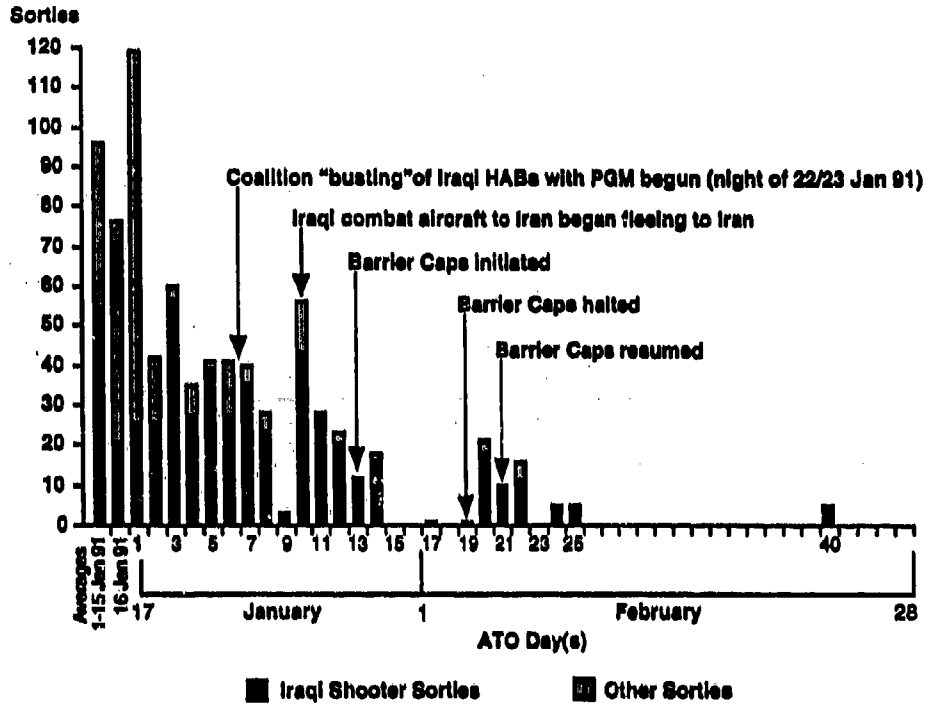
Further evidence for the speed and efficiency with which Coalition air forces gained control of the air can be seen in the decline of Iraqi flight activity over the first week of the war. The first day of the war proved to be the only day the Iraqi Air Force managed to exceed the overall number of sorties it had averaged during the first fifteen days of January 1991, and the third day of the war was the only day the number of shooter sorties exceeded the average for 1-15 January (see Figure 3). On the ninth day of the war (25 January 1991), Iraqi flight activity fell to fewer than five sorties for the day, and the numerical resurgence on the 26th marked the beginning of Iraqi efforts to fly fixed-wing combat aircraft to sanctuary in Iran in response to the Coalition's use of 2,000-pound laser-guided bombs to bust Iraqi hardened shelters.[6]

A fact not evident in Figure 3 is that the vast majority of Iraqi shooter sorties were either defensive counterair missions or efforts to flee to Iran. So far as can be ascertained from the available evidence, the only fixed-wing air-to-surface sorties attempted by the Iraqi Air Force against Coalition forces occurred on 24 January 1991, when two F-1s managed to reach the northern Persian Gulf before both being shot down by a Saudi Arabian F-15C.[7] Presumably the Iraqi F-1s, which had enjoyed success attacking ships in the Gulf with Exocet air-to-surface missiles during the Iran-Iraq war, had been targeted against U.S. naval combatants there. In any event, the picture that emerges from Iraqi wartime flight activity is that the Desert Storm air campaign rapidly boiled down to a one-sided contest in which only one side's air force was operating in any meaningful sense. After 25 January 1991, when the first wave of about two dozen Iraqi fighters fled to Iran, the main purpose of Iraqi

[6]Over a dozen noncombat aircraft had already flown to Iran when the first exodus of combat aircraft occurred on ATO Day 10 (Merrill A. McPeak, "The Laurels of Excellence," *Sea Power*, Apr 1991, Figure 2, p 48).

[7]John M. Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, p 22. Except for the two F-1s downed by Captain Ayedh Salah Al-Shamrani on 24 January 1991, all the other confirmed air-to-air kills by Coalition aircrews during Desert Storm were credited to US airmen.

Figure 3
Iraqi Shooter versus Nonshooter Flight Activity[5]



flight activity seems to have focused not on attacking Coalition forces, or even defending Iraqi airspace, but on getting as many advanced combat aircraft as possible to safety in Iran in hopes of being able to recover

[5]The majority of the data in Figure 3 were taken from *Conduct of the Persian Gulf War: Final Report to Congress*, Apr 1992, p 152. The very limited data on Iraqi flight that survived the war within the national intelligence agencies were sketchy and only justified a few minor corrections to the data originally published in the DOD final report. One reason that better data could not be obtained was that records of daily Iraqi flight activity were not retained except for what was reported in message traffic. The other was that as Coalition attacks degraded the Iraqi air defense system, the things being tracked shifted rapidly enough that flight-activity data early in the war were not comparable to those recorded later. Given the limits of low-altitude AWACS coverage in central Iraq, it seems likely that the Iraqis flew more sorties than were observed.

them after the war (see Figure 4 for the portion of Iraqi flight activity that consisted of flights to Iran).

One final measure of Coalition dominance in the air that bears mentioning is the box score from air-to-air engagements between Iraqi and Coalition aircraft. During Desert Storm, Coalition fighters and fighter-bombers were officially credited with downing thirty-three Iraqi fixed-wing aircraft (five MiG-29s, eight Mirage F-1s, two MiG-25s, eight MiG-23s, two Su-25s, four MiG-21s, three Su-7/17s,[9] and one IL-76) and five helicopters.[10] In addition, toward the end of March 1991, U.S. F-15 pilots were credited with three more Iraqi aircraft (two Su-22s and a helicopter) when Iraqi forces violated the cease-fire conditions imposed on Iraq.[11]

It was thought, immediately after the war, that no Coalition aircraft had been shot down by Iraqi aircraft.[12] Postwar reexamination of Coalition losses eventually suggested, however, that the lone aircraft lost on the first night of the air campaign, an F/A-18 from the USS *Saratoga*, may have been downed by an Iraqi MiG-25. Detailed reconstruction of the circumstances surrounding the fate of this aircraft produced no positive evidence that it had been lost to an Iraqi radar-guided surface-to-air missile (as was believed initially), and the known presence of an Iraqi

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[9]Although these three kills were officially credited as Su-7/17s, they were more likely Su-20 or Su-22 variants (Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, p 41).

[10]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, Apr 1992, p 160; Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, pp 40-41. Deur's summary also includes the MiG-24 destroyed in the air by a GBU-10, laser-guided bomb from an F-15E on 14 February 1991, for which no "kill credit" was awarded (*ibid*, pp 14 and 41).

[11]Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, p 41.

[12]9th Air Force briefing to GWAPS, "Desert Storm: Offensive Air Campaign," given 9 Mar 1992, Shaw AFB, NC; Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, p 38; (S) Thomas P. Christie, Gary C. Comfort, and Richard E. Guild, *Desert Shield/Desert Storm Air-to-Air Performance Study* (Alexandria, VA: Institute for Defense Analyses, April 1992), IDA document D-1090, p 28.

MiG-25 in the immediate vicinity when the F/A-18 went down left the Iraqi interceptor as the most likely cause of the loss.[13]

The best figure for the Coalition's air-to-air box score during Desert Storm, therefore, is thirty-three fixed-wing kills for one loss. While this thirty-three to one exchange ratio is not, in itself, quite as impressive as the eighty-five to zero ratio claimed by the Israelis against Syria in June 1982, it does confirm a wide margin of Coalition superiority in air-to-air combat. What is not evident in the Coalition's bare exchange ratio is the degree to which Coalition fighters, operating in conjunction with platforms like the E-3 AWACS (Airborne Warning and Control System), were able to achieve sufficient "situational awareness" to be able to shoot beyond visual range (BVR). Since the appearance in the late 1950s of the F-4 armed with the radar-guided AIM-7 Sparrow missile, the United States and other countries have had fighters with the technical capability to down opposing aircraft at distances outside the ranges at which the target could be visually observed. However, well-founded fears of accidentally shooting down friendly fighters–particularly once the fight was joined and opposing aircraft became tightly intermingled–have made BVR shots in actual combat the rare exception. In 1982, even though about half of Israel's eighty-five kills were made by F-15s, the Israeli Air Force maintained that no shots were taken from beyond visual range.[14]

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[13]Cmdr Mark Fitzgerald, GWAPS Intvw, 15 May 1992. At the time this interview took place, Fitzgerald was the skipper of the Naval Intelligence Command's Strike Projection Evaluation and Anti-Air Warfare Research organization (SPEAR). (SPEAR is an operator-oriented and operator-led organization modeled on the original Checkmate group created by Air Force Chief of Staff Gen David Jones in 1976. The initial concept for Checkmate was to put fighter pilots together with intelligence and logistic personnel and let them reach bureaucratically unfettered assessments of likely combat outcomes of a conventional war in central Europe.) During the Gulf War, Fitzgerald was on the *Kennedy* and led the first A-7 raid into Iraq on the opening night of the war. While airborne over Iraq on this mission he saw the MiG-25, to which the loss of the F/A-18 has been attributed, pass overhead in afterburner. SPEAR's efforts to pin down the cause of this loss had persuaded Fitzgerald by May 1992 that the MiG-25 was the most likely cause, and the US Navy subsequently acknowledged this point publicly.

[14]Robinson, "Surveillance Integration Pivotal in Israeli Successes," *Aviation Week*, 5 Jul 1982, p 16; Lambeth, *Moscow's Lessons from the 1982 Lebanon Air War*, Rand R-3000-AF, p 9.

In Desert Storm things turned out rather differently. Of the twenty-three AIM-7M kills credited to USAF F-15s during the period 17 January-28 February 1991 (including two helicopters), sixteen involved missiles that "were fired" from beyond visual range.[15] As a result, Desert Storm was the first conflict in history in which a significant percentage of the air-to-air engagements that produced confirmed kills–sixteen of the thirty-eight victories credited to Coalition fighters during Desert Storm (more than forty percent)–involved beyond-visual-range shots. The degree of control over highly dynamic engagements implied by this statistic has no historical precedent, not even in the Israelis' eighty-five to zero performance against the Syrian Air Force flying Soviet fighters in 1982.

Statistics like the Coalition's roughly 160-to-1 preponderance in shooter sorties and 33-to-1 air-to-air exchange ratio obviously bear out the general conclusion that the U.S.-led Coalition quickly gained control of the air over Iraq, much as the October 1990 SNIE had predicted. Details such as the rapid decline of meaningful Iraqi flight activity and the ability of Coalition fighters to take beyond-visual-range missile shots with avoiding air-to-air fratricide[16] tend to support an even stronger conclusion: namely, that Coalition effectiveness in achieving air superiority during Desert Storm would rank among the very best performances of the second half of the twentieth century.

While conclusive statistical data for this stronger conclusion are not readily available, support can be gleaned from comparing Coalition loss rates and operational tempos during the Gulf War with those recorded by American airmen during Rolling Thunder and Linebacker. Table 8 summarizes Coalition fixed-wing aircraft losses during the forty-three

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[15]GWAPS Statistics report, Table 218, "Coalition Air-to-Air Kills Matrix"; (S) Christie, Comfort, and Guild, *Desert Shield/Desert Storm Air-to-Air Performance Study*, pp 30-31; also Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, pp 5, 8, 11, 14-15, 18-20, 25-26, 28, 31, and 33. In most cases, the rules-of-engagement (ROE) for F-15 BVR shots were satisfied by E-3A Airborne Warning and Control System (AWACS) aircraft, which were able to confirm "hostile target, no friendlies" (Christie, Comfort, and Guild, p C-5).

[16]The Iraqis were not evidently as fortunate. For example, an Iraqi MiG-23 is believed to have been accidentally downed by a radar missile from an Iraqi MiG-29 on the opening night of the war ("Tim Bennett's War," *Air Force Magazine*, Jan 1993, p 36).

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days of Desert Storm. Some thirty-eight aircraft were lost to enemy action; another fifteen were lost during Desert Storm either to nonhostile-but-known causes such as fuel exhaustion, pilot error, and aircraft-system failures, or else to unknown causes.[17]

Table 8
Coalition Fixed-Wing Losses (17 January-28 February 1991)

Combat Losses:

U.S.	4 A-10	**Saudi Arabia**	1 Tornado GR-1
	1 AC-130		1 F-5
	1 EF-111		
	2 F-15E	**United Kingdom**	7 Tornado GR-1
	3 F-16		
	1 F-4G	**Italy**	1 Tornado GR-1
	1 F-14		
	2 F/A-18	**Kuwait**	1 A-4
	3 A-6E		11
	5 AV-8B		
	4 OA-10		
	37		

Coalition Fixed-Wing Combat Losses: 38

Coalition Fixed-Wing Non-Combat Losses: 15

Losses Not Due To Enemy Action Or Unknown:

U.S.	1 AV-8B	**Saudi Arabia**	1 F-15C
	5 F-16		1 GR-1
	1 B-52		
	1 F/A-18	**United Kingdom**	2 GR-1
	1 A-6E		4
	2 A-7E		
	11		

Source: Maj Bill Troy, USAF Studies and Analysis Agency.

[17]GWAPS *Statistical Compendium*, Table 216, "Total Coalition Combat Losses by Cause"; data derived from Maj Bill Troy, Air Force Studies and Analysis Agency/ Regional Forces Division.

Dividing these two loss totals by the 69,103 shooter sorties flown by Coalition air forces during the Gulf War yields the following loss rates: 0.00055 losses/sortie due to hostile action and 0.00077 losses/sortie with the fifteen additional losses not due to hostile action included. To restate these numbers in more understandable terms, Coalition air forces experienced one loss due to hostile action for roughly every 1,800 shooter sorties flown; if noncombat losses are included, then the figure drops to about 1,300 shooter sorties per loss. The comparable Iraqi loss rate would be 0.076, or roughly one aircraft shot down for every thirteen shooter sorties flown[18]–a figure that reflects the truly staggering differential in air-combat loss rates between the two sides.

How do the Coalition's combat loss rate and operational tempo stack up against comparable figures from the Vietnam war? The U.S. loss rate over North Vietnam from January-December 1967 was 4.7 times higher than Coalition forces experienced in Desert Storm (Table 9). For the initial weeks of Linebacker I in the spring of 1972, the loss rate over the north was almost six times higher than the Coalition's in 1991, and, in Linebacker II the U.S. loss rate was some fourteen times higher. As for operational tempo, the Coalition's average number of shooter sorties per day was four to just over six times that recorded over North Vietnam in May 1972.[19] Furthermore, the array of ground-based defensive systems possessed by Iraqi forces in January 1991–which included SA-2s, SA-3s,

[18]The Iraqi loss rate in the air of 0.076 losses/sorties was based on roughly 430 shooter sorties and 33 fixed-wing losses to Coalition fighters. This loss rate ignores Iraqi aircraft losses on the ground due to uncertainties about the numbers destroyed in hardened aircraft bunkers, nor does it take into account Iraqi aircraft flown to Iran and not returned to Iraqi control. Even so, the Iraqi combat loss rate is some two orders of magnitude greater than the Coalition's even if the Coalition's 15 losses to nonhostile causes are included.

[19]This comparison of operational tempos ignores the large numbers of sorties US forces flew daily over South Vietnam, Laos, and other areas of Southeast Asia. During May of 1972, for example, the US averaged some 790 attack and combat-air patrol sorties/day throughout all areas of operations (DOD, OASD/Comptroller, Directorate of Information Operations, Table 310, 22 Jun 1972). Thus, the average of 260 sorties/day over North Vietnam during this period shown in Table 3-3 was only about one-third of the total American effort in the air throughout Southeast Asia. Again, the much lower air-defense threat, particularly in South Vietnam itself, was the primary reason for excluding all but combat sorties over North Vietnam for comparison with Desert Storm.

Table 9
Loss-Rate and Sorties/Day Comparisons[20]

	Iraq 1991 (Desert Storm)	North Vietnam 1967 (Rolling Thunder)	North Vietnam May 1972 (Linebacker I)	North Vietnam 18-29 Dec 1972 (Linebacker II)
"Shooter" Sorties	69,103	129,039	8,051	3,191
Losses to Enemy Fire	38	337	26	25
Average Sorties/Day	1,607	355	260	290
Loss-Rate	0.00055	0.00261	0.00323	0.00783
Sorties-Flown/Loss	1,819	383	310	128
Loss-Rate/Sortie Ratios		1967/1991 4.7-to-1	May1972/1991 5.9-to-1	Dec1972/1991 14.2-to-1
Sorties/Day Ratios		1991/1967 4.5-to-1	1991/May1972 6.2-to-1	1991/Dec1972 5.5-to-1

SA-6s, SA-8s, SA-9s, SA-13s, Rolands, antiaircraft artillery, and various handheld infrared surface-to-air missiles–was far more complex than the SA-2/AAA threat that predominated over North Vietnam. So the Coalition's combat loss rate in Desert Storm was substantially lower than those for comparable portions of the Vietnam air war, despite the higher daily levels of effort sustained in the Gulf War and the more complex air defenses that confronted Coalition air forces over portions of Iraq and the Kuwait theater of operations.

It would probably be unwise to push these sorts of statistical comparisons too much further. As suggested in Chapter 1, the strategic

[20]DOD, OASD/Comptroller, Directorate of Information Operations, Table 311 (22 Jun 1972) and Table 321 (19 Apr 1972); (S) Headquarters Pacific Air Forces (PACAF), Directorate of Operations Analysis, *Summary: Air Operations Southeast Asia*, Jan 1973, pp 4-B-1 and 4-B-2. The portions of the Vietnam air war chosen for comparison with the Desert Storm air campaign were basically those involving air operations over North Vietnam. The large numbers of sorties US forces flew daily over South Vietnam, Laos, and other areas of Southeast Asia in conjunction with the bombing of North Vietnam were excluded due to the much lower-threat air-defense environment US airmen faced over South Vietnam and much of Laos.

circumstances in which the Gulf War occurred were quite different from those of the Vietnam conflict, and the Iraqi Air Force was never intended to take on an opponent as large, well trained, or well equipped as the Coalition force that initiated Desert Storm on 17 January 1991. Nevertheless, the basic statistical data on control of the air from Desert Storm broadly supports the view that the Coalition was highly effective in achieving air superiority. Forcing the Iraqi Air Force to suspend meaningful air operations after just eight days by imposing a loss rate in the air of more than one-hundred times greater than the Coalition's, the Coalition air forces were also able to achieve surprisingly high operational tempos compared to the peak efforts over North Vietnam while holding their combat loss rate to a fraction of what U.S. air forces experienced during the period 1965-1972.

Chapters 4, 5, and 6 in this report will explore the operational and strategic use that Coalition air forces made of their early control of the air over Iraq and occupied Kuwait. The burden of the present chapter will be to describe in more depth those aspects of this overall achievement that were more operational or strategic than tactical in nature. In this regard, the attainment of air superiority (and, later, of air supremacy) by Coalition air forces can be viewed as a set of interrelated actions or steps whose overall aim was to eliminate the various defensive and offensive employment options available to the Iraqi Air Force. Highly favorable air-to-air exchange ratios constituted, if you will, one piece of the traditional air-superiority problem. Other major pieces of the problem, whose operational-strategic aspects will be covered in this chapter, include disrupting the "KARI" command and control system that provided the central nervous system of Iraq's integrated air defense system, suppressing Iraq's radar-guided or "strategic" SAMs, and attacking the airfields from which the Iraqi Air Force operated. In general, the reader interested in the tactical details of air-to-air combat, suppression of enemy air defenses, or airfield attack during Desert Storm should refer to the GWAPS report on weapons, training, and tactics.

It is also possible to view the problems of suppressing Iraqi launches of modified Scud missiles at neighboring countries, and of defending against incoming ballistic missiles once launched, as extensions of the traditional air-superiority problem. As mentioned in the introduction, however, it was decided to cover the anti-Scud effort by Coalition air forces as part of the "core" strategic air campaign in Chapter 6.

Concerning the now-disputed details of wartime success rates of the Patriot air defense system in defending targeted areas in Israel and Saudi Arabia against Iraqi extended-range Scuds, these issues were judged primarily tactical in nature and, consequently, outside the scope of the present report. To briefly summarize what occurred, 21 U.S. Patriot batteries (132 launchers) were deployed to Saudi Arabia to protect crucial assets such as airfields, ports, command and control centers, oil production and refinery facilities, and logistics bases, and 7 batteries (4 U.S., 1 Dutch, 2 Israeli) totaling 48 launchers were deployed to defend selected populations in Israel, although only the U.S. and Israeli batteries were involved in Scud engagements.[21] The postwar controversy over Patriot performance focused on the relatively high success rates intercepting incoming Scud warheads that were reported during and immediately after the war. Operationally successful intercepts of incoming Scuds were reported to have occurred almost ninety percent of the time over Saudi Arabia and around forty-five percent of the time in the case of launches against Israel.[22] Critics opposed to ballistic-missile defenses in general were quick to attack these claims,[23] and, in April 1992, the U.S. Army slightly reduced its claims of Patriot success to seventy percent of the modified Scuds launched at Saudi Arabia and forty percent of those aimed at Israel.[24]

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[21]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, Apr 1992, p 756. The four Patriot batteries deployed to Turkey were not involved in any Scud engagements (*ibid*).

[22]Part way through the war, Gen Schwarzkopf told reporters that the Patriot's success rate had been "100 percent. . . .[O]f 33 engaged, there have been 33 destroyed" (Ben Sherwood, "The Blip Seen 'Round the World," *Washington Post*, 20 Sep 1992, p C2). Raytheon claimed immediately after the war that Patriot managed to hit incoming Scud warheads aimed at Saudi Arabia 89% of the time, and those aimed at Israel some 44% of the time (Robert Skelly, "Critics Fire Misinformation at Patriot," *Defense News*, 13 May 1991, p 33; Anthony H. Cordesman, "Rushing to Judgment on the Gulf War," *Armed Forces Journal International*, Jun 1991, p 72). US Army spokesmen defended similar percentages for over a year (Brig Gen Robert A. Drolet, "PEO Air Defense Response to Patriot Criticisms," *Inside the Army*, 9 Dec 1991).

[23]See, for example, Theodore A. Postol, "Lessons of the Gulf War Experience with Patriot," *International Security*, winter 1991/1992, pp 119-171. Subscribers to *International Security* also received a 28-page rebuttal of Postol's paper by Robert M. Stein of Raytheon entitled "Patriot ATBM Experience in the Gulf War."

[24]Headquarters US Army, ODCSOPS (DAMO-FDE), *The Story of Patriot in Desert Storm*, 28 Sep 1992, pp 28 and 32; Sherwood, "The Blip Seen 'Round the World," *Washington Post*, 20 Sep 1992, p C2.

Data constituted the fundamental limitation on evaluating the tactical performance of the Patriot in Desert Storm. Digital recordings of actual engagements were only available "for a few of the Scud attacks."[25] The same was true for high-speed-camera shots: good optical data only covered a few of the engagements over Israel, whereas television coverage provided, at best, low-confidence data that could not conclusively establish the results of individual engagements one way or the other.[26] Again, though, these are tactical, rather than operational or strategic, matters. Moreover, even the harshest critics of Patriot's wartime performance have conceded that its employment had "significant political and psychological effects" in making it easier for Israel to stay out of the war, as well as in reassuring Saudi and Israeli civilians and Coalition forces in the region.[27] Militarily, Iraq's use of modified Scuds had no direct effect on Coalition operations such as causing the cancellation of sorties; indirect effects such as the diversion of sorties to Scud hunting did not measurably constrain the air campaign due, if for no other reason, to the large numbers of sorties available; and, Israel did not enter the war in response to attacks by Iraqi Scuds. Last but not least, since Patriot had been designed primarily to defend against enemy aircraft, successful intercepts against tactical ballistic missiles even a modest percentage of the time represented a considerable technical achievement.[28]

Air-to-Air Effectiveness

The basic facts concerning Coalition performance in air-to-air combat against the Iraqi Air Force have already been sketched. During Desert Storm Coalition air forces shot down thirty-three Iraqi fixed-wing aircraft, as well as five Iraqi helicopters, while suffering, at most, one air-to-air loss on the opening night of the war. More than forty percent of the Coalition's kills from 17 January through 28 February 1991 involved beyond-visual-range shots, and the Iraqi Air Force largely ceased flying meaningful combat sorties by the second week of the air campaign. The tactical successes of Coalition aircrews in air-to-air combat, which were

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[25]US Army, *The Story of Patriot in Desert Storm*, 28 Sep 1992, p 27.

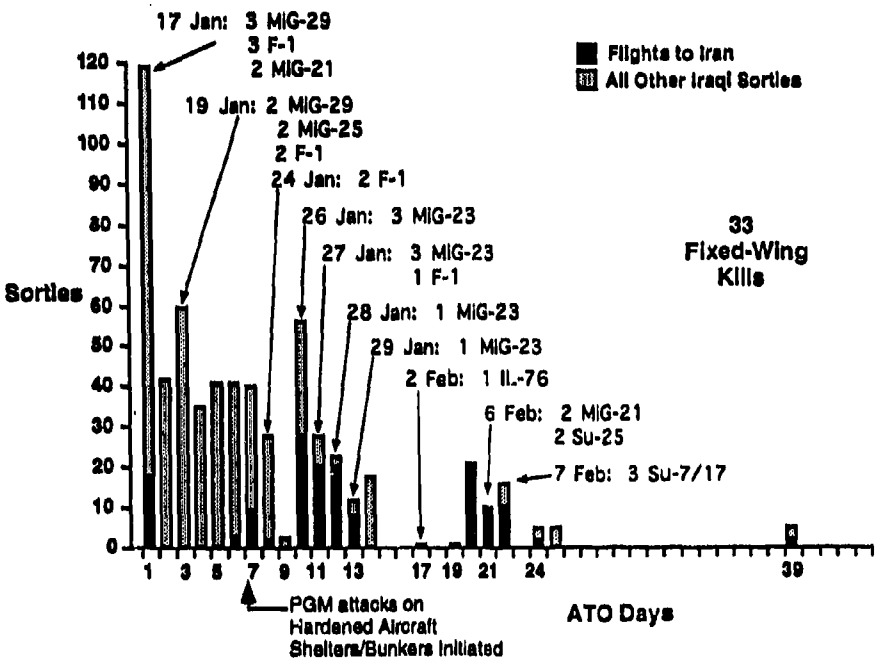
[26]Stein, "Patriot ATBM Experience in the Gulf War," p 16.

[27]Postol, "Lessons of the Gulf War Experience with Patriot," *International Security*, Winter 1991/1992, p 121.

[28]US Army, *The Story of Patriot in Desert Storm*, 28 Sep 1992, p 3.

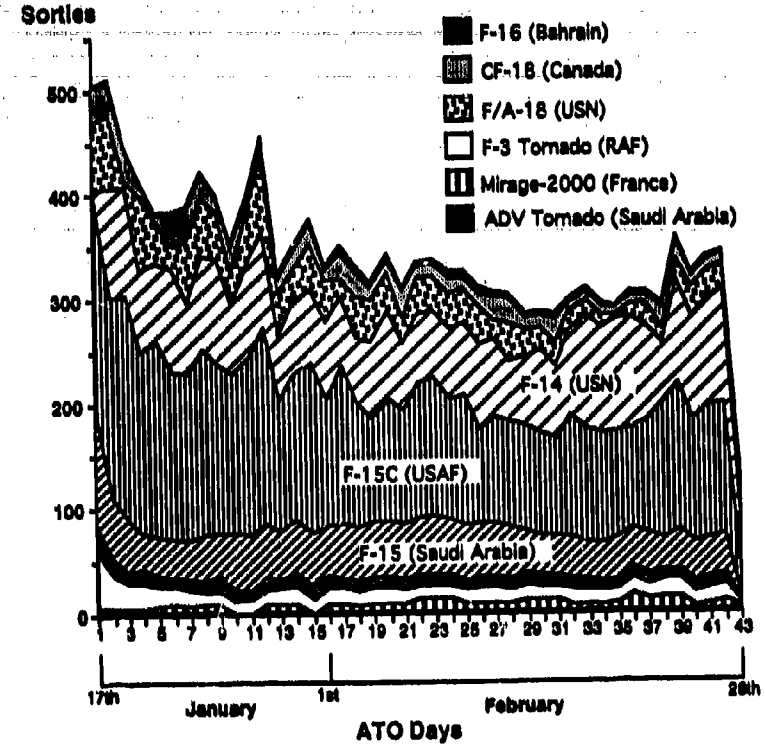
as much a testament to U.S. investment in realistic training in programs like Red Flag throughout the 1980s as to the quality of U.S. weaponry, produced the operational result of demonstrating, at the outset of the campaign, that Iraqi pilots could not compete head-to-head against Coalition aircrews in aerial combat. A collection of successful tactical engagements, which were not obviously interconnected or sequentially linked, quickly led to the decline in Iraqi flight activity evident in Figure 4. Especially when Iraqi sorties to Iran are set aside, the picture that emerges of the Iraqi Air Force during Desert Storm is one of more or less steady decline in flight activity over the first two weeks of the war, and almost nothing after that. Save for the unanticipated crisis precipitated by the beginning of systematic Coalition efforts to destroy Iraqi hardened aircraft bunkers and shelters, Iraqi flight activity might well have basically ceased by the ninth or tenth day of the air campaign. The total of fourteen Coalition kills on 17 and 19 January appear to have been particularly effective in bottling up the Iraqi Air Force on the ground.

Figure 4
Iraqi Flight Activity versus Coalition Kills



Coalition kills occurred on a variety of offensive and defensive counterair missions, including pre- and poststrike sweeps to clear ingress and egress corridors for strike aircraft, pure fighter sweeps not tied to specific strike packages, escort missions on which the fighters would stay with a given strike package, High Value Airborne Asset (HVAA) combat air patrols to protect support aircraft such as AWACS or tankers, and Barrier Combat Air Patrols (BARCAPs) to stop Iraqi aircraft from fleeing to Iran. All in all, a fairly sizable level of Coalition effort–on average, more than 340 sorties daily–went into air-to-air during Desert Storm (Figure 5).

Figure 5
Coalition Air-to-Air Sorties[29]



[29]GWAPS *Statistical Compendium*, tables 98, 99, 106, 107, 109, 113, 114, 115, and 116. Note that air-to-air sorties logged as OCA (offensive counterair) by US Navy and Marine Corps F/A-18s could not be broken out separately for inclusion in Figure 5.

Given the seeming lack of effective resistance by the Iraqi Air Force, how should the effectiveness of the more than 14,500 Coalition air-to-air sorties be evaluated? Before this question can be answered there are certain tactical details that need to be mentioned. Regarding the tactical competence of the Iraqi pilot force, some of the initial ambushes that the Iraqis put together were reasonably well designed. Nevertheless, the consistent and overriding pattern evident in debriefs of engagements by Coalition pilots was the evident lack of situational awareness by their Iraqi adversaries. Accustomed to relying heavily on direction from controllers on the ground, Iraqi interceptor pilots showed little capacity to adjust to dynamic engagements or to exercise much initiative. Those shot down during Desert Storm generally did not react to radar lock-ons by Coalition fighters[30] and, for the most part, performed little effective maneuvering, either offensive or defensive; time and again, the principal defensive reaction by Iraqi pilots subjected to attack by Coalition fighters was to descend to very low altitude in the apparent belief that the pulse-doppler radars of Coalition fighters could not lock onto them there.[31]

Most of the Coalition's air-to-air kills occurred with clearance to fire beyond visual range (BVR) having already been granted by the Airborne Warning and Control System.[32] This authorization meant that the target was known to be hostile and that there were no friendly aircraft in the way. [DELETED][33] [DELETED][34] The rules of engagement were structured in this way to minimize the possibility of one Coalition aircraft shooting down another, something Coalition air commanders were determined to avoid.

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[30]There were, of course, occasional exceptions to the general lack of reaction by Iraqi pilots to Coalition fighters during Desert Storm, but they were not common.

[31](S/NF/NC) 57th Fighter Wing, "Desert Storm Air to Air Engagements," 3 Mar 1992, portion of document titled "33rd Fighter Wing Air to Air Engagements," pp 11, 16, 17, and 25. This compendium contained engagement debriefings for the four provisional US Air Force F-15C wings that operated during Desert Storm, and each wing's portion had its own page numbers. The 33rd, which was credited with more kills than any other unit, was based at Tabuk in Saudi Arabia.

[32](S) Christie, Comfort, and Guild. *Desert Shield/Desert Storm Air-to-Air Performance Study*, p C-5.

[33](S) *Ibid*, p 44.

[34](S) *Ibid*, p 50.

One consequence of this emphasis on avoiding air-to-air fratricide, however, was that Coalition forces were not able to exploit the long-range-shot capability of the Phoenix missile on the U.S. Navy's F-14s during Desert Storm.[35] Even after Iraqi combat aircraft began escaping to Iran, the F-15s continued to predominate as the platform of choice for the barrier combat air patrol points most likely to have opportunities to score kills against escaping Iraq aircraft.[36] This preference naturally created some frustration within the U.S. Navy F-14 community. In retrospect, though, the beyond-visual-range limitations of the F-14 under the established rules of engagement appear to have been the primary factor in the plane's limited use on overland combat air patrol stations. As a Navy pilot who flew in Desert Storm and scored one of the U.S. Navy's three confirmed kills later observed:

> The F-14 has the Phoenix which is an extremely long range missile, but they don't have NCTR [non-cooperative target recognition] and hostile [identification friend or foe] interrogation. They can interrogate good guys, but not the bad guys. If you can't tell who they are, that's [a serious problem] because there were so many Coalition airplanes flying around. I didn't feel that the rules of engagement were structured against the Navy; they just took advantage of the technical capabilities of the F-15.[37]

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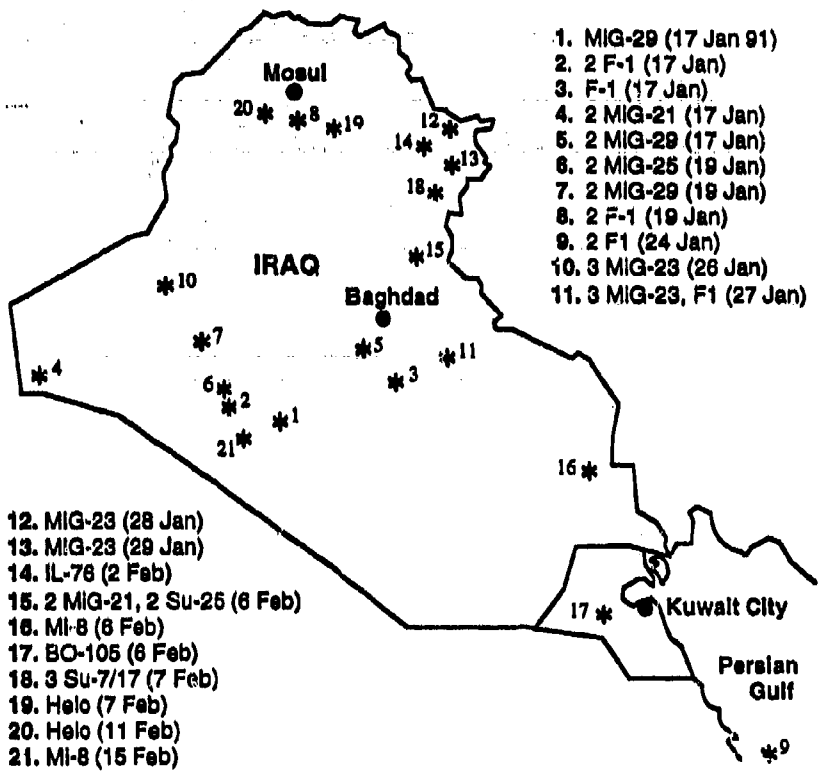
[35]The only kill credited to an F-14–an Iraqi Mi-8 helicopter on 6 February 1991–was made with AIM-9 heating-seeking air-to-air missile.

[36]F-14s did begin helping with the Elaine barrier CAP on 6 February 1991 [(S) Charles E. Chambers, et al, *Desert Storm Reconstruction Report*, Vol 3, *Antiair Warfare* (Alexandria, VA: Center for Naval Analyses, Oct 1991), CRM 91-179, p 3-56]. But the use by F-14s of call signs other than those in the ATO led to "endless confusion" in transferring control of this CAP between Air Force and US Navy control agencies (*ibid*, p 3-50).

[37]Lt Cmdr Mark I. Fox, quoted in Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, p 5.

Figure 6
Credited Coalition Kills[38]



The final tactical issue bearing discussion concerns the general areas in which air-to-air operations by Coalition fighters were focused at various stages of the Gulf War. If the fourteen kills scored on 17 and 19 January 1991 are excluded, then the bulk of the remaining fixed-wing kills occurred over the east-central portions of Iraq (see Figure 5).

[38]Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, p 7.

[DELETED][39] Coalition fighters sent to this area to prevent Iraqi fighters from escaping to Iran were usually stretched on fuel, and, as frustration mounted in Riyadh over escaping Iraqi fighters, their pilots had to cope with sortie lengths of more than seven hours.[40] From a tactical standpoint, therefore, counterair sorties in this region tended to stretch Coalition fighters and crews alike to the limits of their capabilities.

With these tactical considerations in hand, a more precise assessment of the Coalition's operational-strategic effectiveness in air-to-air should now be possible. Once again, the Iraqi Air Force was quickly bottled up on its airfields. Moreover, the Coalition's thirty-three to one exchange ratio (thirty-eight to one counting helicopters) indicates a high degree of tactical effectiveness, as does percentage of kills involving beyond-visual-range shots (forty-two percent or forty-eight percent, depending on the whether the credited helicopter kills are included) while avoiding any "blue-on-blue" kills.[41] On the other hand, a balanced assessment of the Coalition's operational-strategic effectiveness in this area must take into account the likelihood that the Iraqi leaders never intended to risk the levels of aircraft attrition that the Iraqi Air Force would have had to accept in order to oppose the Coalition's initial air strikes, or broad Coalition control of the air, to any serious degree.

The strategy of the Iraqi Air Force on 17 January 1991 appears to have focused mainly on riding out the initial Coalition bombing raids inside what were believed to be virtually bombproof aircraft shelters while attempting some defensive counterair under close control from

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[39](S) Christie, Comfort, and Guild, *Desert Shield/Desert Storm Air-to-Air Performance Study*, p 50.

[40](S) *Ibid*, p C-2. Sortie lengths to this region of Iraq became so long that US F-15 pilots were, for a period of time, authorized to use stimulants and sleeping pills to combat drowsiness on these missions and, once back on the ground, to sleep (Glosson, GWAPS intvw, 14 Apr 1992).

[41]While there were no "blue-on-blue" shot-downs, some "blue-on-blue" encounters occurred; see, for example, (S) Chambers, et al, *Desert Storm Reconstruction Report*, Vol 3, *Antiair Warfare*, CRM 91-179, p 3-57).

Iraq's integrated air defense system.[42] The Iraqis undoubtedly hoped that, with minimal risk to force survival, they would be able to disrupt the Coalition air campaign somewhat and, possibly, inflict enough losses on Coalition air forces by going after isolated stragglers and egressing strike aircraft low on fuel to impress their fellow Arabs. Nonetheless, there is no credible evidence that Saddam Hussein or the leaders of the Iraqi Air Force believed that Iraq had the capability to go head-to-head with the Coalition air forces in fighter-versus-fighter combat.

The Iraqis, like the people of many other Middle East states, have traditionally embraced very different ideas about the importance, utility, and role of air forces than have Western countries such as the United States and Great Britain.[43] Early in the Iran-Iraq war, both the Iraqi and Iranian air forces made modest attempts to establish overall air superiority through counterair operations, but both air forces soon abandoned their attempts.[44] In the Iraqi case, the principal reasons appear to have been two: first, the Iraqi leadership under Saddam Hussein believed that the army, not the air force, was the key to victory in modern war, and, second, the military gains that might be achieved through a determined application of air power were perceived to be far outweighed by the losses in political power and deterrent value against strategic attacks by regional adversaries that would accompany substantial attrition of front-line combat aircraft.[45]

In the weeks and months preceding Desert Storm, Saddam Hussein publicly reiterated these long-standing themes. In particular, he repeatedly dismissed the idea that Coalition air power could be decisive in a war against Iraq. Instead, he confidently predicted that once the initial air strikes were over, the Coalition would have to send in infantry, armor, and artillery, and that the Iraqi army would still be "safe and sound and ready

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[42]Norman Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," *The Journal of Strategic Studies*, Mar 1992, p 19.

[43]Ronald E. Berquist, *The Role of Airpower in the Iran-Iraq War* (Maxwell AFB, AL: Air University Press, Dec 1988), p 54.

[44]*Ibid*, p 59.

[45]*Ibid*, pp 51, 55, and 74. In November of 1980, Saddam Hussein stressed in a speech to the Iraqi National Assembly the view that, "We will not use our air force. We will keep it. Two years hence our air force will still be in a position to pound Bani-Sadr and his collaborators." (cited in Berquist, p 46).

for battle" when Coalition ground forces appeared.[46] Other comments indicated that, as in the Iran-Iraq war, ground-based aircraft defenses, rather than Iraqi fighters, would be the primary means of strategic defense in blunting any Coalition air strikes that might occur.[47]

[DELETED]

During the eight-year Iran-Iraq war, Iraqi pilots had not only avoided air-to-air engagements but had generally broken off strike missions and returned to base if their aircraft received a radar lock-on from an Iranian fighter.[48]

This appreciation of the capabilities and likely intentions of the Iraqi Air Force led to a concept of operations for the opening hours and days of air campaign that focused explicitly on intimidating the Iraqi fighter pilot. Coalition air planners stated consistently in postwar interviews that the target of the air-to-air packages on the opening night of the war was the mind of the Iraqi fighter pilot and his commanders. Based on personal experiences with Arab pilots and discussions with Coalition pilots from Gulf countries during Desert Shield, the air planners in Riyadh decided that no more than a handful of the Iraqi pilots would be capable of presenting any serious air-to-air challenge to Western-trained aircrews. If Coalition fighters could cover the key Iraqi fighter bases in the opening moments of the war and shoot down any aircraft that managed to take off in response to the initial F-117 strikes, then the remaining Iraqi pilots might not even take off at all, thereby effectively bottling up the Iraqi Air Force on the ground.[49] Thus, the concept behind the initial air-to-air portion of the air campaign was to convince Iraqi

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[46]Saddam Hussein, speech to the People's International Islamic Conference, 11 Jan 1991, *Sawt-Al-Sha'b* (Amman), 12 Jan 1991, p 15 (cited in Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," p 18).

[47]Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," p 19.

[48][DELETED]

[49](S) Glosson, GWAPS Intvw, 14 Apr 1992; also, "33rd TFW Air-to-Air Engagements Through 21 February, 1991." The write-up in the 33rd Tactical Fighter Wing's engagement summaries of Penzoil flight's shoot down of an Iraqi MiG-29 shortly after H-Hour in the early morning hours of 17 January 1991 confirms that Glosson's planning intent had been conveyed to at least some of F-15 crews. Lt Col David Deptula's personal notes from just before the war also confirm this intention.

pilots–especially the more capable ones–that their chances of surviving the very next sortie against Coalition pilots were not high.[50]

In retrospect, this approach did succeed in bottling up the Iraqi Air Force on its airfields within a matter of days. But this conclusion must be qualified. The Iraqi Air Force surely did not need much encouragement to hunker down in its hardened shelters. By 14 January 1991, some twenty to thirty Iraqi support aircraft had already fled to Iran, and, by the end of the first day of the war, most of Iraq's combat aircraft had been moved into hardened bunkers or otherwise dispersed.[51] The rapid decline in Iraqi flight activity over the first nine to fourteen days of Desert Storm, therefore, would appear to have been as much the result of the Iraqi Air Force's predisposition to put force survival ahead of air superiority as it was of Coalition tactical effectiveness in air-to-air combat. True, the Coalition's operational objective of bottling up the enemy air force on its field was quickly achieved. The virtual attrition of the Iraqi Air Force–particularly of its potential to contest control of the air and increase Coalition losses–was the immediate goal, and relatively few air-to-air kills by Coalition fighters proved necessary to achieve that objective.

However, the way in which this success was achieved–more by intimidation than by physical destruction–soon came to be perceived as posing a new problem for Coalition air planners in Riyadh. So long as the Iraqis retained a significant number of modern combat aircraft in hardened facilities, the potential for an aerial variant of the 1968 Tet

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[50]Pilot debriefings from some of the initial Coalition kills make it clear that the operational intent of the air planners in Riyadh was communicated down to the fighter crews. In the words of an F-15 pilot who shot down an F-1 on the opening night of Desert Storm: "The big guys figured that the first strike would sneak in. They wouldn't be seen as they were all going in low or be stealthy. The Iraqis' reaction would be after the first bombs dropped. There would be confusion, and they would launch airplanes. We were going to come in and try to knock as many down as we could." (Capt Robert E. Graeter, cited in Deur, *Wall of Eagles: Aerial Engagements and Victories in Operation Desert Storm*, p 8).

[51](S) OWAPS, CHC 10, J2 Combat Assessment Cell, Fact Paper: "Iraqi Air Force Courses of Action," 24 Jan 1991.

offensive against South Vietnam, whether employing conventional high-explosives or "mass-destruction" weapons, remained.[52]

By the sixth day of the war, the potential danger of such attacks prompted Coalition air planners to start going after the hardened aircraft shelters and bunkers in which the bulk of Iraq's combat aircraft were hidden.[53] Laser-guided bombs like the 2,000-pound GBU-24A/B and GBU-27 provided the means to begin systematically "busting shelters." Three days later, on 26 January 1991, some two dozen Iraqi combat aircraft fled to safety in Iran.[54]

The initial flights of Iraqi aircraft to Iran spawned a new air-to-air problem for the Coalition: trying to intercept and shoot down escaping Iraqi fighters and fighter-bombers before they could transit the relatively short distances from their bases in Iraq to the Iranian border. From fighter bases in the central part of the country like Balad Southeast, Al Numaniya, and Rasheed (in southeastern Baghdad), the Iranian border was 6-8 minutes flying time away at 500 knots. From Al Taqaddum, further west, the en route time was still under 15 minutes at 500 knots. So the "time windows" for interception prior to the Iranian border were tight, and the only tactical option for Coalition air forces was to begin mounting continuous fighter patrols over eastern Iraq between the Iraqi bases and the Iranian border.

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[52]The possibility of an Iraqi "suicide" raid against crowded air bases in Saudi Arabia was not wholly a figment of the imaginations of Coalition intelligence officers. After the war evidence emerged that TU-16 Badger bombers had been readied for one-way missions with conventional ordnance [Intelligence Information Report] Frequent use will be made of enemy prisoner of war debriefings, reports of which are found in a series of Intelligence Information Reports (hereafter referred to as IIRs) issued by the US Army's 513th Military Intelligence Brigade, the organization which oversaw the Iraqi enemy prisoner of war exploitation effort. Copies of these records are in numerous locations, including a master file at the Defense Intelligence Agency. The GWAPS collection includes some on computer disc and others on paper in CHST 32-5 and New Acquisition Folder 312.

[53]The Coalition assessment was that the "destruction" of the Iraqi Air Force would require the "systematic destruction of its HABs," and that was precisely what the Coalition proceeded to begin doing on the night of 22/23 January [(S) GWAPS, CHC 10, Fact Paper: "Iraqi Hardened Aircraft Bunker Vulnerabilities," 24 Jan 1991].

[54](S) The Iranians were evidently taken by surprise when Iraqi combat aircraft started appearing at Iranian airfields using commercial call signs [(S) GWAPS, CHC 10, Fact Paper: "IzAF Aircraft to Iran (C)," 11 Feb 1991, p 1].

Preventing any additional Iraqi combat aircraft from escaping to Iran proved difficult. It became not uncommon for sortie lengths by F-15 pilots manning these barrier stations to exceed seven hours. Another tactical problem was that Iraqi fighters usually ran for the Iranian border at extreme low altitudes and were often beyond the low-altitude detection ranges of AWACS aircraft orbiting over northern Saudi Arabia. Finally, the Iraqis had the option, which they immediately exploited when the barrier combat air patrols were temporarily dropped, of simply waiting for breaks in coverage by Coalition fighters to make their escapes. In the end, over one hundred modern Iraqi combat aircraft were able to escape to Iran while only a handful–some thirteen fixed-wing fighters and fighter-bombers–were shot down in the process.

On the one hand, preventing the escape of enemy aircraft to a neighboring country was something of a new mission for Coalition fighters. In the context of the Gulf War, it also had a definite political component insofar as the survival of the Iraqi Air Force had political and deterrent value to Saddam Hussein.[55] Like its chemical and nuclear weapons, the survival of its air force enhanced Iraq's ability to pose a military threat to neighboring countries in the region after Desert Storm. And, from a military standpoint, systematically eliminating the Iraqi Air Force after it had been bottled up on its airfields deprived Saddam Hussein of certain offensive options. On the other hand, Coalition fighters do not appear to have been very effective in blocking the flight of Iraqi combat aircraft to Iran. True, the geography of the tactical situation was weighted heavily against Coalition success in the case of Iranian sanctuary. In this regard, it may well have been the perceived effectiveness of Coalition fighters in air-to-air combat that eliminated any real possibility of Saddam Hussein sending fighters to Jordan instead of Iran. Nonetheless, the number of Iraqi fighters and fighter-bombers that got through to Iran simply underscores the tactical difficulties of the task that Coalition fighters faced in trying to seal the Iran-Iraq border to Iraqi aircraft.

Attacking KARI and Iraq's Radar SAMs

As explained in the preceding section, Iraqi operational practice throughout the eight-year Iran-Iraq war indicated that Baghdad would depend primarily on ground-based air defenses, not fighters, to cope with

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[55](S) GWAPS, CHC 10, Fact Paper: "IzAF Aircraft to Iran (C)," 11 Feb 1991, p 2.

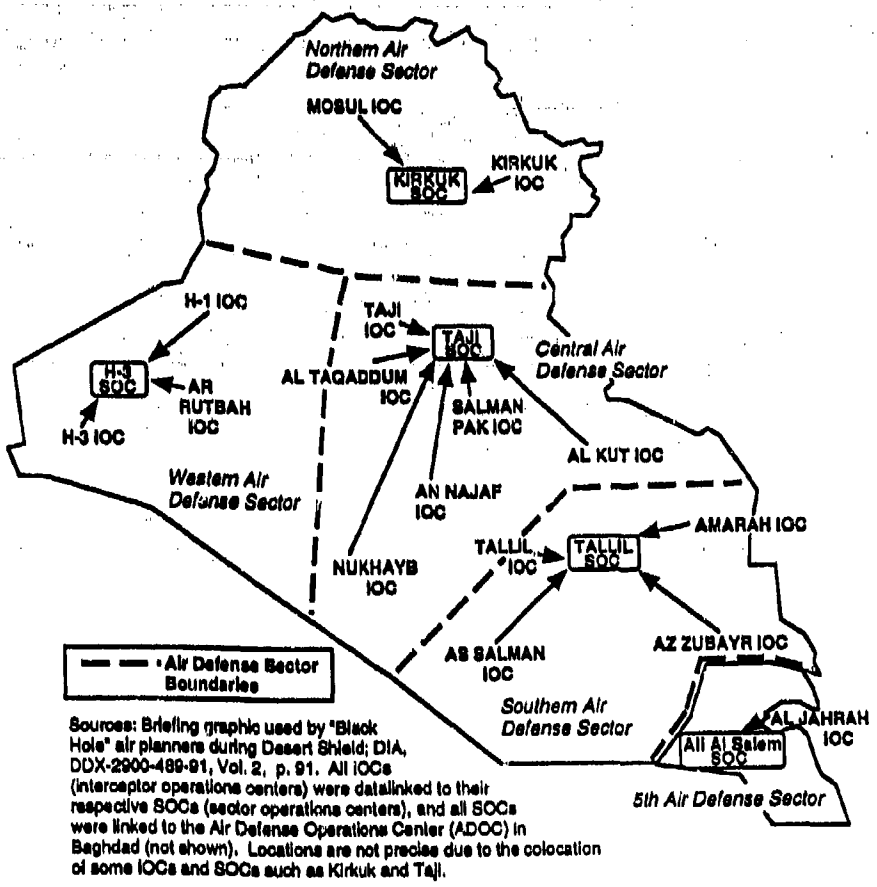
Coalition air attacks. On the eve of Desert Storm, Iraq's air defenses consisted of several elements:

- the KARI (Iraq spelled backwards in French) air-defense, command and control system that was used to track airborne threats and allocate particular tracks to fighters or radar-guided surface-to-air missile (SAM) batteries;
- radar-guided SAMs (SA-2, SA-3, SA-6, SA-8, and Roland) concentrated around the major cities and military facilities to deal with medium- and high-altitude air threats;
- large numbers of antiaircraft artillery and a variety of infrared SAMs to protect point targets from low-altitude threats; and,
- the Iraqi fighter force, whose role in the Gulf War has already been discussed.

Coalition air planners in Riyadh realized early in Desert Shield that KARI, which had been designed, built, and installed by the French firm Thompson CSF, was the nervous system of Iraq's air defenses. As of 17 January 1991, KARI consisted of early-warning and low-altitude radars, over two dozen operations centers, more than one hundred reporting and control posts, computers and software, line-of-sight microwave and troposcatter communications links, and hardware interfaces.[56] Construction of this system had began in the late 1970s, but the Iraqis had not declared it fully operational until 1987.

[56]SPEAR, *Iraqi Threat to U.S. Forces*, p 3-15.

Figure 7
KARI Sectors, SOCs, and IOCs



Sources: Briefing graphic used by "Black Hole" air planners during Desert Shield; DIA, DDX-2900-489-91, Vol. 2, p. 91. All IOCs (interceptor operations centers) were datalinked to their respective SOCs (sector operations centers), and all SOCs were linked to the Air Defense Operations Center (ADOC) in Baghdad (not shown). Locations are not precise due to the colocation of some IOCs and SOCs such as Kirkuk and Taji.

KARI's center was the Air Defense Control Center (ADOC) in Baghdad. From the ADOC, the system branched out to five Sector Operations Centers (SOCs). Each of the five SOCs (northern, central, southern, western, and, by January 1991, the fifth in Kuwait) were linked, in turn, to a maximum of six Interceptor Operations Centers (IOCs), and each IOC formed the hub for its radar-reporting and observer-control

posts. All KARI nodes were linked by "landline and/or microwave (either troposcatter or line-of-sight)."[57] Prior to the war, the SOCs were believed to have direct landlines to the national level, and all the IOCs were located along existing telecommunications trunks capable of carrying both voice and data (see Figure 7).[58]

The principal tasks of the interceptor operations centers were to perform ground-controlled intercepts for Iraqi fighters and to designate targets for Iraqi surface-to-air missiles under the direction of the sector operations centers. Given the limited capabilities of Iraqi interceptors detailed in the preceding section, the aspect of the KARI system of greatest interest to Desert Storm air planners was its ability to control and employ radar-guided or "strategic" SAMs (principally the radar-guided SA-2, SA-3, and SA-6, but also the shorter-range Roland and SA-8).[59] In this regard, several points should be noted:

> First, the strategic SAMs were not widely dispersed throughout Iraq. Instead, they were concentrated in dense pockets around potential high-value target areas (Mosul, Kirkuk, H-3, the Baghdad area, Basra, etc.).[60] As Figure 8 indicates, the vast majority of Iraqi airspace was not covered by radar-guided SAMs.
>
> Second, while the precise linkages and interfaces between the IOCs and SAM batteries were not well understood going into the conflict, it appears likely that landlines of some sort existed to most fire units and reporting posts.[61]

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[57] *Ibid*, p 3-17.

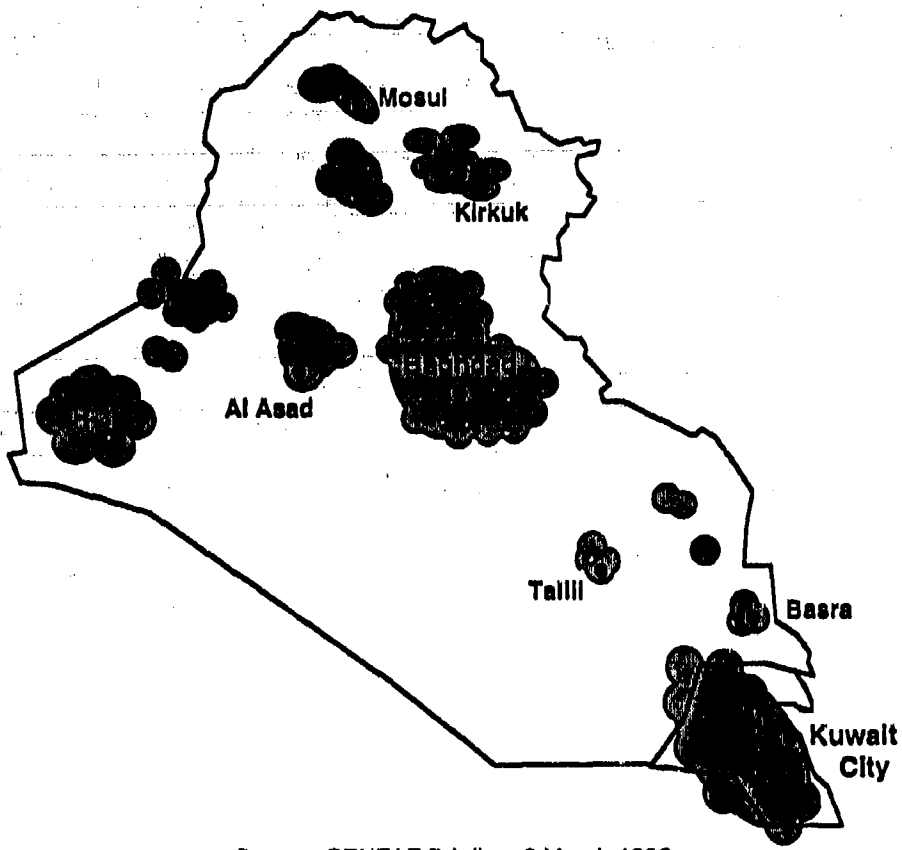
[58] *Ibid*, p 3-25. The French, in fact, sold the KARI system with modems so that each node could switch easily between landline and atmospheric communications.

[59] Notwithstanding recurring reports of I-HAWK activity throughout the war, postwar investigation suggested that the Iraqis were never able to make use of the five HAWK batteries they captured in Kuwait.

[60] SPEAR, *Iraqi Threat to U.S. Forces*, pp 3-86 and 3-87.

[61] *Ibid*, pp 3-72 and 3-73.

Figure 8
Iraqi Radar-Guided SAM Coverage Prior to Desert Storm



Source: CENTAF Briefing, 9 March 1992.

Finally, the KARI system was designed to deal with, at most, modest-size raids from the east (Israel) or west (Iran). The system was not intended to cope with north-south attack or with raids of the scale or sophistication mounted by Coalition air forces during Desert Storm.[62]

[62](S) SPEAR messages of 10 and 23 Aug 1990, GWAPS, BH 8-9.

Coalition planning to suppress Iraq's radar-guided SAMs consisted of two main thrusts. The first was to attack KARI physically. By destroying as much of this command and control system as possible, Iraq's capabilities to coordinate the defense of its airspace with interceptors or radar-guided SAMs would be degraded. The fifty-five targets in the SAD (Strategic Air Defense) target category[63] on 17 January 1991 were, with a couple of exceptions, elements of the KARI system, and this near equivalence between KARI and SAD targets persisted into late February 1991, after the SAD category had grown to some eight-five targets.[64]

The second thrust focused on the active suppression of Iraq's radar-guided surface-to-air missiles using drones and large numbers of antiradiation missiles (principally the HARM high-speed antiradiation missile) from Wild Weasel F-4Gs, F/A-18s, and other aircraft. The idea was to convince Iraqi SAM crews in the opening hours of the conflict that utilizing their fire-control radars long enough to acquire, target, and guide missiles to impact against Coalition aircraft would expose them to immediate, lethal attack. Just as the air planners in Riyadh sought to make Iraqi pilots reluctant to take off, they also hoped to use SEAD (suppression of enemy air defenses) to make radar-guided SAM operators reluctant to turn on their radars or to operate their systems in anything approaching a normal mode.[65]

Coalition efforts to neutralize Iraq's radar-guided SAMs, thereby giving Coalition aircraft relatively unimpeded access to medium- and high-altitude airspace throughout Iraq, produced some of the most complex attacks of the Gulf War. The SEAD packages sent against the Baghdad area on the opening night of the war, for instance, were preceded by, first, F-117 strikes and, shortly thereafter, the coordinated use of Tomahawk land attack missiles, BQM-74 drones, and standoff jammers such the EF-111 and EA-6B. The first event "visible" to the Iraqis was the impact of precision-guided bombs from F-117s. Next, in addition to the

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[63]For a fuller explanation of target categories such as SAD, which were developed by Black Hole air planners, see Figure 27 in Chapter 6.

[64]BH 2-3, Master Target Folder. Note that targets were not removed from the Black Hole's targets lists after they had been struck, not even if they were believed completely destroyed.

[65]Maj Gen Larry Henry, GWAPS Intvw, 28 Aug 1992. Henry realized that he had the assets to overload KARI on the opening night of Desert Storm. His Day-1 priorities were to blind KARI and to neutralize Iraq's fixed SAMs.

fighter sweeps already described, TLAMs began arriving at a variety of targets in and around Baghdad. They were followed by "flights" of BQM-74s, simulating the speeds, profiles, and radar- signatures of attacking fighter-bombers; their role was to simulate the air defenses by giving them "visible" targets.[66] Finally, two large packages of fighter-bombers supported by standoff jammers approached the Iraqi capital. But, instead of proceeding to bomb targets there, the fighter-bombers began preemptively firing HARMs against the now-alerted air defenses while the F-4Gs attempted to destroy individual emitters.

How effective were Coalition efforts to suppress KARI and its associated radar-guided surface-to-air missiles? Figure 9 depicts the more than 630 *strikes* against elements of KARI–meaning occasions on which ordnance was actually released against discrete strategic air defense targets[67]–that occurred during Desert Storm. Nearly half of this total occurred during the first week of the campaign, and almost a quarter involved A-10s strafing various reporting posts in remote areas of Iraq during the first few days of the conflict. The bombing of key elements of the KARI system with precision-guided, hard-target-penetrating bombs[68] consisted mainly of strikes by F-117s against hardened targets such as the KARI sector operations centers and interceptor operations centers. Most of these strikes occurred early in the war. Nevertheless, more strikes were eventually accumulated against KARI using either unguided bombs or guided bombs such as the GBU-10 and GBU-24A/B whose 2,000-pound

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[66]"BQM-74 Drones Operated by Former GLCM Unit Played Key Role in Deceiving Iraqi Military," *Aviation Week and Space Technology*, 27 Apr 1992, p 20.

[67]As used by GWAPS, the term "strike" denotes occasions on which air-to-ground ordnance was delivered against a discrete target. Strikes can differ from sorties in at least two ways. If a fighter-bomber took off on a combat mission, then a countable sortie was considered to have occurred even when the aircraft aborted the mission prior to any ordnance being dropped; such cases would count as a sortie but *not* as a strike. On the other hand, if an aircraft like the F-117 delivered precision-guided munitions against two discrete targets or aim-points on a given sortie, then the mission would count as *two* strikes and *one* sortie. Some F-111F sorties during Desert Storm produced four strikes.

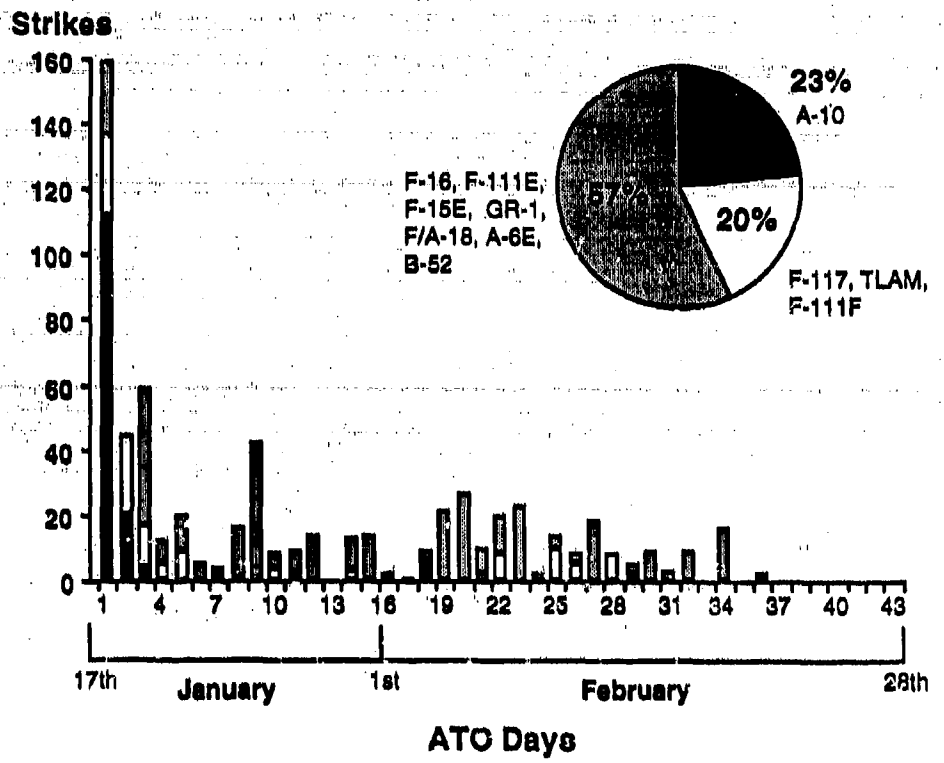
[68]At the beginning of the Gulf War, the only precision bombs with a hard-target-penetration capability were those that used the "I-2000" or BLU-109 warhead, which had been specially designed to penetrate hardened structures. The GBU-24A/B and GBU-27 munitions resulted from marrying laser-guidance kits to the BLU-109 warhead. The GBU-27 weapon was unique to the F-117, and GBU-24A/Bs were only delivered by the F-111F during Desert Storm. During Desert Storm, F-117s dropped 739 GBU-27s, and F-111Fs dropped 897 GBU-24A/Bs.

Mk-84 warhead had not been specifically designed to penetrate hardened structures. As Figure 9 suggests, the air effort against KARI can be seen as having had two main parts: during the first two days of the war, A-10s and F-117s were used to blind and paralyze the system; thereafter, bombing, predominantly with nonprecision weapons, was used to keep the system ineffective in coordinating the defense of Iraqi airspace.

While strikes (in the sense of occasions on which ordnance was actually dropped on discrete targets or aimpoints) offer a somewhat better measure of effectiveness than number of sorties flown, they are still an input measure. In themselves, they provide little conclusive evidence of operational or strategic effectiveness. To get at effectiveness, other measures must be considered.

Two more output-oriented measures would be the damage imposed on interceptor operations centers and sector operations centers and the kill rates achieved against Iraqi radar-guided SAMs by Coalition antiradiation missiles designed for lethal suppression. In the case of hardened elements of KARI such as the sector operations centers, the approach of the air planners in Riyadh was not so much to seek outright physical destruction as to disrupt their functioning. If two or four GBU-27 2,000-pound, laser-guided bombs from F-117s appeared to cause a given SOC to cease operations, the planners were generally not inclined to put more of these weapons against it until there was evidence that the facility had come back on line. This "functional-damage" approach obviously helped to economize on F-117 sorties. Especially during the first three nights of the war (ATO Days 1 and 2), it enabled the F-117s to cover as wide an array of high-priority targets as possible, including carrying out over thirty strikes against elements of KARI.

Figure 9
Coalition Strikes Against KARI



Source: GWAPS Missions Database, Black Hole Counts, Dec 1992.

In some cases, just a few precision bombs sufficed to achieve the desired functional effect on KARI operations centers. It appears that both the fifth SOC at Ali Al Salem air base in Kuwait and the Tallil SOC in southern Iraq were abandoned by the Iraqis soon after Desert Storm began.[69] The sector operations center at Tallil, for example, received two GBU-27s from

[69](S/NF/WN) Lt Col Allan W. Howey, AF/XOXW-G, "Trip Report–AF/XO Strategic Assessment Mission, Kuwait Theater of Operations, 14-29 April 1991," 9 May 1991, pp 7-8; discussions with Lt Col Howey, 2 Jun 1992; and, discussions with Capt Ed O'Connell who visited the Tallil SOC with the DIA/DNA team.

F-117s on the first day of the war and a third GBU-27 on the second.[70] After that, it was not struck again by F-117s, evidently because the air planners in Riyadh did not subsequently receive intelligence indicating that the facility was back in operation. But, far from having been destroyed by the F-117 attacks, postwar inspection of this SOC by a DIA/DNA (Defense Intelligence Agency/Defense Nuclear Agency) team revealed that the operations portion of the facility had not been penetrated.[71] The fact that it appeared to have been abandoned after the initial attacks indicated that the desired functional elimination of this operations center had been achieved with a minimal expenditure of sorties and ordnance.[72]

The functional success attained with the Ali Al Salem and Tallil sector operations centers, however, is not the whole story. There were other elements of the KARI system that the Iraqis tried to keep functioning despite Coalition bombing, and rendering these elements permanently inoperative proved more difficult. The Kirkuk SOC in northern Iraq was probably never down more than a few days.[73] Moreover, communications between KARI nodes proved harder to sever than anticipated, and some connectivity seems to have persisted through the end of the war. Granted, as more and more reporting posts, early warning radars, and other sensor elements of KARI were eliminated, the operational utility of the system's residual capacity to pass tracking information on Coalition strike packages became less and less. Nevertheless, in Iraqi hands KARI exhibited an ability to regenerate portions of itself–despite the paralyzing shocks sustained during the first two Air Tasking Order days of the air campaign.

The kill rates achieved by HARM antiradiation missiles against Iraqi fire-control radars employed by Iraqi surface-to-air missiles are also suggestive of less than complete tactical success. Based on crediting SAM "kills" whenever the fire-control radars went off the air for some period of time following HARM shots, the missile achieved a success rate of

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[70]37th Tactical Fighter Wing electronic database, lines 18, 19, and 95.

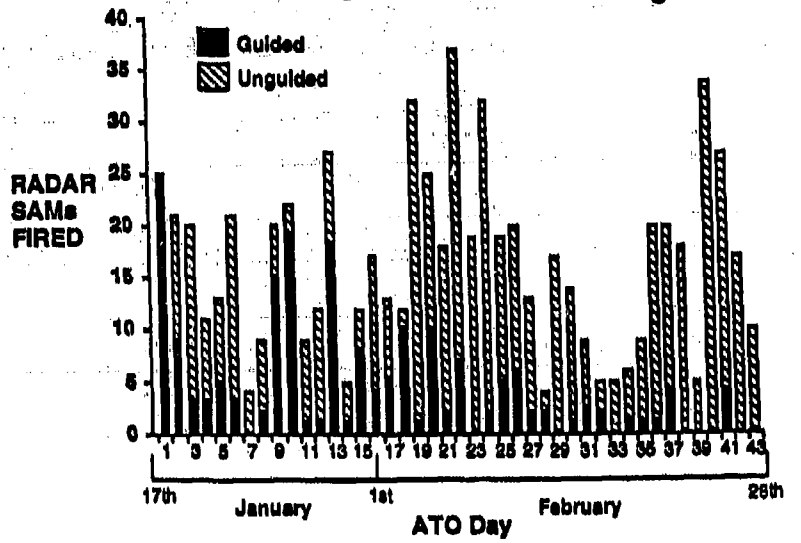
[71]Discussions with Capt Ed O'Connell.

[72]Using traditional *Joint Munitions Effectiveness Manuals* criteria for physically destroying these facilities, some eight GBU-24/27s would have had to be dropped on each SOC. After the war, Lt Col Deptula took pride in the fact that no Iraqi SOC received more than four precision-guided bombs (Deptula, GWAPS intvw, 20-21 Dec 1991).

[73]Intvw with Maj Gen Glosson, 14 Apr 1992.

twenty-five to thirty percent during Desert Storm.[74] Further, as Figure 10 indicates, radar-guided SAMs were fired right to the end of the war.

Figure 10
Guided versus Unguided Radar SAM Firings[75]



Source: Wartime data recorded by CENTAF/INO Missile Team.

What, then, do the facts like uneven Coalition success in physically destroying SOCs and HARM kill rates in the vicinity of twenty-five to thirty percent imply about operational-strategic effectiveness in gaining air superiority? While closer to outputs than measures such as sorties or strikes, these data still only paint a part of the broader picture. After all, the fundamental operational aim behind attacking both KARI and Iraqi

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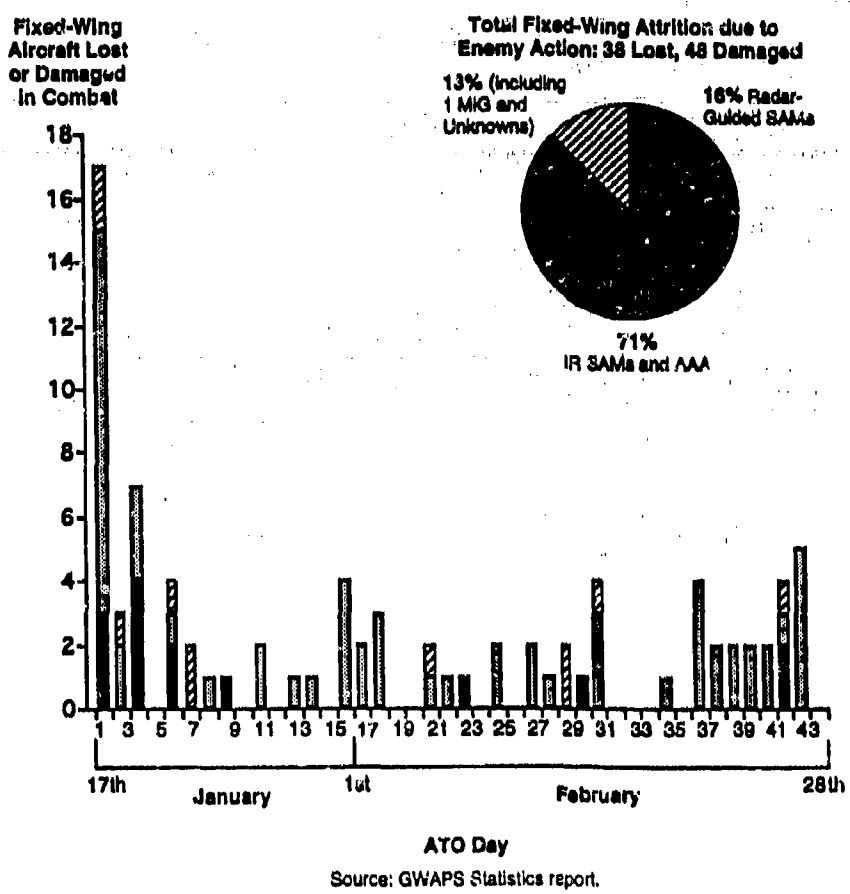
[74](S/NF/WN) Air Force Intelligence Command, Air Force Electronic Warfare Center, *Operation Desert Storm Electronic Combat (EC) Effectiveness Analysis*, Jan 1992, pp 8-4 and 8-5. The Coalition squadrons based at Shaikh Isa in Saudi Arabia, which included F-4Gs, provided most of the lethal defense suppression for strike packages coming out of the Gulf states. Almost 30% of the 700-plus HARMs fired against "lethal radars" by Shaikh Isa aircraft have been assessed as successful; the Proven Force HARM shooters operating out of Incirlik in Turkey had a success rate of about 26% (*ibid*).

[75]The data in Figure 10 were based on mission reports (MISREPs) from Coalition aircrews. Whenever there were questions or uncertainties, the CENTAF/INO missile team called the units and spoke with the crews involved. Lt Col Steven L. Head, who served with CENTAF intelligence during Desert Storm, provided these data. The firings shown included SA-2s, SA-3s, SA-6s, SA-8s, and Rolands.

radar-guided SAMs was not to destroy facilities like SOCs and individual SAM batteries per se. These effects were merely means to the overarching operational end of neutralizing Iraq's capability to shoot down Coalition aircraft operating at the medium or higher altitudes. In conjunction with Coalition success in bottling up the Iraqi Air Force on its airfields and dominating air-to-air engagements, neutralizing Iraq's radar-guided SAMs was seen by the air planners in Riyadh as equivalent to achieving theater-wide air superiority everywhere except in the low-altitude regime (where Iraqi antiaircraft artillery and infrared SAMs proved too numerous to destroy). With this overarching aim in mind, Figure 3-9 shows that, while SA-2, SA-3s, SA-6s, SA-8s, and Rolands continued to be fired throughout Desert Storm, guided firings incrementally declined as the war progressed, notwithstanding the partial resurgence during the second week. What Figure 3-9 documents, in fact, is that after the first Air Tasking Order day, Iraqi SAM operators became more and more hesitant to employ their weapons against Coalition aircraft in anything approaching a normal, much less optimum, mode. Over the last four weeks of Desert Storm, only about fifteen percent of the nearly 480 SA-2s, -3s, -6s, -8s, and Rolands fired by the Iraqis were assessed to have been guided by Coalition aircrews.

The most conclusive evidence of Coalition success in rendering KARI and its associated "strategic" SAMs impotent, though, can be seen in Coalition attrition data (Figure 11). From an operational standpoint, the bottom-line measure of effectiveness against radar SAMs was not SOCs, IOCs, or missile batteries physically destroyed but the numbers of Coalition aircraft that were *not* shot down or damaged carrying out their missions over Iraq and the Kuwait theater. As Figure 11 points out, during the first six days of Desert Storm, eight Coalition fixed-wing aircraft were either downed or damaged by radar SAMs; for the rest of the campaign, this segment of Iraq's air defenses was only able to damage or down another five Coalition airplanes. Given the large numbers of combat sorties flown daily by Coalition air forces, the degree to which Iraq's

Figure 11
Coalition Fixed-Wing Combat Attrition By Cause



Source: GWAPS Statistics report.

strategic SAMs were virtually eliminated as a significant contributor to Coalition attrition does appear to justify fully the conclusion that this portion of the air campaign was highly effective.

To round out this discussion of KARI and Iraq's radar-guided or "strategic" surface-to-air missiles, the role *not* played in this war by the large numbers of antiaircraft artillery and infrared SAMs deployed around most Iraqi cities and targets, as well as integral to Iraqi ground forces, needs to be briefly considered. Such weapons had accounted for the

majority (eighty-five percent) of U.S. aircraft losses during the Vietnam war, and the Iraqis undoubtedly hoped to have similar success with low-altitude antiaircraft weapons.[76] The solution taken by Coalition air forces to this problem was relatively straightforward given the degree of suppression and disruption achieved early in the war against KARI and its radar-guided SAMs. Although some crews initially tried NATO-type low-level ingress tactics during the first few days of Desert Storm, the sheer volume and ubiquity of barrage AAA, combined with the ability of Stinger-class infrared SAMs to be effective up to 12-15,000 feet, quickly persuaded almost everyone on the Coalition side to abandon low altitude, even for weapons release. Coincident with aircrew reactions to the dangers of low-altitude operations, Brig. Gen. Buster C. Glosson quickly directed the U.S. Air Force units under his command to shift to medium altitude for ingress, egress, and weapons release.[77]

This decision was not without its tactical costs. For aircraft like the F-16 and F/A-18, which principally employed unguided (or "dumb") munitions during Desert Storm, it entailed a definite sacrifice in bombing accuracy. From an operational-strategic perspective, however, this tactical sacrifice appeared well worth the cost. As Lt. Gen. Charles A. Horner put it to his staff in early February 1991, American support for the war at home depended in large measure on the ability of Coalition forces to operate "with less than anticipated" losses of human lives among Coalition airmen, soldiers, sailors, and marines.[78] It was imperative not to lose any more aircraft than absolutely necessary. By the second week of the air campaign, Coalition air forces had largely negated Iraq's extensive investment in antiaircraft artillery and infrared surface-to-air missiles by operating above the low-altitude threat regime most of the time and by temporarily suppressing the low-altitude defenses whenever aircrews had to go lower to deliver ordnance. Combined with early Coalition

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[76]Directorate of Management Analysis, *USAF Management Summary: Southeast Asia Review*, as of 30 June 1973, p. 30, "Air Force Aircraft Combat Losses (by cause) FY 62-73."

[77]As would be expected, the exact flight and weapon-release "floors" for many aircraft fluctuated during the course of the war in response to tactical conditions and mission requirements.

[78](S) "Daily Comments of Lt Gen Charles A. Horner, Commander USCENTAF, during Operation Desert Storm, 17 January through 28 February 1991," CHST, Chain of Command, Horner Comments, entry for 7 Feb 1991/1700.

success in air-to-air, the shock and damage inflicted on KARI and the suppression of radar-guided SAMs resulted in a firm Coalition grip on control of the air over Iraq and Kuwait.

Two final points should be noted about the suppression of Iraq's radar surface-to-air missiles and the Coalition's early shift away from low-altitude operations. First, even after most Coalition aircrews ceased operating at low altitude, there were occasions prior to C-Day on which circumstances demanded greater accuracy from planes like the A-10 or F-16 than they could generally achieve releasing from medium altitudes. Intense suppression of the antiaircraft artillery and infrared SAMs in a particular area offered one way of dealing with the intermittent need for some aircraft to work at lower altitudes. And, as G-Day approached, the air commanders in Riyadh began making it clear that if Coalition ground forces needed emergency close air support, aircrews would have to run greater risks to get the needed ordnance on target than they had generally taken during the air-portion of the campaign. While General Horner still stressed avoiding air-to-ground fratricide, he encouraged his crews to feel a "compulsion" to hit the target when soldiers' lives were on the line.[79]

Second, although the initial success of Coalition air forces in negating Iraqi long-range SAMs was probably due more to intimidation than physical destruction, as time went on this effect was reinforced by attacks on the SAM sites themselves. Missions aimed at physically destroying individual SAM sites with antiradiation missiles or other munitions eventually totalled to more than 1,300 strikes, of which about half involved F-4G Wild Weasels.[80] In addition, some eleven fire missions against SA-2, SA-3, SA-6 sites were carried out by U.S. Army Tactical Missile System units within the U.S. VII Corps.[81] Given the persistence of Iraq attempts to employ radar-guided SAMs right to the end of the war, this accumulation of destructive effects was undoubtedly important in maintaining the degree

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[79](S) GWAPS, CHP 13B, "Daily Comments of Lt Gen Charles A. Horner during Operation Desert Storm, 17 January through 28 February 1991," HQ USCENTAF Office of History, 20 Mar 1991, p 64.

[80]GWAPS *Statistical Compendium*, Table 187 (Strikes by AIF Categories).

[81](S) Headquarters Department of the Army, DSOPS, viewgraphs provided to GWAPS on 16 Jul 1992.

of disruption and ineffectiveness inflicted by the first week's efforts to paralyze KARI and intimidate the Iraqi SAM operators.[82]

Attacking Iraqi Airfields

The final component of the Coalition's efforts to gain and maintain air superiority consisted of attacks on Iraqi airfields. The initial focus of these attacks, once again, was to try to bottle up as many of Iraq's more capable aircraft and pilots on their bases as possible. Over the first five days, strikes against runway surfaces–particularly those by Royal Air Force (RAF) Tornados delivering the runway-cratering bomblets and area-denial mines carried by the JP233 system from low altitude–were seen by the air planners in Riyadh not so much as a means of completely closing Iraqi air bases as a way of limiting the interceptors that the Iraqis could put into the air at any time to numbers that Coalition fighters could readily handle.[83]

Toward the end of the first week of Desert Storm, the decision was taken to shift the focus of Coalition efforts against Iraq's main operating bases from runway surfaces to hardened aircraft bunkers (HABs) and shelters (HASs). By then it was clear that Coalition fighters were able to shoot down virtually any air-to-air opposition that the Iraqis might choose to put into the air. At the same time, Iraqi flight activity was trailing off rapidly, which meant that the value of attacks on takeoff surfaces was also declining. As airmen in both Riyadh and Washington quickly real-

[82]Of course, functional effects are inherently harder to measure than physical damage. Iraqi SAM operators who had been intimidated sufficiently during the opening nights of Desert Storm to stop employing their weapons very effectively still retained some capability to down Coalition aircraft. One suspects that aircrews briefing for missions during the war tended to plan against potential capabilities rather than functional effects.

[83]Maj Chip Setnor, telephone intvw, 27 Jan 1993; Lt Col Rich King, telephone intvw, 3 Feb 1993. Maj Setnor, who had flown F-117s, served in the Black Hole during Desert Storm; Lt Col King worked BDA in Washington DC during the war and served with GWAPS afterwards. King specifically recalls discussing the notion of using runway attacks to "meter" the flow of Iraqi interceptors with members of the Special Planning Group prior to the war.

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ized, there was little point in continuing to mount JP233 sorties against runways that the Iraqis were not using.[84]

The campaign to begin busting HABs and HASs on Iraqi airfields with precision-guided munitions was initiated on the night of 22/23 January 1991 with attacks by F-111Fs delivering laser-guided GBU-10s and GBU-24s on about half of the HABs at Al Asad air base.[85] The intention was to destroy the Iraqi Air Force as a force in being. This aim was motivated by both wartime and postwar objectives. From a military standpoint, destroying the Iraqi Air Force would eliminate the possibility that it might be used to mount a Tet-offensive-like assault on Coalition airfields or troop concentrations to undermine popular support for the Coalition's campaign, especially in the United States. Looking beyond the war, destroying the Iraqi Air Force would remove a political-military weapon from Saddam Hussein's hands that, on 17 January 1991, had the potential to threaten countries throughout the region.

Overlaid on these two successive phases of Coalition attacks on Iraqi air bases during Desert Storm was a third concern: Iraq's chemical/biological weapons and their potential means of delivery. Destroying

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[84]There was much speculation during and after the war that the four GR-1 Tornados the RAF lost prior to the last JP233 attacks on 21 January 1991 could be attributed to the low-level ingress and delivery tactics demanded by the JP233 system. But, in fact, two of these losses were due to radar SAMs, and only one of the four occurred on a JP233 sortie (Alfred Price, "Tornado in the Desert," *Air Force Magazine*, Dec 1992, p 44). So the British argument that their early losses seem to have been due more to a "run of bad luck" than to weaknesses inherent in JP233 or low-altitude tactics appears to have some merit. Nonetheless, when US Air Force and Navy aircrews abandoned low-altitude attacks in favor of exploiting the medium-altitude vulnerability afforded by the suppression of Iraq's radar SAMs, Air Vice Marshal Bill Wratten "ordered the Tornado GR. Mk.1 force to follow the move" (*ibid*, p 46). Ignoring the loss of a fifth British GR-1 to unknown causes on 22 January 1991, only two more Tornados were downed by Iraqi air defences after the RAF Tornados went to medium altitude.

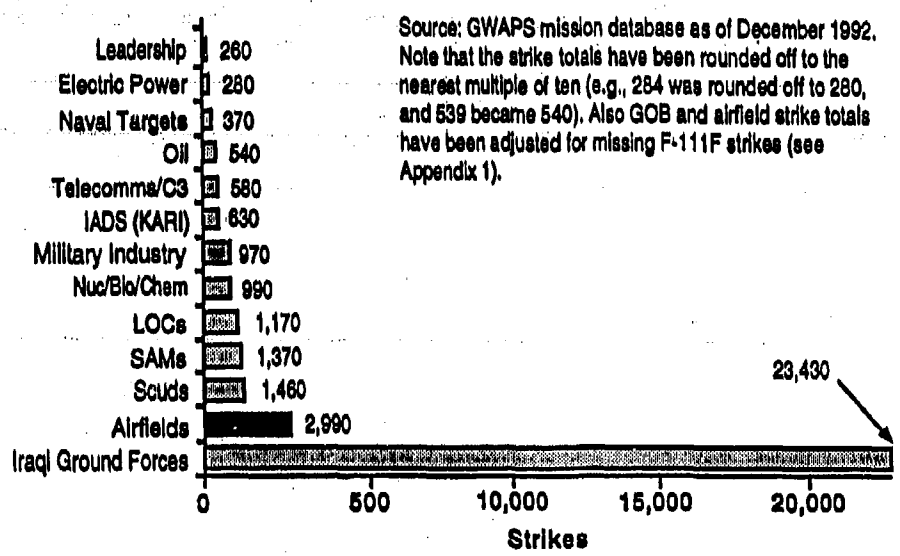
[85]GWAPS Missions Database, entries for the 48th TFW, mission numbers 2601A, 2602A, 2606A, 2607A, 2611A, 2613A, 2614A, 2623A, and 2627A on ATO Day 6. These missions were flown on the night of 22/23 January 1991. Hand annotations by Lt Col David Deptula on Checkmate's 23 January 1991 proposal for a shelter-busting campaign indicate that what the database confirms: that the recommended decision had already been made to shift to begin busting shelters by the time the Air Staff proposal reached the Black Hole by classified FAX [(S) FAX to Black Hole, 23 Jan 1991/0710, in "Intel/Tgt Folder #2," GWAPS, BH 2-25].

these weapons was, once again, an explicit military objective of the Coalition. The Iraqis had delivered chemical munitions from aircraft during the Iran-Iraq war, and a number of Iraqi airfields had weapon-storage bunkers that were assessed by Coalition intelligence to contain chemical or, possibly, biological munitions. Some of the Iraqi airfields also contained aircraft capable of delivering chemical munitions, and a portion of the fixed launchers for Iraq's extended-range Scud ballistic missiles were at the H-2 airfield in western Iraq. In addition, evidence emerged, before and during the campaign, that led air planners to believe that aircraft shelters, including some at Kuwaiti bases, were being used to store modified Scuds and, possibly, chemical munitions. Thus, there were overlapping reasons for attacking specific targets on airfields throughout Iraq and occupied Kuwait that went well beyond the Coalition's goal of establishing early air superiority.

It is these overlapping objectives that ultimately led Coalition planners to put as much effort against airfields as they did. Enemy airfields, as Figure 12 highlights, received more strikes during Desert Storm than any other target category except the Iraqi field army in the Kuwait theater. As a target category, airfields per se received more strikes than any other target category besides ground order of battle by almost a factor of two.[86] And, because some targets associated with other categories–including aircraft and storage bunkers thought to contain chemical/biological weapons, the fixed-site Scud launchers at H-3, and elements of KARI–were on airfields, there are strikes in several of the categories shown in Figure 12 that hit within the boundaries of airfields but were counted against other target categories. In this sense, the weight of Coalition efforts over the course of the war against airfields was even greater than indicated in Figure 12.

[86]Even if KARI, the Black Hole's telecommunications/C^3 category, and other C^3 targets associated with Iraqi ground forces are combined into a single category, the total would still be fewer than 1,500 strikes.

Figure 12
Coalition Strikes by Target Category for Desert Storm
(17 Jan-28 Feb 1991)[87]

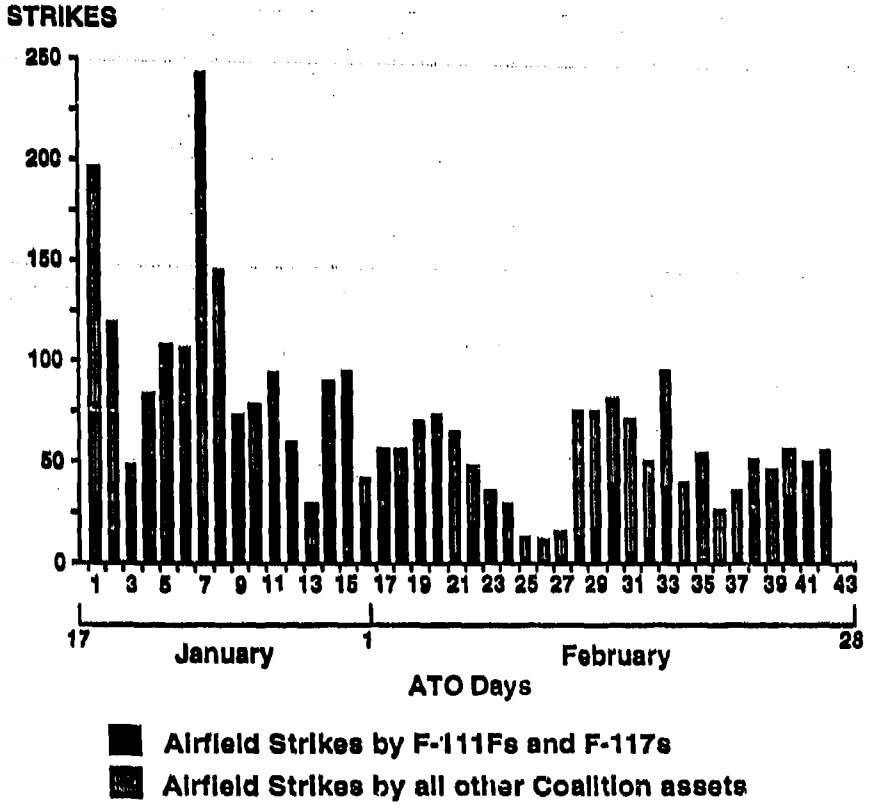


The effectiveness of Coalition air forces against Iraq's weapons of mass destruction and ballistic missile capabilities will be treated in Chapter 6,

[87]The use of the term "strike" in Figure 12 is as explained in Note 68 (occasions on which an aircraft released air-to-ground ordnance against a discrete target). The totals shown were selected primarily from strike counts organized using the Automated Intelligence Installation File (AIF) categorizations for grouping targets. In a few cases, however, the counts associated with the Black Hole's wartime target categories were used instead. Of particular relevance to the present chapter, the AIF scheme lumps airfield targets, those associated with the KARI command and control system, and a few other things into a single OCA (offensive counterair) category. Since airfields and KARI were treated discretely in this chapter, it seemed appropriate to break them out. Note also that the total of 35,018 strikes reflected in Figure 12 represents only about 85% of the 42,240 strikes in the GWAPS Missions Database. The missing strikes are the 5,660 that GWAPS was never able to categorize by target category due to missing mission reports (although most of these strikes were undoubtedly flown against ground order of battle), plus an assortment of primarily OCA strikes that did not fit into any of the Black Hole categories used. See Chapter 6 for a more detailed treatment of the Black Hole's target categories.

along with seven other "core" strategic-target categories. The remainder of this section will largely defer these aspects of strikes on Iraqi airfields and focus, instead, on strikes against airfields in pursuit of air superiority.

Figure 13
Coalition Strikes against Airfields[88]

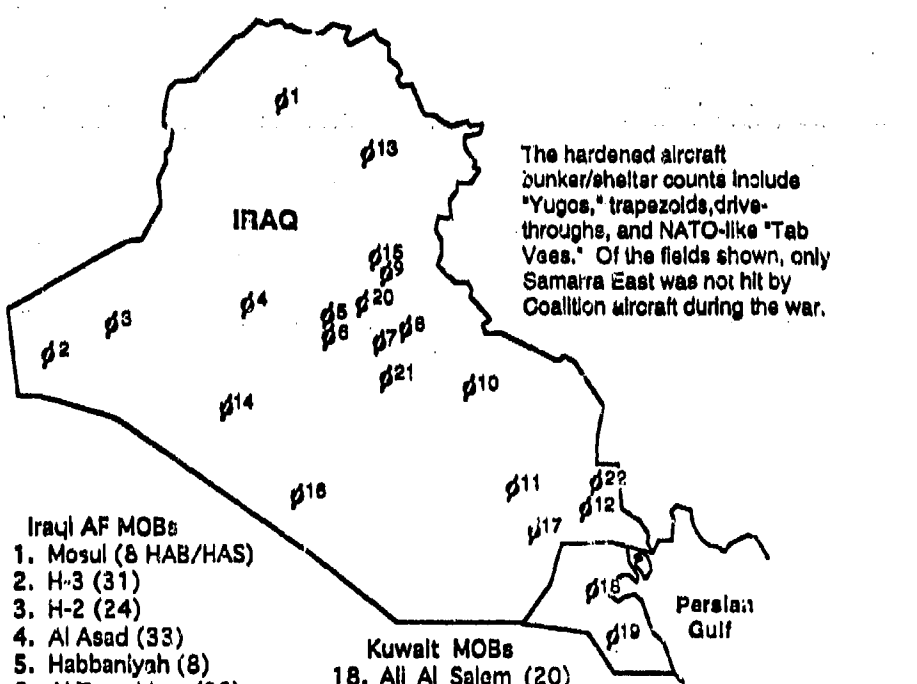


Source: GWAPS Missions Database, Black Hole Counts, 9 Dec 1992.

[88]According to electronic records kept by CENTAF intelligence during the Gulf War, the strikes shown in Figure 13 encompassed a total of 44 airfields in Iraq and Kuwait (Lt Col Steven L. Head, telephone intvw, 2 Feb 1993).

Coalition forces averaged over sixty strikes a day against airfields. Ignoring a few highs and lows in the first and fourth weeks, strikes against airfields continued through ATO Day 42 (Figure 13). Also, strikes by the two Coalition aircraft that delivered precision-guided bombs with hard-target-penetrating warheads during the war–the F-111F and F-117–persisted into the fifth week of the campaign. Enemy airfields, in short, were a concern to Coalition air planners and commanders almost to the end.

Figure 14
Selected Iraqi Air Bases



Source: DIA/DX-5B, "Battle Damage Assessment: Iraqi and Kuwaiti Airfields, Summary Report," 10 May 1991, (S WN Rel UK, CA, AS).

Prior the 17 January 1991, Coalition intelligence had identified nearly seventy airfields that could be used by Iraqi military forces. Iraq itself contained twenty-six main operating bases (sixteen air force, five army, two navy, and three training).[89] The seizure of Kuwait in August 1990 had given the Iraqis two additional fighter bases in that country (Ahmed Al Jaber and Ali Al Salem) plus the international airport in Kuwait City and one Kuwait air force highway strip. Except for H-2 and H-3 in western Iraq, the bulk of Iraq's main operating bases were generally located in the center of the country along a line from Mosel airfield in the north to Shaibah and Umm Qasr in the southeastern-most corner of the country. When the war started, Iraq also had another twenty-one deployment bases,[90] some still under construction, that provided an "outer ring" of reasonably capable bases around the main operating bases. Some of these bases, such as Jaliba in the southeastern Iraq, had sizeable numbers of hardened aircraft bunkers. There were also another nineteen dispersal bases capable of providing instrument approaches and the fuel needed to turn aircraft (but not too much else).[91]

Except for the medium bombers (Tu-16 Badgers and Tu-22 Blinders) at Al Taqaddum and longer-range fighter-bombers like the Su-27 Fencers and F-1s, most of Iraq's ground-attack aircraft lacked the unrefueled radius of action to reach targets as distant as Riyadh or Dhahran in Saudi Arabia from bases in central Iraq. Fighter-bombers such as the Su-17/20/22 Fitter would first have had to be deployed to bases on the periphery of Iraq.

By the eve of the Persian Gulf War, Iraq's principal military airfields were, for the most part, extremely hardened, robust facilities. Starting in the 1970s, the Iraqis had embarked upon a systematic program to develop a network of air bases that would be able to withstand attack with conventional munitions. Almost all of the main operating bases in central Iraq had one or two (and sometimes three) long, widely separated runways, as well as redundant taxiways, at least one of which usually

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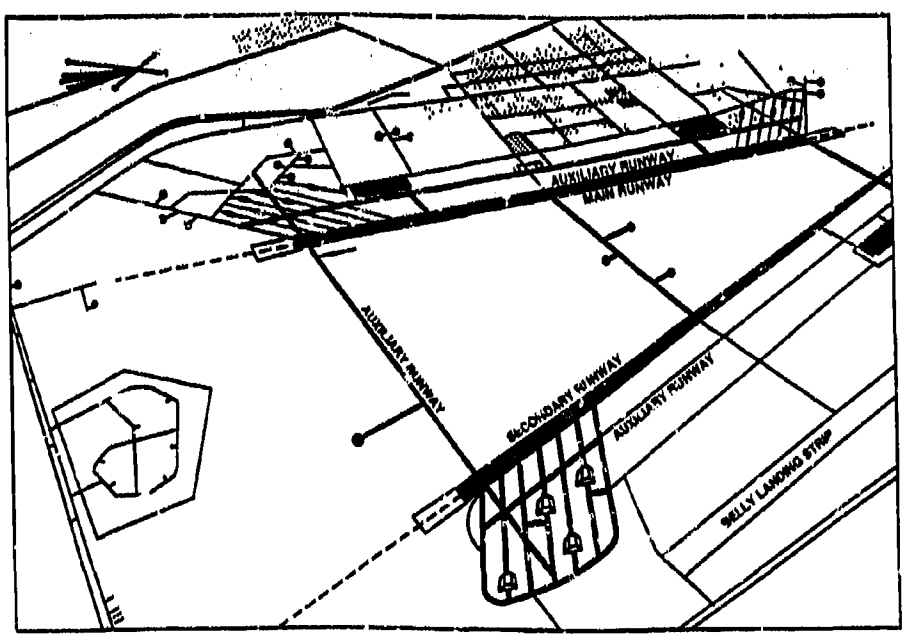
[89](S/WN/NF/NC) SPEAR, *Iraqi Threat to U.S. Forces*, NIC-2660S-018-90, Dec 1990, p N-7.

[90](S/WN/NF/NC) *Ibid*, p N-9.

[91](S/WN/NF/NC) *Ibid*, p N-11.

provided an additional surface for takeoffs and landings.[92] These bases had trained, well-equipped runway repair teams. Extremely hardened aircraft bunkers, with redundant access to takeoff surfaces, had been constructed by Yugoslavian and other contractors (see Figure 15).[93] The hardest of these shelters—the so-called "Yugos" and "trapezoids"—were augmented by earlier-generation shelters such as the "TAB-VEEs" that did not have the bomb resistance of the Yugos or their Kuwaiti equivalents. Altogether, Iraq's sixty-plus air bases had well over 500 aircraft shelters and bunkers—enough to provide varying degrees of protection for the majority of Iraq's combat aircraft. The only aircraft that could not be sheltered were the bombers and other large aircraft such as IL-76s. Finally, considerable redundancy and some hardening had been added to the air bases infrastructure, especially at the central main operating bases.

Figure 15
Balad Southeast



[92]Christopher M. Centner, "Ignorance Is Risk," *Airpower Journal*, Winter 1992, p 29.

[93]"Iraq's Superbase Programme," *Jane's Defence Weekly*, 2 Feb 1991, p 133.

The objectives that motivated the Coalition's shift, toward the end of Desert Storm's first week, from airfields surfaces to hardened aircraft shelters and bunkers have already been described.[94] Once this redirection of the offensive counterair effort was made, how effective were Coalition air forces in eliminating the Iraqi air arm as a force in being?

The first thing that should be noted is that the goal of destroying the bulk of Iraq's combat aircraft went beyond what most air forces have traditionally been asked to do in the name of air superiority. When the busting of shelters and bunkers began, Coalition air forces had already achieved air superiority over Iraq and occupied Kuwait and were well on their way to establishing air supremacy.[95] As a result, the sorts of measures (Coalition-Iraqi sortie ratios, low Coalition aircraft attrition rates, air-to-air exchange ratios, etc.) that have already been used to document the Coalition's early achievement of air superiority (and, subsequently, of air supremacy) offer little insight into the success of Coalition air force's in eliminating what was, when the shelter/bunker-busting began, a prostrate, combat-ineffective force.

What measures would make sense? Two that immediately suggest themselves are: the portion of Iraqi combat aircraft lost as a result of the shelter/bunker campaign and whether any appreciable number of combat aircraft survived the war in Iraqi hands. Both of these measures concentrate, of course, on the physical attrition of aircraft, and, given Iraqi resourcefulness in dispersal and concealment, the shelter/bunker-busting campaign appears to have become a protracted exercise in incremental attrition. Once the first few HABs were successfully penetrated by

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[94]One of the earliest documentary discussions of the rationale for attacking airfield shelters and bunkers pointed out that doing so would put Saddam Hussein in a "use-or-lose" situation regarding his air force [(S) "Point Paper (Information): Iraqi Aircraft Bunker Vulnerabilities," 24 Jan 1991, GWAPS CHC 10]. A later document discussing the subsequent flight of the Iraqi Air Force to Iran noted that Iraq's most important objective regarding the Air Force was to preserve it as "a deterrent force in being" [(S) "Fact Paper: IzAF Aircraft to Iran (C)," 11 Feb 1991, GWAPS CHC 10, p 2].

[95]Again, air superiority was understood as the ability of one side's aircraft to operate in selected airspace at a given time without prohibitive interference from the opposing forces–it was achieved by the end of ATO Day 1; by 27 January 1991 (D+10 or ATO Day 11), Gen Schwarzkopf was able to declare supremacy; air supremacy meant that the Iraqi Air Force was no longer combat effective.

Coalition aircraft, the Iraqis began flying aircraft to sanctuary in Iran.[96] Given the limited number of Coalition aircraft that had hard-target penetrators (GBU-24A/Bs and GBU-27s with the I-2000 warhead), as well as the large number of Iraqi hardened aircraft shelters and bunkers throughout the country, a major redirection of the air campaign to take down the majority of them in a few nights was probably not a realistic option. There were simply too many other targets of higher priority that demanded the F-111Fs and F-117s. In fact, only enough F-111Fs were initially made available to go after two or three bases a night in any strength, and the weight of the early strikes fell mostly on southern bases.[97] As a result, effort against airfield shelters and bunkers quickly turned into a slogging campaign of attrition.[98]

Inevitably, this approach allowed the Iraqis leeway to play shell games both on and off the airfields with their surviving combat aircraft. By dispersing aircraft into the open on the airfields, they could preclude Coalition aircraft from getting both a bunker/shelter and a combat aircraft with a single laser-guided bomb. By moving aircraft in the open regularly–every day or so–they could make it difficult for Coalition planners to target individual aircraft.[99] By dispersing aircraft off the airfields, they

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[96]The Iranians were evidently surprised when combat aircraft began showing up using commercial callsigns [(S) "Fact Paper: IzAF Aircraft to Iran (C)," 11 Feb 1991, GWAPS, CHC 10, p 1].

[97]Al Asad in central Iraq was initially selected, but most of the munitions dropped that night were GBU-10s that did not penetrate the HABs (GWAPS Missions Database, ATO Day 6). Tallil, H-2, and Qalat Salih were selected for ATO Day 7, but most of these strikes were aborted by weather. ATO Day 8 saw Tallil and Al Jarrah in the south targeted along with Al Taqaddum. ATO Day 9 saw poor weather over Al Asad, Shaibah, and Tallil, and on ATO Day 10 few shelter-busting strikes mounted went against Tallil. In short, the initial pattern of attack was incremental with most of the early strikes falling on southern bases.

[98]In the end, a total of 41 airfields in Iraq and 3 in Kuwait received some degree of damage during the war; some 375 hardened aircraft shelters and bunkers were assessed to have been damaged or destroyed [(S/WN/REL UK, CA, AS) DIA/DX-5B, "Battle Damage Assessment: Iraqi and Kuwaiti Airfields, Summary Report," 10 May 1991].

[99]A practical constraint for F-111Fs that did most of the initial shelter attacks on Iraqi airfields was that individual Iraqi aircraft were substantially harder to break out with FLIR (forward-looking infrared) sensors than, for example, aircraft bunkers. While F-111F aircrews sometimes could see aircraft when reviewing video recordings after a mission, they rarely saw them during their attacks.

could increase the area that would have to be searched to find them. And, by exploiting the Coalition's reluctance to risk damage to cultural monuments such as Islamic mosques, the Iraqis were able to make some of their planes off limits to Coalition airstrikes by parking them nearby.

A consequence of these sorts of Iraqi responses to the Coalition's aircraft shelter/bunker campaign was that keeping track of the Iraqi Air Force as a whole became increasingly complex and labor intensive. At two points in February 1991 (the 8th and 20th), Central Command Air Forces (CENTAF) intelligence attempted to estimate the numbers of Iraqi aircraft that had been destroyed inside hardened shelters or bunkers.[100] When combined with thirty-three fixed-wing air-to-air kills, Iraqi aircraft assessed to have been destroyed out in the open on or near airfields during Desert Storm, and those Iraqi aircraft that escaped to Iran, these estimates produced a figure of about 325 for the number of fixed-wing aircraft still in Iraqi hands at the end of the war.

The most uncertain of these numbers is the estimate of Iraqi aircraft destroyed in shelters. After the war, Coalition forces were only able to inspect two of Iraq's principal operating bases, Tallil and Jaliba Southeast. While around half of the fifty-seven shelters and bunkers on these two bases contained destroyed Iraqi aircraft, the early emphasis on these two bases makes it risky to generalize what was seen there to the rest of the Iraqi airfields. Further, there was a fair amount of uncertainty during the war about the numbers of Iraqi aircraft that had escaped to Iran, and the roughly 630 sorties attributed to the Iraqi Air Force during Desert Storm is almost surely low (although, by how much remains a matter of conjecture).[101] Given these uncertainties, it seems likely that the

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[100]These estimates were predicated on having kept track of which aircraft were still present at which Iraqi airfields and where they were located. At the beginning of the war Coalition intelligence had fairly accurate counts of the Iraqi combat aircraft at each base. Which types of aircraft normally occupied which shelters or bunkers on a given field was also known.

[101]Some of the wartime estimates of the number of Iraqi aircraft that had escaped to Iran were nearly double the total of 109 given in DOD's official report [(S) Rpt, Chambers, et al, *Desert Storm Reconstruction Report*, Vol 3, *Antiair Warfare*, CRM 91-179, p 5-47; DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, Apr 1992, p 154].

Table 10
Iraqi Aircraft Attrition By Cause[102]

724 Fixed-Wing Aircraft (as of 10 Jan 91)

403
- 36 Shot down Air-to-Air (3 later disallowed)
- 113 Destroyed in the open
- 121 Escaped to Iran
- 141 Estimated destroyed in shelters/bunkers

- 403 Lost 17 Jan-28 Feb 91

321 Fixed-Wing Aircraft in Iraqi Hands (1 Mar 91)

portion of the Iraqi Air Force that survived the war in Iraqi hands was probably in the vicinity of 300-375 fixed-wing aircraft. Including the aircraft that did not return from Iran, this estimate indicates that more than half of the Iraqi Air Force was eliminated through either destruction of virtual attrition during the air campaign. However, it also confirms that, contrary to what the air planners in Riyadh set out to do toward the end of Desert Storm's first week, the Iraqi Air Force was not completely destroyed by the war's end. The downing of an Iraqi MiG-25 by a U.S. F-16 in January 1993 confirmed that some advanced aircraft and the capability to operate them survived.

One of the reasons that many Iraqi aircraft survived the shelter campaign seems to have been that they were moved into the open on or near airfields, and aircraft in the open were only targeted intermittently. The issue of passing up exposed aircraft to hit shelters and bunkers was a subject of discussion between General Horner and his Navy counterpart,

[102]CENTAF/IN electronic database, provided by Lt Col Steven L. Head; paper printouts of these wartime data can be found in GWAPS NA 397 with an accompanying letter of explanation from Head dated 15 October 1992. While the figures for Iraqi fixed-wing losses to various causes given in DOD's *Conduct of the Persian Gulf War* only total about 300 (versus the 403 in Table 10), the report also suggests that "fewer than 300" were believed to have remained in Iraqi hands by the war's end (p 154). If accurate, this number tends to support the 322 remaining figure reached by CENTAF/IN as of 15 March 1991.

Admiral Arthur, early in the war.[103] For the F-111Fs in particular, though, the issue was not as simple as it may have seemed to senior commanders in the heat of battle. The aircraft were attacking at night with a sensor that seldom "saw" individual aircraft in the open unless they were right beside a targeted shelter. Further, expending precious GBU-24A/Bs[104] on soft targets like aircraft instead of the hard targets they were designed to penetrate was not what these aircraft were being tasked to do in the Air Tasking Order during the second and third weeks of the air campaign. Nevertheless, in retrospect it does appear that the emphasis on aircraft shelters permitted some Iraqi aircraft to survive the war out in the open.

Measured against the ambitious and, once again, somewhat unprecedented goal of physically destroying all of Iraq's combat aircraft, it can be argued that this portion of the air campaign fell a bit short. But such a judgment may focus too much on a measure which is incomplete at best. At least from a wartime perspective, the driving operational aim of the shelter campaign was to prevent any possibility of a Tet-like air attack on Coalition cities, bases, or, especially after G-Day, ground forces. Given Saddam Hussein's likely desire to survive the war with as much of his air force intact as possible, the chances are that such an attack was never contemplated very seriously by the Iraqis on any large scale. On the other hand, even a few aircraft getting through with chemical weapons had the potential to change the strategic context of the entire war. Measured against the more modest objective of rendering the chances of such attacks as remote as possible, the shelter campaign would appear to have largely succeeded even though several hundred Iraqi aircraft managed to elude destruction. As the Navy's Strike Projection Evaluation and Anti-Air Warfare Research (SPEAR) group noted in a 16 February 1991 advisory, the majority of Iraq's remaining fixed-wing aircraft had been dispersed in northern and central bases and would have had to redeploy south to be able to attack targets in the Kuwait theater; further, by this stage of the war, the Iraqis evidenced no intention of

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[103](S) Message from COMUSNAVCENT to USCENTAF, subject "Air Campaign," 23 Jan 0727Z; (S) Message from USCENTAF/CC to USCENTNAV, subject "Air Campaign," 26 Jan 2130Z. In the first message Adm Arthur noted that his pilots had seen aircraft out in the open that had not been hit, especially at Al Taqaddum. Gen Horner's reply was that pilots who passed up aircraft in the open to hit shelters did not "have the big picture." Hand notations on airfield-related documents in Lt Col Deptula's "Intel/Tgt Folder #2" (GWAPS, BH 2-25) indicate that this message was conveyed to the Black Hole.

[104]Again, the GBU-24A/B used the I-2000 or BLU-109 hard-target-penetrating warhead.

committing any significant number of the few surviving aircraft in southern bases to support of ground operations against the Coalition's pending ground offensive.[105]

Summary Observations

General Schwarzkopf's declaration of air supremacy on 27 January 1991 was based on the judgment of Coalition airmen that Iraq's air defenses and air force had been rendered essentially combat ineffective. Only at the low altitudes did the Iraqis retain any appreciable combat effectiveness by late January, but Coalition aircraft could largely operate above the reach of Iraqi antiaircraft artillery and infrared surface-to-air missiles. In retrospect, the various effectiveness measures examined in this chapter do bear out the judgment that air superiority was achieved in the opening hours of Desert Storm, and air supremacy within less than two weeks. They do so, moreover, even though the present survey had little access to high-level Iraqi officials or wartime records. The bottom line regarding Coalition control of the air *is* known: it is evident in the hundreds of Coalition aircraft that flew combat missions each day without being lost or damaged by hostile action, as well in the near absence of Iraqi attacks on Coalition ground forces, airfields, rear areas, cities, or ports. Indeed, based on what is known, the Coalition's efforts to gain early control of the air would appear to have been highly effective by virtually any historical standard.

The next three chapters will cover the operational-strategic effectiveness of Coalition air forces against the Iraqi field army in the Kuwait theater and the various "strategic" targets that were attacked, mostly in Iraq. As will be seen, in the case of the certain strategic targets such as Iraq's national leadership facilities and telecommunications, the lack of access to Iraqi data will be much more of an obstacle to reaching definitive judgments about effectiveness than it was in this chapter. In at least one such target category, no firm judgment about operational-strategic effectiveness will even be possible one way or the other given the present survey's lack of access to Iraqi information. In the case of control of the air, though, the absence of information from the "other side of the hill" poses no such limitation: the operational and strategic objectives of the air superiority portion of Desert Storm were, for the most part, achieved.

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[105]Subject: "SPEAR Advisory 4-91: Iraqi Aviation Threat to a Coalition Ground Offensive," 160630Z Feb 1991, in "Intel/Tgt Info #2," GWAPS BH 2-25.

4

Attacking the Iraqi Army and Navy

Air power's role in support of surface forces in the Gulf War was to reduce the Iraqi Army in the Kuwait theater and carry out associated attacks against the Iraqi Navy, then support the ground invasion. This chapter begins an examination of these roles, principally focusing on the attacks against the in-place Iraqi Army; a shorter section on the Iraqi Navy follows at the end. The next chapter deals with air power as it was employed against engaged ground forces during the action at Al Khafji and in the final four days of the war. Taken together, these chapters outline how air power accomplished the goals set by the Coalition strategy for defeating Iraq's surface forces.

Coalition Strategy

> Our strategy to go after this army is very, very simple. First, we're going to cut it off, and then we're going to kill it.
> (General Colin Powell, News Briefing, 23 January 1991)

Coalition air operations against Iraqi ground forces consisted of those two basic elements. Cutting off the forces in the theater–from supplies and from information–entailed attacks on supply routes, bridges, and railroad yards. Attacks on information were undertaken within the theater by strikes against command posts and communication facilities. There was also a parallel effort against the communications target sets in Iraq proper, a subject more fully addressed in Chapter 6.[1] Another part of the campaign was direct attacks on the army itself throughout the Kuwait theater. Strikes against Iraqi armor and artillery were the most distinctive features of this effort, but command and control sites, ammunition stockpiles, transportation within the theater, and the troops themselves were also prominent targets.

[1]A case could also be made that the attacks on Iraqi aircraft and airfields (covered in Chapter 3) also helped isolate the Iraqi ground forces from information by prohibiting aerial reconnaissance.

The vast weight of the Coalition air effort was directed against Iraqi ground forces in Kuwait or against supply lines to those forces. Ground forces absorbed most of the attack sorties of the war and an even larger proportion of the bomb tonnage. While a command bunker in Baghdad or at a sector air operations center was apt to be targeted with one or two precision-guided munitions, a brigade or division command post was more likely to be in the path of one or more unguided bombs dropped in strings of fifty-one from each of three B-52s, or dropped in pairs from F-16s or F/A-18s or from a variety of other Coalition aircraft dropping a variety of munitions. Moreover, a single divisional target may have been visited by flights of four aircraft arriving in sequence for hours at a time. Precision weapons were employed in Kuwait but to far less a degree than in Iraq.[2] This portion of the air war was characterized more by a gradual attrition of Iraqi forces rather than by a sudden change in Iraqi capabilities, such as had characterized the attacks on the Iraqi Air Force and air defense system. Bomb-damage assessment was not a matter of scoring the success of any individual sortie but of attempting to measure the cumulative effort of many sorties over time.

The operations plan for the campaign stated simply that Iraqi combat effectiveness in the Kuwait theater was to be reduced by at least 50 percent, but there were few good measures by which success could be judged. Measuring success in cutting off the army from supplies was dependent on knowing how many days of supplies the army had in place and how much sustainment was needed, as well as estimating how much the flow of supplies had been constricted. For attrition of the forces themselves, the measures seized on were the degradation of armor and artillery by 50 percent.[3] What could not have been known when this figure was proposed in August 1990 was that the disposition of the Iraqi Army the following January would have the heavy divisions, holding the bulk of all the armor, in the rear areas. Nor could all Iraqi equipment be considered of equal value: for stopping an attacking Iraqi force, armor attrition was the key; for attacking a defending Iraqi force, the situation in

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[2]The F-111Fs by themselves dropped almost 1,800 precision-guided bombs in the Kuwait theater and A-10s fired over 5,000 Maverick missiles, so the campaign was far from being a throwback to an earlier era. The contrast was to strategic bombing within Iraq, where a far higher percentage of attacks used precision bombs (Precision-guided Munitions Category Counts, GWAPS Missions Database).

[3](S) HQCENTCOM, Combined Operation Desert Storm, 17 Jan 1991, para 3. d. (3) (c). GWAPS, CHP 18-1.

January 1991, attrition of artillery became preeminent. For these and other reasons, as will be seen in the execution of the plan, a number of factors tended to make these measures of equipment degradation less meaningful.[4]

The prosecution of air attacks against the Iraqi Army recognized the important status of the Republican Guard, but those forces proved a difficult target. They were singled out as a center of gravity for the part they played as the strategic reserve in the Iraqi ground scheme of maneuver and for their political role as defender of Saddam Hussein's regime. Central Command planning, in fact, addressed the possibility of staging an earlier-than-planned ground attack if it was discovered that the Republican Guard was about to retreat back into the interior of Iraq before the planned ground offensive got underway.[5] Fearing an early withdrawal, Gen. H. Norman Schwarzkopf directed that bridges be struck early in the air campaign (in Phase I) not simply to stop the flow of supplies into the theater but to interrupt the retreat of the Guard out of the theater.[6] Still, the position of these forces, set the farthest back in the theater, made them the most difficult units to observe and to attack and, as will be discussed, allowed several divisions to be among the least damaged Iraqi units by the end of the war.

A final factor influencing the prosecution of the air campaign in Kuwait was the restriction on bombing altitude. Crews bombed from altitudes much higher than their previous training prepared them for in order to remain above the altitude in which they would be susceptible to antiaircraft artillery and many surface-to-air missiles. As a result, a number of penalties were accepted: first, the aircraft were simply less accurate from the higher altitudes because of the greater distance to the target and the resulting magnification of sighting errors; second, some of the munitions dropped were designed for low-altitude release, particularly the cluster mines or bomblets, and were thus less effective because of the excessive dispersion pattern of the munitions that resulted; and third, the

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[4]The subject of the proper measures of attrition became moot with the difficulties that emerged in determining even what had occurred as a result of the bombing.

[5](S) J-5 After Action Report, "Headquarters CENTCOM/Joint Forces and Theater Operations," 5 Mar 1991, Vol IX, Tab Z, GWAPS, NA 259.

[6]"Cut key bridges, roads, and rail lines immediately south of Basrah to block withdrawal of RGFC forces." (S) HQCENTCOM, Combined Operation Desert Storm, 17 Jan 1991, para 3.f.(1) (b) 3, GWAPS, CHP 18-1.

crews had a much greater problem in identifying targets and assessing the damage done.[7] Precision weapons were not affected as much by the release altitudes, but in the Kuwait theater, where much depended on the use of unguided munitions, results came much more slowly, and because of the virtual absence of adequate bomb-damage assessment, this situation was not well understood until well into the air campaign.

Iraqi Ground Forces

The general disposition of Iraqi ground forces deployed in Kuwait was well known by Coalition military leaders before the beginning of the air war. The number of Iraqi divisions grew throughout the fall of 1990, and U.S. intelligence documents had, by December 1990 and January 1991, depicted the general placement and anticipated employment of those forces–information that was confirmed both by the experience of the ground war and by information learned during and after the war from enemy prisoner of war debriefings and captured Iraqi military documents.[8]

Map 2 displays the identification and placement of Iraqi ground forces, deployed to meet the Coalition ground attack in three stages. The frontline forces were to meet the initial Coalition attack, slow down and cause attrition in those forces, and allow the Iraqi military leadership to determine the main axis of attack. The second stage employed the

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[7]This subject is treated in depth in the GWAPS Weapons, Tactics, and Training report. See also: (S) USAF Fighter Weapons Center, Tactical Analysis Bulletin, Volume 91-2, Jul 91, GWAPS, NA 216; (S) Rpt, Strategic Air Command/XP, *B-52 Desert Storm Bombing Survey*, SAC-TR-91-36, 15 Dec 1991, p 33, GWAPS, NA 100; (S) Frank Schwamb, et al, *Desert Storm Reconstruction Report, Vol II: Strike Warfare* (CRM 1991-178, Alexandria, VA: Center for Naval Analyses, 1991), pp 5-24 through 5-29; and (S) US Marine Corps Research Center, "Aviation Operations in Southwest Asia," Research Paper #92-0003, US Marine Corps, Quantico, VA, Jun 1992.

[8]Some units were misidentified and others remained unidentified, but the dispositions of the forces were accurate. Information presented in (S) *Iraq as a Military Adversary*, Special National Intelligence Estimate (SNIE), memo to Holders of SNIE 36.2-5-90, 2 Jan 1991. In this chapter frequent use will be made of enemy prisoner of war debriefings, reports of which are found in a series of Intelligence Information Reports (hereafter referred to as IIRs) issued by the US Army's 513th Military Intelligence Brigade, the organization which oversaw the Iraqi enemy prisoner of war exploitation effort. Copies of these records are in numerous locations, including a master file at the Defense Intelligence Agency (DIA). The GWAPS collection includes some on computer disc and others on paper in CHST 32-5 and New Acquisition Folder 312.

tactical and operational reserves of armored and mechanized divisions throughout central Kuwait and extending into Iraq, deployed behind the frontline divisions, that were to reinforce and block penetrations of the front lines (the Iraqi tactical reserves were the 5th, 3d, 1st, 6th, and 52d Divisions; the operational reserves were the II Armored Corps' 51st and 17th Divisions and the Jihad Corps' 12th, and 10th Divisions). The Republican Guard divisions formed the third echelon north and west of the Kuwait border. These forces made up the strategic reserve poised to counterattack against the main Coalition attack; of principal interest were the heavy divisions of the Guard, the Tawakalna, Madinah, and Hammurabi.[9] Other infantry divisions in the theater had general missions to act as reinforcements (as part of the tactical reserve), protect the coast, and defend against possible airborne attacks into central Kuwait, but the overall Iraqi military strategy was understood correctly by the Coalition as being embodied in these three stages of defense. Central Command referred to the formations as twenty-five committed, nine reinforcing, and eight theater reserve divisions; except for minor variations, they are the same as portrayed.[10]

Based on the depiction of Iraqi force deployment and the military strategy to employ them, the identification of the Republican Guard as an Iraqi center of gravity was fitting. Not only were these forces vital for the internal support of the Iraqi leadership, they were also the key forces counted on to turn back the Coalition ground attack. Certainly not by coincidence, the Republican Guard also occupied a blocking position between the remainder of the Iraqi divisions and their retreat (or desertion) back into Iraq. Finally, and critically for the Coalition strategy, the Republican Guard's positions, except for the Tawakalna Division, made them the most difficult for the Coalition forces to reach and the most likely to escape from the theater.

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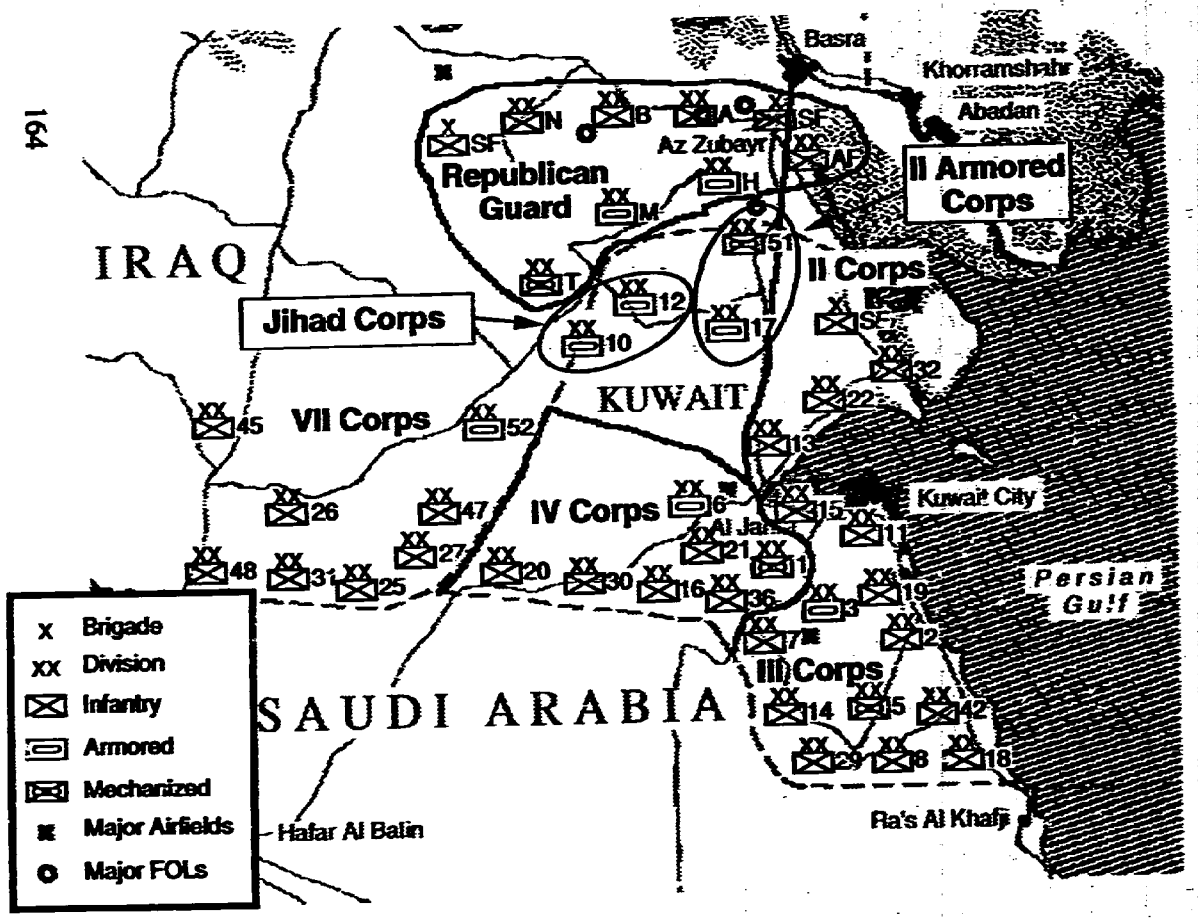
[9](S) *Iraq as a Military Adversary*; Department of Defense, *Conduct of the Persian Gulf War*, Final Report to Congress, Apr 1992, pp 110-12. Note: heavy division is the term describing either an armored or mechanized division.

[10](S) *Ibid*; USCENTCOM Situation Report, 23 Feb 1991, GWAPS, CHST 68.



Map 2
Deployment of Iraqi Divisions in the Kuwait Theater During the Air Campaign, 17 January-23 February 1991

While the number and placement of units was both observed and updated before and during the war, the number of Iraqi troops that made up these units, as well as the equipment totals (armor and artillery) of the units, were estimates based on what was known about Iraqi unit structure, updated where possible from other intelligence information but not further amended during the war. Once the numbers of troops and equipment were derived, the divisions were assumed to be fully manned and equipped.[11] Even during the war, when there were many indications from prisoner of war reports that units had deployed with substantially fewer men and less equipment, those estimates were not updated. Furthermore, the military command structure did not comment on or engage in any assessments of Iraqi personnel losses–body counts–either during or after the war.

The unwillingness of both Central Command Commander General Schwarzkopf and Chairman, Joint Chiefs of Staff General Powell to deal explicitly with numbers of personnel was based both on their experiences with body counts in the Vietnam War and their conviction that numbers of people were not a good measure of combat power; they directed attention to numbers of maneuver divisions and brigades.[12] Even a year after the war, the official Department of Defense position was that there were 540,000 Iraqi troops in the theater when the air war began, and "On the eve of the ground offensive, Coalition planners thought nearly 450,000 Iraqi troops remained in the KTO."[13]

The decision not to use numbers of troops as a reliable indicator of combat power was an appropriate one during the war, but, for purposes of analysis, the estimated numbers of troops can be used as a measure of how the relative Iraqi combat strength changed over time. The relationship is surely not a direct one, but, in this war, marked as it was by heavy desertions during the air campaign, an accounting of personnel strength of the Iraqi forces over time provides some measure of the entire

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[11](S) Tables in *Iraq as a Military Adversary*, pp 15-21, GWAPS, CHSH 97-3. Totals for Iraqi troops in the theater included both the sum of divisional totals and those personnel at corps level and above.

[12]CENTCOM News Briefing of Gen H. Norman Schwarzkopf, Riyadh, Saudi Arabia, 27 Feb 1991; (TS) Intvw, Ron Cole, JCS/Historical Staff, and Diane Putney, Office of Air Force History, with Rear Adm J. M. McConnell, USN, Deputy Director for Intelligence, Joint Staff, 14 Feb 1992, GWAPS, NA 261.

[13]DOD, *Conduct of the Persian Gulf War*, Final Report to Congress, pp 85, 254.

effects of the bombing. While the Iraqis themselves have not provided such data (and may lack accurate information), and until captured documents are exploited to gain further insights, enemy prisoner of war reports remain as the best source.

The prisoner of war debriefings conducted by the Coalition included questions about the standard as well as actual manning of the individual's unit, type and amount of equipment, number of desertions, and numbers killed or wounded by bombing. This information, with reference to the date of the prisoner's capture, provides a measure of the original size and attrition of Iraqi forces. The information must be used with caution, however, since the bulk of the deserters came from the frontline, often lowest-manned, divisions; far fewer came from the heavy divisions in reserve. Only during the incursion at Al Khafji and during the ground offensive were troops from the operational and strategic reserve divisions and higher ranking officers captured and interrogated. As a result, there are numerous and reinforcing reports by soldiers from nearly all of the frontline divisions, particularly in the west, but far fewer from elsewhere.[14] The Survey conducted no independent investigation on the size of the Iraqi Army but used the information obtained in these interrogations to update the U.S. prewar estimates–not on the number of Iraqi units (divisions and brigades) in the theater but on the number of troops estimated to be a part of these units.

Reports from prisoner of war interrogations point to several reasons for the Department of Defense prewar estimate of 540,000 Iraqi troops in the theater as too high. First, the reports indicate that a full-strength Iraqi division had fewer troops than U.S. intelligence sources estimated. Whereas the estimate for a full strength Iraqi division was 11,500 to 12,000 (depending on the type of division), prisoners reports set the authorized strengths of their divisions at not more than 10,000.[15] Second, few, if any, of these divisions deployed with a full 10,000 complement,

[14]Of particular interest are prisoner reports on some of the heavy division that played a significant part in the ground action, including the 3d, 5th, 52d, 12th, Tawakalna, and Hammurabi Divisions.

[15]The prisoner reports include those from high ranking officers who had specific knowledge of manning of divisions. Needless to say, most of the prisoners taken had very little to say about manning levels above their own squad or company. (S) *Iraq as a Military Adversary*, pp 15-21.

and some had considerably fewer. There were a great many variations, with the infantry divisions occupying the front lines having the weakest manning; among those divisions, both the quality of the unit and its manning levels grew worse along the front line, moving from east to west. Thus, III Corps divisions, along the coast, were in the best shape, and VII Corps divisions, aligned west of the Wadi al Batin, were the worst, with the 48th Division, at the end of the line in the west, having the lowest manning of any division in the theater for which information is available–deploying at only 50 percent of its authorized full strength.[16] Third, the Iraqi policy of allowing troops to take leave at frequent intervals meant that a significant number of soldiers were absent when the air campaign began–and were never to rejoin their units. Whether the leave policy was a method of reducing the task of feeding the troops or was a method of controlling desertions, as one Iraqi officer stated, is not certain, but the practice resulted in a significant decrement in the size of the Iraqi Army by the time the air war began. Certainly there were outright desertions throughout the fall of 1990, but, lacking other data, at least a partial accounting of these deserters is possible by recognizing them among those soldiers counted as on leave. Approximately 20 percent of the troops were given leave at any one time, and the prisoner debriefings indicate that those on leave seldom, if ever, returned after the air war had begun.[17]

From the prisoner accounts, several general adjustments to the original estimates can be reasonably made:

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[16]Such a disposition of divisions would make sense in light of the Iraqi anticipation of a Coalition attack coming up the coast road or from the area of the Wadi al Batin (into either the IV or III Corps areas). Note, however, that some units, such as the 3d and 12th Armored Divisions, deployed at close to full strength. As a result, any theater-wide assessments must be made with caution.

[17]Enlisted men received 7 days leave for every 28 days (20 days for officers) in the field. Anticipation of leave from their units would no doubt lessen the soldiers' inclination to desert. If this were the case, it also explains why the leave policy was reinstated, although briefly, during the war.

Original Estimate	540,000
Adjustment for divisional manning:	
(a) decrease based on difference in Iraqi reports on authorized divisional size compared to U.S. estimate of same; and	
(b) decrease based on reports of actual manning levels of frontline western division; lacking further evidence, assume other divisions at closer to full strength (11 frontline divisions at 57 percent, 33 divisions at 85 percent, for an overall theater manning level of just under 78 percent)[18]	-120,000
	420,000
Adjustment for troop departures prior to the air war: disregard desertions, but assume that 20 percent of force is on leave when the air war began[19]	-84,000
	336,000

The total of 336,000 troops (in 43 divisions and independent brigades) in the Kuwait theater on 17 January 1991, taking into consideration the assumptions used, is best described as a "not more than" figure but appears a more valid estimate of the Iraqi force than the 450,000 number estimated during the war. While no Department of Defense source has published updated figures, a report of the House Armed Services has attempted to reconstruct the size of the force based on information from the prisoner of war statements and has estimated an even smaller Iraqi force. While that report cannot be directly compared to the above figures, since it does not estimate a number for the beginning of the air war (it computes a figure only for the beginning of the ground war), it bases its analysis on two different assumptions: that the Iraqi divisions were under-strength by an average of 34 percent and that there

[18]This decrement could be greater if the other divisions in the theater had similarly low manning levels.

[19]Desertions prior to 17 Jan are counted within the 20% authorized to be on leave. This decrement could be greater if there was a substantial early desertion rate in addition to the numbers on leave.

were few soldiers on leave.[20] As indicated, prisoner reports mention that there were significant numbers on leave. Also, since the prisoner reports were predominantly from the western divisions' frontline troops, the most under-strength of the army, that population does not seem representative of the remainder of the Iraqi Army; the reports from other regions of the theater, though there are far fewer reports, indicate higher manning levels. The estimate of 336,000 Iraqi troops, as well as the Armed Services Committee estimates, will be returned to later in this chapter during the discussion of attrition during the air war.

Like the troop estimates, numbers for Iraqi armor and artillery in the theater were determined in a similar manner--by reference to what was understood as the standard equipping of the divisions, updated by other intelligence. The numbers determined were 4,280 tanks, 2,870 armored personnel carriers, and 3,110 artillery pieces, based on 42 (later upgraded to 43) divisions, some independent brigades, and additional, attached battalions. Unlike troop estimates, though, these equipment estimates can be updated by reference to more than just prisoner reports; later exploitation of photo imagery provides better counts. Central Intelligence Agency analysis of photo imagery taken just before the air campaign began provides the counts in Table 11, which appear to the Survey as highly credible.[21]

Two additional items not evident in the numbers themselves are noted for later reference: First, although the actual number of tanks was less than the total authorization, the armored and mechanized divisions had virtually 100 percent of their authorization; in other words, almost all of the shortfall occurred in the infantry divisions. Second, the most modern and capable tanks, the T-72s, were possessed by the Republican Guard heavy divisions. [DELETED][22]

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[20]US House of Representatives Committee on Armed Services, *Defense for a New Era, Lessons of the Persian Gulf War* (Washington, DC: 1992), pp 32-33. The difference cited in these two assumptions would tend to be offsetting.

[21](S/WN) Information is based on photo imagery of 15 Jan 1991. (S) Brfg, CIA Office of Imagery Analysis to GWAPS, 25 Jun 1992. These counts can be considered as final counts, since imagery detected no substantial amount of additional equipment brought into the theater during the air campaign.

[22]Numerous enemy prisoner of war reports reinforce the picture of the low number of tanks assigned to infantry divisions. Ground order of battle information, but those gaps were filled in based on intelligence secured during the ground attacks.

Table 11
Iraqi Equipment in the Kuwait Theater, Estimated and Observed

Iraqi Equipment, as of 16 Jan 1991	Tanks	Armored Personnel Carriers	Artillery
Original Estimate (CIA/DIA)	4,280	2,870	3,110
Photo imagery counts (CIA)	3,475	3,080	2,475
Percent Difference	19% (-)	7% (+)	20% (-)

Interdiction of Iraqi Lines of Communications

When General Powell spoke of "cutting off" the Iraqi Army occupying Kuwait, he was referring to air interdiction of the highways and rail line over which troops and materiel moved between central Iraq and the Kuwait Theater of Operations (KTO).[23] Central Command plans called for air attacks designed "to sever Iraqi supply lines" throughout all phases of Operation Desert Storm.[24] The objective was to "isolate the KTO" and "deny/disrupt Iraq's capability to resupply Iraqi forces via

[23]He also was referring to Coalition air strikes against "the nerve center, the brains of the operation, the command and control of the operation" in Baghdad. (Transcript, news briefing, The Pentagon, 23 Jan 1991, p 6.)

[24](S/NF) Msg, USCINCCENT to JCS, 161735Z Jan 1991, subj: USCINCCENT OPORD 91-001 for Operation Desert Storm, GWAPS, NA 357; (S) HQUSCENTCOM and Joint Forces and Theater of Operations OPLAN, Combined Operation Desert Storm, 17 Jan 1991, pp 2, 4, 5 and 6, GWAPS, CHC 18-1. Note that the US-only OPLAN for Desert Storm, issued a month before OPORD 91-001 and the Combined OPLAN, directed US air forces to "cut Iraqi supply lines *totally*." [(S/NF) USCINCCENT OPLAN, Desert Storm, 16 Dec 1990, p 5, emphasis added, AFHRA 0269602]

highway and rail."[25] Depriving the Iraqi Army of ammunition, POL (petroleum, oils, and lubricants), food and water, and other essential supplies was expected to sap its strength and thus diminish its ability to resist a Coalition ground offensive. As the Director for Operations for the Joint Staff put it, "we would like to . . . see those forces at the front atrophy. We would like to see them starve in terms of supplies so that their combat power is reduced, so that our relative advantage over them is enhanced."[26] In addition to the stated objective of the interdiction effort, there may also have been a hope that denying resupply would not just weaken the Iraqi Army but compel it to leave Kuwait.[27]

While air interdiction operations were devoted largely to cutting the flow of supplies, they also aimed at stopping the movement of forces. Most Iraqi ground forces had been deployed to the Kuwait Theater by the

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[25]"Isolate the KTO": (S) Msg, USCINCCENT to JCS, 161735Z Jan 1991; "deny/disrupt . . . rail": briefing slides (S/NF), Tactical Air Command, USCENTCOM Target Objectives (undated, but probably Dec 1990 or later).

[26]Transcript, Lt Gen Thomas Kelly, news briefing, The Pentagon, 12 Feb 1991, pp 3-4. One month after the end of the war, Gen Horner told a representative from the Air Staff that he had viewed preventing the resupply of food, water, and POL as more important than halting the flow of ammunition because of the sizable ammunition stockpiles the Iraqi Army had amassed in the theater prior to Desert Storm. [Excerpts from (28 Mar 1991) intvw with Lt Gen Horner, attachment to memo, Maj Terry L. New, XOXWD, to XOXW, XOX, subj: Trip Report from Joint Doctrine Center visit to Desert Storm locations, 30 Apr 1991, GWAPS, CG 6.]

[27]In an interview conducted three months before the war, Gen Glosson argued that execution of the planned strategic air campaign would make it "for all practical purposes impossible for [Saddam] to resupply the troops that he has in Kuwait. . . . [O]nce you've done that, the only thing you have to do is have the *patience to wait out the effect of what you've already accomplished.* In other words, be patient enough to enjoy the fruits of victory. It's impossible for that military force of 500,000 people and 4,000 tanks, to eat and drink and have resupplies for more than about 10 days after we complete the [Phase I] air campaign. At that point in time the Iraqis only have three options: they can either retreat back into Iraq, they can make an attack on what limited food, water, and munitions they have, or they can stay dug in until literally they have to come out of the dug-in positions in order to survive from a physical standpoint. There are no other choices. . . . Therefore, it's just a matter of days until the people have to walk away, and that's why I feel so confident that the air campaign will accomplish the objectives the President laid down." [(S/LIMDIS/SAR)Intvw, TSgt Theodore J. Turner, USCENTAF Office of History, with Brig Gen Buster C. Glosson, 17 Oct 1990, p 13, emphasis in original, GWAPS, CHP 5A.]

start of war, so the need to block reinforcements was limited.[28] Of greater concern was the need to prevent Iraqi forces from departing Kuwait intact by cutting off their path of retreat, as discussed earlier.[29] Although these lines of communications were not cut during the first days of the air war, the Republican Guard also did not retreat, contrary to Schwarzkopf's fear.[30] In the final days of the conflict, air interdiction operations kept Iraqi reserve divisions from mounting an effective defense against the Coalition ground offensive and slowed the enemy's retreat, a subject discussed further in the next chapter. Between the start of the air campaign and the start of the ground offensive, air interdiction–and allied control of the air overall–precluded any major repositioning of Iraqi forces in response to the massive "shift west" of Coalition ground forces.[31] After the war, captured Iraqi officers told their interrogators that

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[28]According to Gen Horner, the job was to prevent the flight, rather than the further buildup, of Iraqi forces (Horner intvw, 28 Mar 1991.)

[29]See footnote 6, this chapter. On 6 November, when Gen Schwarzkopf met with his component commanders to discuss the strategy for a Coalition offensive to drive the Iraqi Army from Kuwait, CENTAF was told "[e]very bridge and railroad was to be cut by tactical air so no vehicles could go north or south from Basra." [(S/NF) Rpt, Rear Adm (Ret) Grant Sharp, *Planning for the Gulf War* (draft), 3 Dec 1991, p 42.]

[30](S) Master Attack Plans prepared for the first and third days of the air campaign included F/A-18 and A-6 strikes against eight bridges in Al Basra [(S) Master Attack Plan, First 24 Hours, GWAPS, CHST 57-4; (S/LIMDIS/SAR) Master Attack Plan, Third 24 Hours, GWAPS, CHST 57-6.] However, none of those planned strikes was executed. [(S/NF/WN) Rpt, Schwamb, et al, *Desert Storm Reconstruction Report, Vol II: Strike Warfare*, pp 6-38 and 6-42 - 6-45.] The Master Attack Plan for the second day identified bridges in As Samawah and An Nasiriyah, and across the Hawr Al Hammar–locations *northwest* of Al Basra–as "Republican Guard escape routes" and assigned F-15Es to those targets [(TS/LIMDIS/SAR) Master Attack Plan, Second 24 Hours, GWAPS, CHST 57-5.] Only the An Nasiriyah bridge was attacked on that day, with five Mk-82 bombs; the other strikes were canceled (GWAPS Missions Database).

[31]Air superiority and air interdiction capabilities were fundamental to Coalition plans and preparations for the "left hook." As Gen Schwarzkopf explained the day before the war ended: "very early on we took out the Iraqi Air Force. We knew that [the enemy] had very, very limited reconnaissance means. Therefore, when we took out his air force, for all intents and purposes, we took out his ability to see what we were doing . . . in Saudi Arabia. . . . When we knew that he couldn't see us any more, we did a massive movement of troops all the way out to . . . the extreme west [of Saudi Arabia], because at that time we knew that he was still fixed in [Kuwait and southeastern Iraq] with the vast majority of his forces, and *once the air campaign started, he would be incapable of moving out to counter this move, even if he knew we made it.*" (Transcript, CENTCOM news briefing, Riyadh, 27 Feb 1991, pp 2-3, emphasis added.) In his autobiography,

even if they had possessed good intelligence on the allied shift,[32] they would not have been able to redeploy their forces while under Coalition air attacks. Finally, on the one occasion when Iraq did attempt a ground offensive (the Battle of Al Khafji), Coalition air power was instrumental in countering the move, in part by attacking divisions that were preparing for a follow-on assault.[33]

In short, the Desert Storm air campaign included operations directed toward both force (or mobility) interdiction and supply (or logistics) interdiction.[34] In essence, air power was assigned the task of imposing a barrier behind the Iraqi Army. Force interdiction was intended to keep that army in; supply interdiction, to keep materiel out. Like the interdiction effort itself, the discussion below will focus on supply interdiction. The effects of Coalition air attacks on the transport of military supplies to the Kuwait theater will be examined first. The effects of allied attacks on the availability and distribution of supplies within the theater are then considered. The discussion concludes with an assessment of the effectiveness of air interdiction in reducing the combat potential of the Iraqi Army and contributing to the success of the Coalition ground offensive.

Because the principal lines of communications between Baghdad, the main military supply center, and the Kuwait theater generally followed and frequently crossed rivers, bridges became the key targets of air operations to "isolate" the theater. Map 3 depicts the major supply routes from Baghdad to Al Basra.[35] A highway and single-track rail line ran along the

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Schwarzkopf reports that he made this same point during a 14 November meeting in which he provided an early outline of the "left hook" plan to his senior commanders. [*It Doesn't Take a Hero* (New York, 1992), pp 380-383.]

[32](S/REL UK) MR, Joint Debriefing Center, 513th Military Intelligence Brigade, US Army, subj: The Gulf War: An Iraqi General Officer's Perspective (JDC Rpt 0052), 11 Mar 1991, p 5, GWAPS, CHST 32-2.

[33]See Chapter 5.

[34]The distinction between "force" and "supply" interdiction can be found in Edmund Dews and Felix Kozaczka, *Air Interdiction: Lessons From Past Campaigns* (N-1743-PA&E, Rand Corp, Santa Monica, CA, 1981).

[35](S/WN/NF) Map 3 is based on information derived from (S/WN/NF) Rpt, Iraq Regional Task Force, *IRAQ: Sustainment Capabilities for the KTO*, Defense Special Assessment 171-91, 20 Feb 1991, p 4; Rpt (TS collateral copy), DIA, *Final BDA Status Report*, 14 Mar 1991, pp 93-97, GWAPS, NA 519. (Note that here and in later citations, page references for the *Final BDA Status Report* come from the collateral copy in the GWAPS files.)

Euphrates River, passing through As Samawah and An Nasiriyah. To the north, another highway roughly paralleled the Tigris River as it ran via Al Kut and Al Amarah. On both of these routes, the distance between Baghdad and Al Basra was approximately 600 kilometers (km). The two highways were connected by a third north-south road following the Shatt al Gharraf between Al Kut and An Nasiriyah. Another highway linked Al Amarah and An Nasiriyah. The road between An Nasiriyah and Al Qurnah was used to bypass the Al Basra area during the war.

There were 126 highway bridges and 9 railroad bridges south of Baghdad.[36] By the end of the war, roughly half the bridges were included on the Black Hole's Master Target List.[37] Bridges represented attractive targets because they were limited in number, easily located, vulnerable to attack (especially attacks by precision-guided munitions), hard to repair, and frequently difficult to bypass.[38] It should be noted that in addition to the bridges, seven rail yards in Iraq also were targeted as transportation choke points, but the damage to the yards was not a major factor in eliminating rail traffic between Baghdad and the theater.[39] The destruction of rail bridges was of much greater consequence.

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[36](S/WN) Notes for brfg, DIA, for DIA Deputy Director for Foreign Intelligence, Log Wrapup Brfg, 11 Mar 1991, files (DIA).

[37](S) Master Target List, 1 Mar 1991, GWAPS, BH, Box 9, Folder 101.

[38]See *Air Interdiction: Lessons From Past Campaigns*, p 13.

[39](S/WN) Coalition air strikes against two rail yards in Al Basra caused "choke point damage" and "damaged tracks." The yard at Ash Shuaybah received "limited damage," with bomb craters between the classification yard and the freight-handling area. One small classification yard in Az Zubayr had track damage at its north and south ends, while another, the Az Zubayr Railroad Yard North, also had "light damage to rails and several rail-related support facilities." Five tracks were damaged at the yard in Khan Abu ar Rayat. The Battikah rail yard was "severely damaged." Despite damage, all the yards remained "functional." [(S/WN) Background Paper, DIA/DB-8B, to Director of the Joint Staff, subj: Iraq's Logistics, 15 Mar 1991, Tasker #5064, DB-8B (now DIR-6B) Taskers Files; (S/WN) Rpt, DIA/DX, *Desert Storm BDA Imagery Review*, Vol III, DDX-2900-489-91, Jul 1991, pp 74-75 and 102-105, GWAPS, CHST 53-1; *Final BDA Status Report*, pp 91 and 92; (S) Intvw, Kurt Guthe, GWAPS, with DIA/DB-8B (now DIR-6B), 7 Oct 1992, GWAPS, notes in Guthe's files.]

Map 3
Lines of Communication into the Kuwait Theater

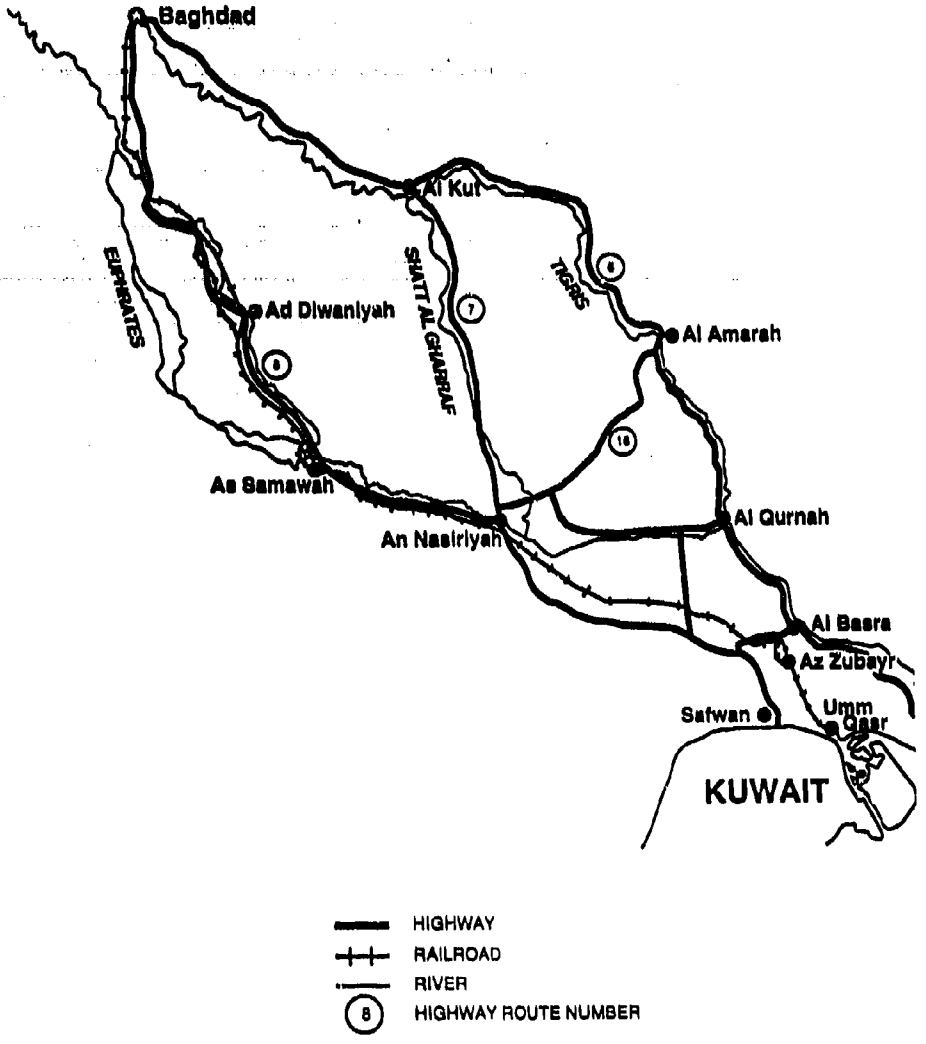
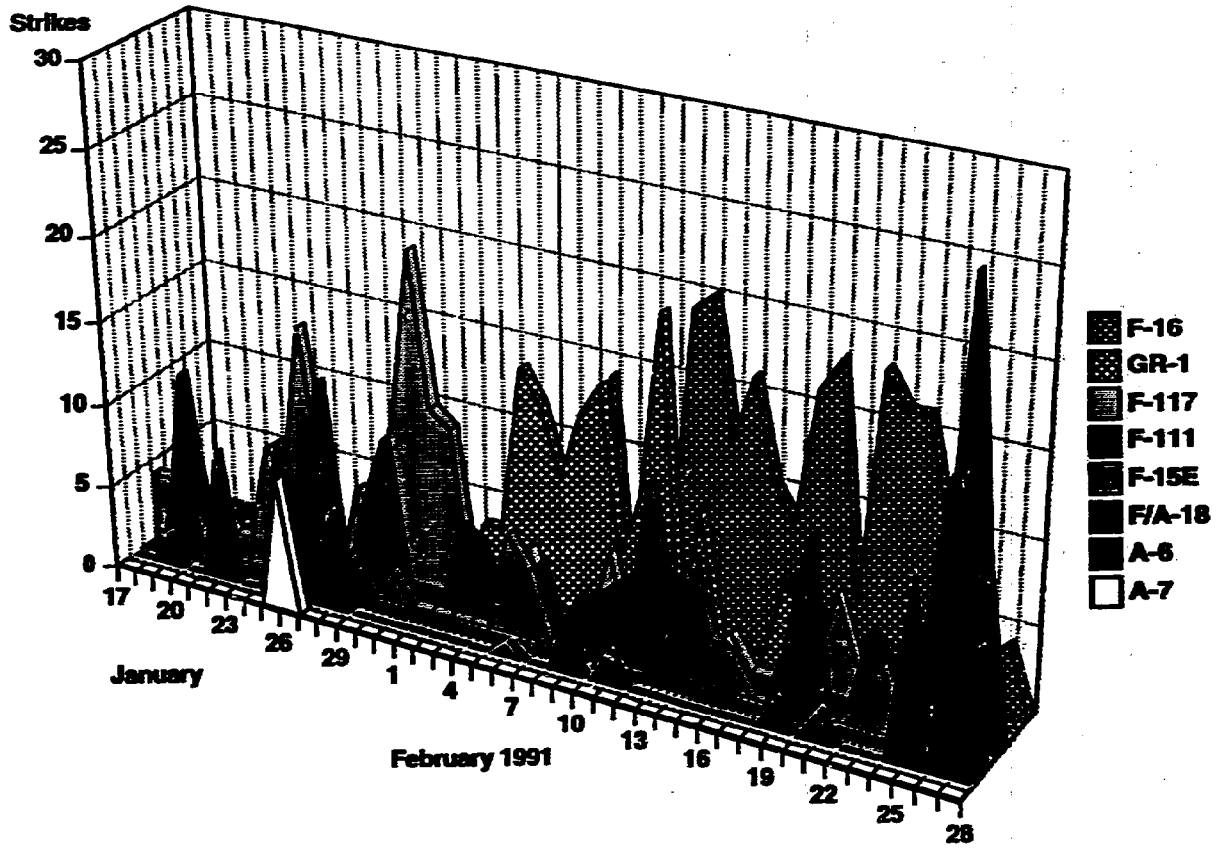
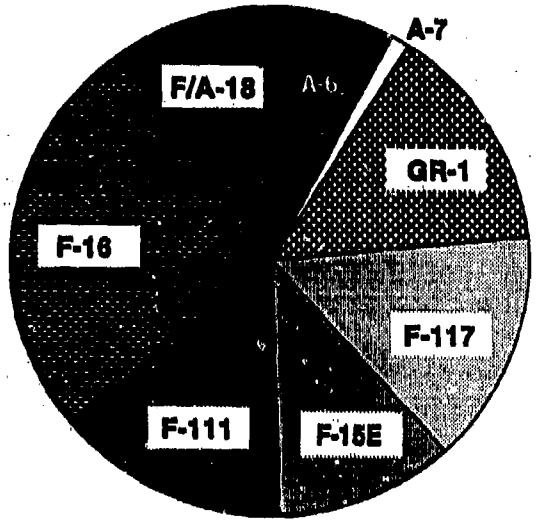


Figure 16
Strikes Against Bridges by Day and Aircraft Type



Highway and railroad bridges in Iraq were attacked throughout Desert Storm.[40] Some eight hundred strikes were carried out against these

Figure 17
Strikes Against Bridges by Aircraft Type



[40]Information on bridge strikes was derived from the (S) OWAPS Missions Database and tables.

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targets. ("Strike" here is defined as the delivery of one or more weapons by a single aircraft against a discrete target.) Nearly 90 percent were aimed at highway bridges. Figure 16 shows the distribution of bridge strikes over time and by aircraft type. A variety of aircraft were used in bridge strikes, with the largest shares executed by F-16s, F-117s, GR-1s, and F-111s (see Figure 17). Both free-fall bombs and precision-guided munitions (PGMs) were employed against bridges. During all 6 weeks of Desert Storm, PGMs were delivered in somewhat less than half (45 percent) of the strikes. In the last two weeks, however, the proportion of PGM strikes (20 percent) was considerably smaller than the proportion in the first four (65 percent) (see Figure 18). This can be attributed to the large share of F-16 strikes with unguided bombs in the latter part of February and the increased use of air-delivered mines and other cluster munitions during the ground war. The distribution of PGM strikes over time and by aircraft type can be seen in Figure 19. F-117, GR-1, and F-111F aircraft together accounted for over 80 percent of the PGM strikes (see Figure 20).

Virtually all strikes were intended to cause structural damage (for example, one or more destroyed spans) that would render the targeted bridges impassable.[41] Figure 21 presents the first-order effect of the antibridge strikes–a steady increase in the number of damaged bridges in Iraq. (Data for the first two weeks of the war were incomplete.)[42] In most cases, the damage left the bridge unusable. In others, the damage was less

[41](S) There were a number of cases near the end of the war in which bridge approaches were mined to trap Iraqi ground forces in the KTO. For example, on 24 Feb, Navy strike aircraft dropped Mk 82 bombs with delayed fuzing to seed the approaches to the Ar Rumayla highway bridge over the Hawr Al Hammar. (Additional Mk 82 bombs were delivered against the bridge itself.) On 26 and 27 Feb, F-111s delivered CBU-87 submunitions against bridge approaches and military vehicles in southeastern Iraq to destroy retreating enemy forces. On 27 Feb, naval air mined the approaches to a highway bridge at Al Madinah, again using Mk 82s. (*Desert Storm Reconstruction Report, Vol II*, pp 6-30, 6-34 - 6-35, 6-43, 6-44 and C-16; GWAPS Missions Database.) That same day, B-52 bombers scattered CBU-89 (Gator) mines along the approaches to the Al Rumayla bridge, helping create a bottleneck that hampered the flight of the Iraqi Army. (S) SAC/XP, *B-52 Desert Storm Bombing Survey*, p 15; (S) Master Attack Plan for 42nd 24 Hours, 27 Feb 1991, GWAPS, BH 2-46. See Chapter 5 for further discussion.

[42]Figure 21 reflects data derived from various Defense Intelligence Agency assessments produced during the Gulf War. Dates correspond to the dates of the DIA documents in which damage to bridges was reported.

Figure 18
Strikes on Bridges in Iraq

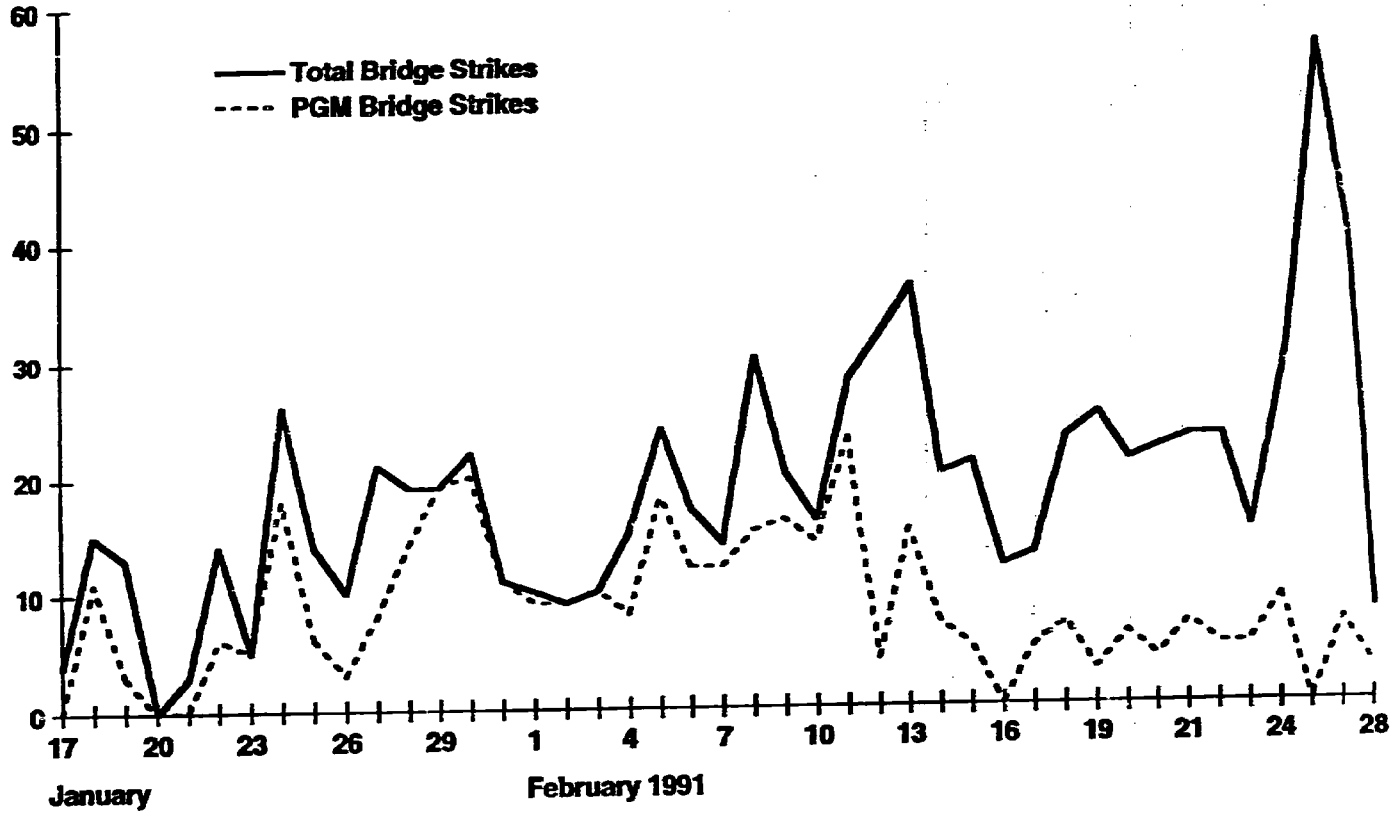


Figure 19
PGM Strikes Against Bridges by Day and Aircraft Type

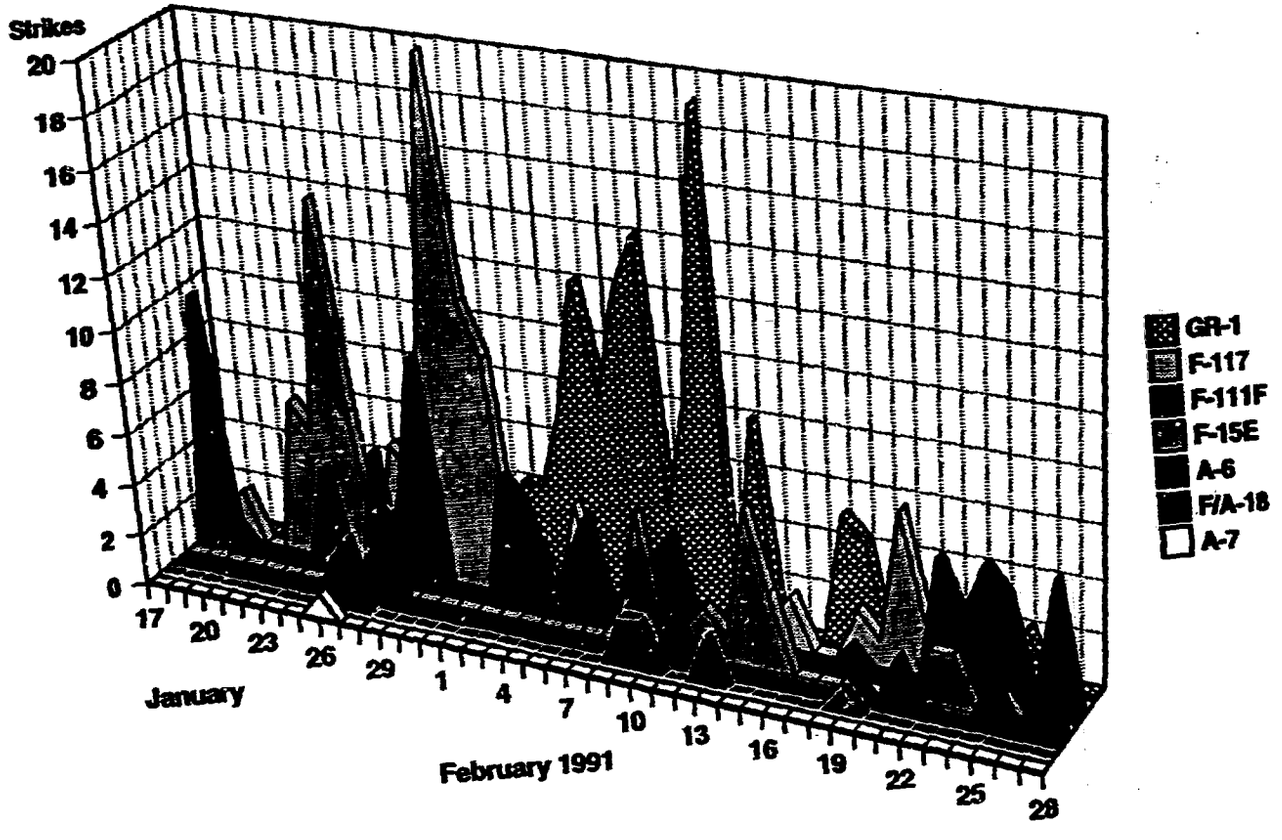
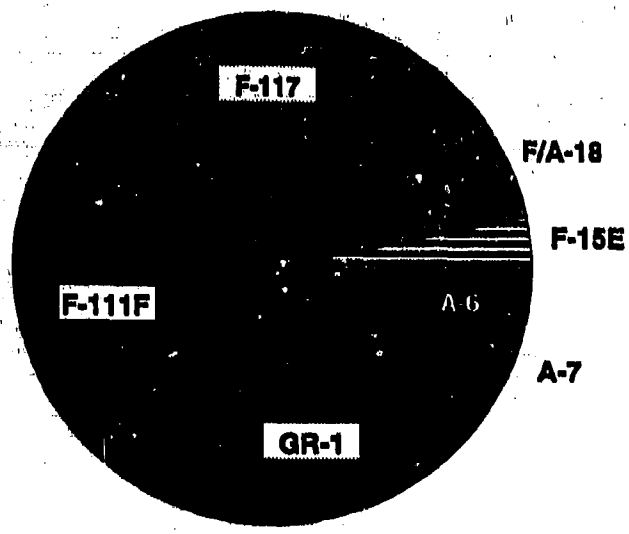


Figure 20
PGM Strikes Against Bridges by Aircraft Type



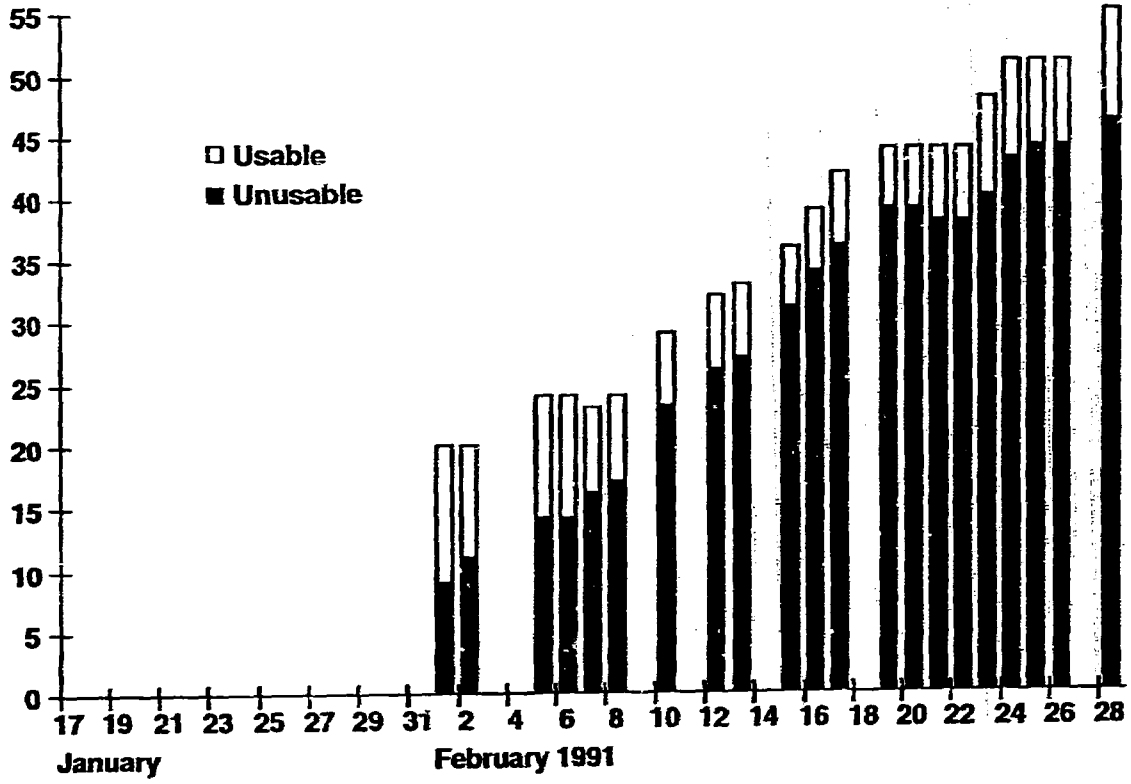
severe (for example, a span was punctured rather than dropped), and the bridge could still be used. By the time of the cease-fire, thirty-seven highway bridges and nine railroad bridges were no longer usable. Another nine highway bridges were severely damaged but usable.[43] As shown in Map 4, roughly two-thirds of these bridges were located on the lines of communications from Baghdad to the theater. As Samawah, An Nasiriyah, and Al Basra had the largest number of damaged bridges.[44]

Throughout the war, Iraq attempted to offset the destruction of its permanent bridges by rerouting traffic, constructing temporary bridges, using amphibious ferry vehicles, and building earthen causeways. Efforts

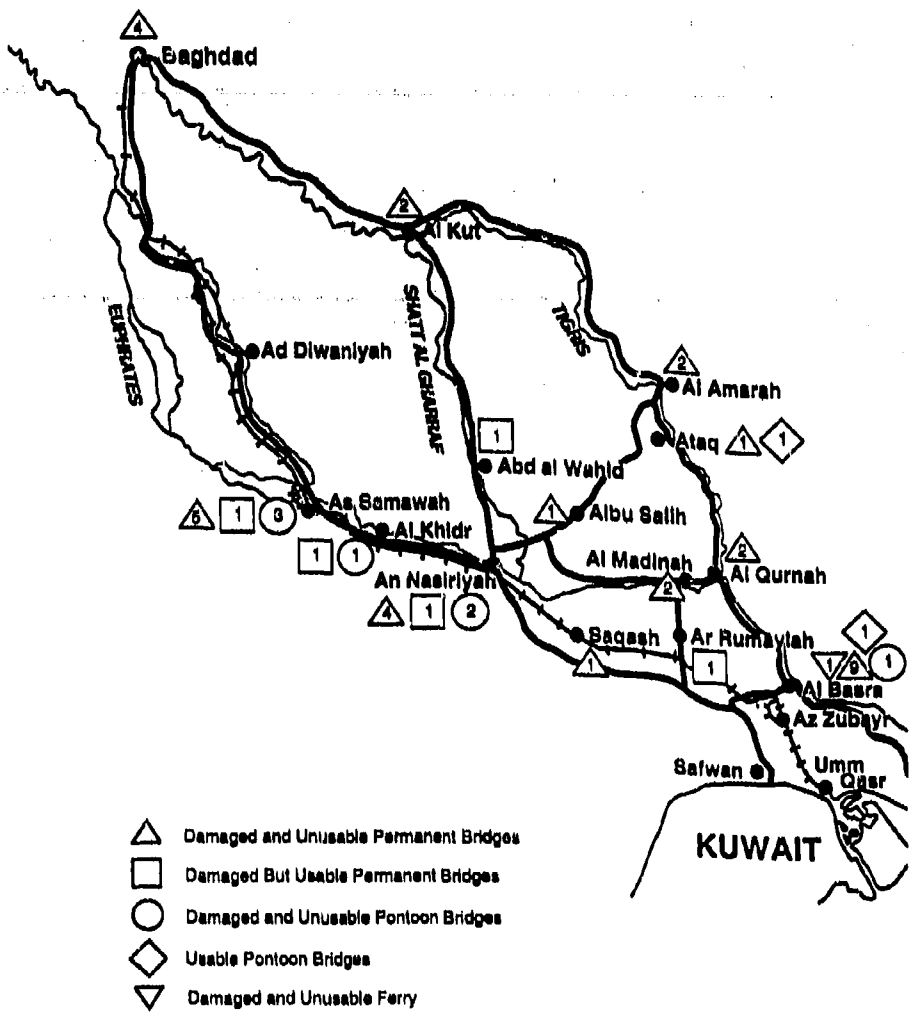
[43] *Final BDA Status Report*, pp 90-91.

[44] Figure 4-9 is based on information derived from *Final BDA Status Report*, pp 90-98; (S/WN) Paper, DIA/DB-8B, list of damaged Iraqi bridges, railway yards, and ferry facilities, 24 Feb 1991, DB-8B Desert Shield/Desert Storm Translog; (S/WN) Large map with overlay, 28 Feb 1991, DIA/DB-8B; Background paper on Iraq's Logistics.

Figure 21
Damaged Bridges in Iraq



Map 4
Status of Bridges on Baghdad-to-KTO Routes,
28 February 1991



to repair major structural damage to bridges were limited, perhaps due to the brevity of the conflict and the threat of further strikes. Resupply traffic moving south took secondary routes to bypass damaged bridges. Rerouting became more difficult as bridge damage spread. While the use of bypass routes increased transit time to the theater, the cost of delays most likely

was minimal, because the Iraqi Army, as a whole, had no *urgent* need for resupplies during the air war.

Temporary bridges, ferry vehicles, and causeways were Iraq's primary counters to Coalition operations against highway bridges. The Iraqi Army had a variety of bridging equipment, including pontoon sections, ribbon bridges (accordion-like pontoons carried on trucks), and self-propelled ferries.[45] Estimates varied as to how much equipment was on hand, although the stocks probably were large.[46] In addition to using wet support bridging, the Iraqis sometimes built a causeway to substitute for a damaged bridge. For example, after F-117-delivered laser-guided bombs closed one of the highway bridges at Al Madinah, a causeway constructed next to the bridge permitted the continued flow of traffic (see photo next page).[47] South of Al Madinah, the Ar Rumayla highway bridge, itself a causeway along an important route circumventing Al Basra, was kept open through the construction of multiple earthen bypasses, despite repeated allied attacks.[48]

Since there were units that deployed to the theater without their assigned river-crossing equipment, the Iraqis had the ability to preposition equipment near key bridges that might be targets of Coalition strikes.[49] (One intelligence report argued the Iraqis had been "forced to divert combat engineer assets to maintain supply and communication lines

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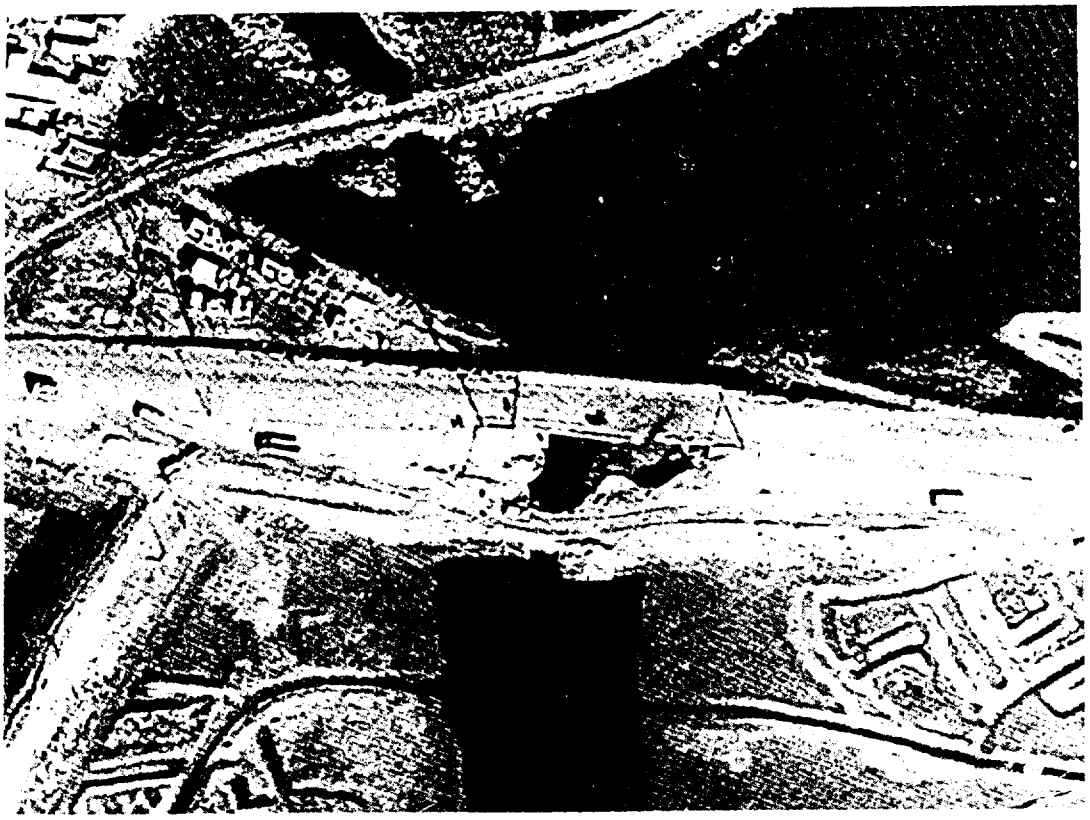
[45](S/WN) Note that these ferries assigned to Iraqi military units should not be confused with the Tannomah highway ferry facility located southeast of Al Basra on the Shatt Al Arab. As indicated in Figure 4-9 [Status of Bridges on Baghdad-to-KTO Routes, 28 Feb 1991], damage inflicted by Coalition air strikes left the Tannomah ferry inoperable.

[46](S/NF/WN) Rpt, *IRAQ: Ability of LOCs to Withstand an Air Interdiction Campaign*, Defense Special Assessment 568-90, 27 Dec 1990, p 2; (S) Memo, DIA/DB-8B to CENTAF/INT, subj: Bridge Repair and Pontoon Bridges, 5 Feb 1991, Tasker #4133, DIA/DB-8B (now DIR-6B) Taskers Files.

[47]GWAPS Missions Database; GWAPS, CIT Folder 588.

[48]GWAPS Missions Database; *Final BDA Status Report*, pp 96-97.

[49](S/NF) *IRAQ: Ability of LOCs to Withstand an Air Interdiction Campaign*, p 2.



28 January 1991, vehicles bypass a bomb-cratered bridge at Al Madinah using a newly constructed causeway.

from Baghdad into the KTO in response to Coalition air strikes.")[50] According to a 20 February intelligence assessment, "large amounts of bridging material" (ferries and ribbon bridges) were hidden. [DELETED][51] [DELETED][52] The skill Iraq exhibited in coping with the destruction of its permanent bridges led Lt. Gen. Charles A. Horner after the war to caution,

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[50](S) CENTAF Desert Storm Intelligence Summary 91-042, 6 Feb 1991 (citing DIA), GWAPS, CC Folder 20.

[51](S/NF) *IRAQ: Sustainment Capabilities for the KTO*, p 2.

[52](S/NF/REL UK, CAN, AUS/WN) Memo, CIA/OIA, to Distribution, subj: The Status of Iraq's Lines of Communication into Kuwait, 7 Feb 1991, GWAPS, CBDA Folder 25; (S/NF) Memo, National Intelligence Officer for Warning, to National Warning Staff, subj: Bridges Along Iraq's LOCs, 19 Feb 1991, GWAPS, CIM Folder 26.

> Anybody that does a campaign against transportation systems [had] better beware! It looks deceivingly easy. It is a tough nut to crack. [The Iraqis] were very ingenious and industrious in repairing them or bypassing them. . . .I have never seen so many pontoon bridges. [When] the canals near Basra [were bombed], they just filled them in with dirt and drove across the dirt.[53]

To defeat Iraqi attempts to maintain river crossings on the main lines of communications, Coalition aircraft restruck permanent bridges that were damaged but passable and also attacked temporary bridges. Beginning in mid-February, strike aircraft conducted "river recce" to keep Iraqi rivers free of usable bridges. F-16s, F-15Es, and F-111s flew armed reconnaissance missions along specified river segments to "destroy all bridges" within each "zone."[54] The Iraqis tried to protect bridging equipment by hiding pontoons and ferry units in wooded areas, submerging sections of pontoon bridges so they appeared damaged, and keeping pontoon bridges parallel to shorelines until needed.[55] Despite these countermeasures, Coalition aircraft succeeded in destroying a total of thirty-one pontoon bridges.[56] [DELETED][57]

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[53](S/NF) Intvw, Perry Jamison, Richard Davis, and Barry Barlow, Air Force History Program, with Lt Gen Charles A. Horner, 4 Mar 1992, Shaw AFB, GWAPS, NA 303, pp 49-50. In these same remarks, Gen Horner also noted the value of laser-guided bombs in taking down enemy bridges.

[54](S) USCINCCENT SITREPs, 15-17 Feb 1991, GWAPS, Container 28, CSS Safe 1; (S) Master Attack Plans, 14-18 Feb 1991, GWAPS, BH, Box 6B, Folders 87 and 88; (S) Brfgs, Desert Storm CSAF Briefs, 14-18 Feb 1991, GWAPS, CHST 101-1, 102-2, 103-1, 104-1, and 105-1; (S) Intvw, Center For Air Force History with Maj Gen Buster C. Glosson, 12 Dec 1991, p 24, GWAPS, Historical Advisor's files.

[55](S) Paper, Combat Plans Officer, 10th TFS, F-16 Operations Desert Shield/Desert Storm, Appendix 15 to Annex C to *The AAFCE TLF Gulf War Conference Report*, 20 Feb 1992; (S) Intvw, Kurt Guthe, GWAPS, with DIA/DB-8B (now DIR-6B), 6 Oct 1992, GWAPS, notes in Guthe's files.

[56]Brfg, XOXW-G, The Desert Storm Strategic Air Campaign: What We Did and Why We Did It, 25 Jun 1991. Note that the 1 Mar 1991 Master Target List included only seven pontoon bridges: As Samawah West over the Euphrates (RR 48), As Samawah East over the Euphrates (RR 49), Awad al Haib over the Euphrates (RR 60), Al Khidr over the Euphrates (RR 59), An Nasiriyah West (bypass) over the Euphrates (RR 47), An Nasiriyah East over the Euphrates (RR 43), and Al Basra over the Shatt al Arab (RR 28). As Map 4 [Status of Bridges on Baghdad-to-KTO Routes, 28 Feb 1991] indicates, all of these bridges were destroyed. (See also DIA/DB-8B, list of damaged Iraqi bridges, railway yards, and ferry facilities, 24 Feb 1991.)

Iraq had no real counters to allied attacks on the bridges for its single-track rail line. The damage resulting from strikes against rail bridges in As Samawah, Saqash, and Al Basra precluded traffic between Baghdad and the Kuwait theater.[58] The Muftal Wadam bridge in As Samawah became unusable after its deck was damaged and its rails were cut. Spans on the Saqash bridge and the Al Basra bridge were damaged or destroyed.[59] None of the bridges were repaired during the war. The Muftal Wadam bridge would have been difficult to bypass. No bypass was available for the Saqash bridge. Elimination of the Al Basra bridge isolated that city from rail traffic.[60] Construction of temporary replacements for these bridges was not an alternative, and as a result, rail service between Baghdad and Al Basra was not restored until several months after the war.[61] (It is interesting to note that while the Iraqis could do little to mitigate the effects of attacks on rail bridges, they did construct "a network of earthen berms on both sides of the main line northwest of the corps-level supply depots west of Az Zubayr most likely as protection against military action [i.e., air strikes]."[62] Coalition air planners, however, never intended to cut the Baghdad-to-Al Basra rail line at any points other than bridges. The threat of air attack apparently prompted the enemy to pursue an unnecessary countermeasure.)

Physical damage to the bridges in Iraq had the military effect of reducing Baghdad's ability to resupply its army in the Kuwait. Highway and railroad route capacities, as measured in metric tons per day (t/d), were greatly diminished as a result of air operations against the bridges. Prior to the air campaign, the major highways from Baghdad to the Kuwait theater together could handle an estimated 200,000 t/d. At the end of Desert Storm, total capacity was one-tenth that amount and dependent on temporary bridges.[63] Figure 22 charts the decline in highway route capaci-

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[57](S/NF) *IRAQ: Sustainment Capabilities for the KTO*, p 2; Wolak intvw, 7 Oct 1992.

[58]*Final BDA Status Report*, p 92; *Desert Storm BDA Imagery Review*, pp 84-85, 92-93, and 100-101.

[59]*Desert Storm BDA Imagery Review*, pp 84-85, 92-93, and 100-101.

[60](S/NF/WN) Memo, DIA to CENTCOM J-2, subj: Interdiction of Selected Targets and Resupply, 26 Aug 1990, Tasker #784, DB-8B (now DIR-6B) Taskers Files.

[61](S) Wolak intvw, 7 Oct 1992.

[62](S/NF/WN) Rpt, DIA, Iraqi Resupply Operations (Update), Nov 1990.

[63]*Final BDA Status Report*, p 93.

ty.[64] After a sharp drop in the last two weeks of January, capacity fell more gradually in February, a change that may have reflected Iraqi use of secondary routes, temporary bridges, and causeways.[65] Temporary bridges in a number of cases kept supply routes open but at lower capacity. (A pontoon bridge able to support 10,000 t/d might have only one-fourth the capacity of the permanent bridge it replaced.)[66] Note that a second sharp drop in the last days of the war coincided with a large increase in the number of strikes against bridges (see Figure 16). Two weeks after the cease-fire, resupply capacity had climbed to an estimated 75,000 t/d through the use of pontoon bridges, causeways, and ferries at Ataq, Al Qurnah, An Nasiriyah, and Al Basra.[67] That relatively rapid recuperation in route capacity suggests the importance of sustained air operations–including "river recce"–in maintaining the cuts in Iraqi supply lines.

Decreases in the capacities of individual routes to the KTO can be seen in Map 5 and 6.[68] Note that the thickness of each highway line (as well as the line for the railroad) is proportional to its relative capacity. Thus, for example, in Map 5, the line for highway Route 6 (76,000 t/d) is twice the thickness of the line for Route 7 (38,000 t/d). By the end of the war, all but Routes 6 and 8 effectively were closed, and even those two highways retained only fractions of their prewar capacities.

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[64]Figure 22 reflects data derived from various Defense Intelligence Agency assessments produced during the Gulf War.

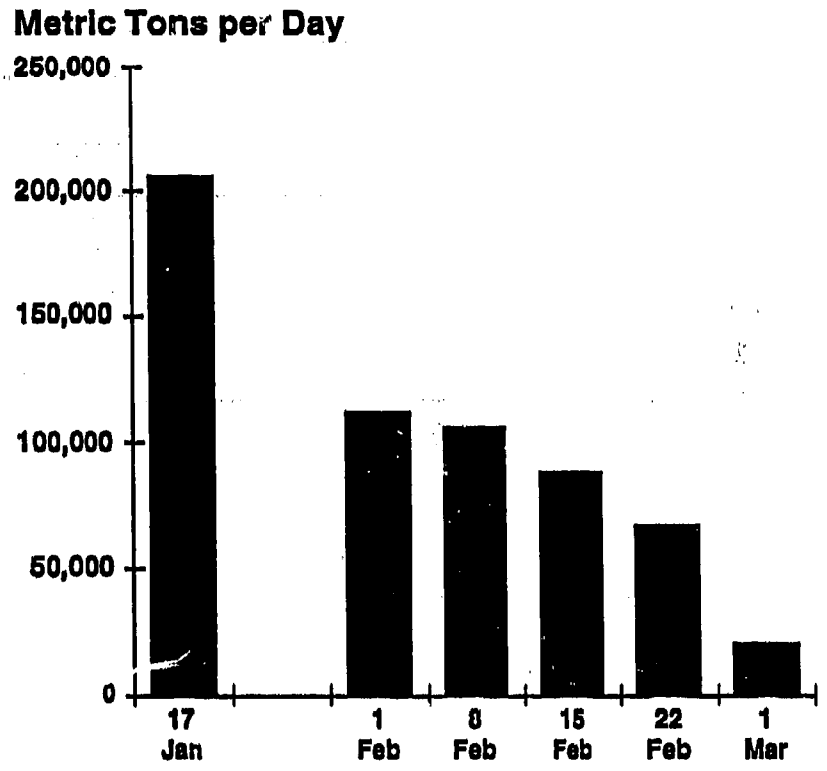
[65]Log Wrapup Brfg for Maj Gen Carr.

[66]Connell Intvw, 6 Oct 1992.

[67]Background paper on Iraq's Logistics.

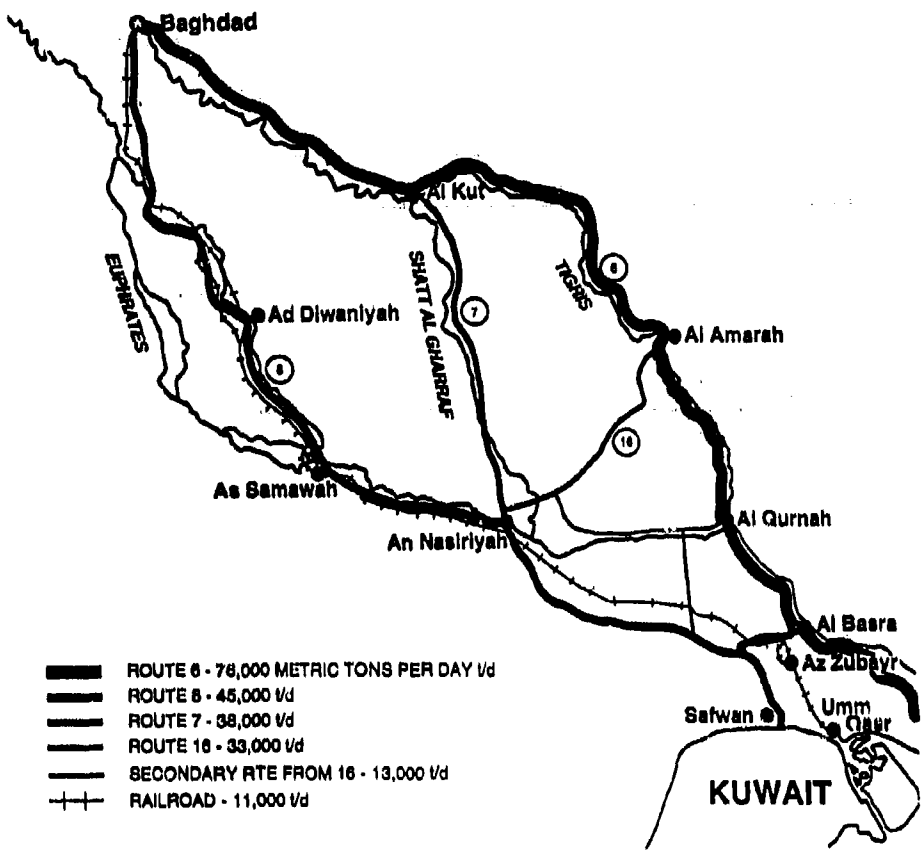
[68]Data for the figures were derived from *Final BDA Status Report*, pp 93-97; Background paper on Iraq's Logistics.

Figure 22
Route Capacity of Baghdad-to-KTO Highways



The capacity of the Baghdad-to-Al Basra rail line was entirely eliminated by the bridge damage described above. (For this reason, no rail line appears in Map 6.) Although the capacity of the line–11,000 t/d–was an order of magnitude smaller than that of the highway system, the loss of the railroad was potentially more significant than these numbers alone

Map 5
Prewar Baghdad-to-KTO Route Capacities



would suggest. Before the air war, it had been the principal means for transporting armor and self-propelled artillery from central Iraq to the theater. After the line was closed, these vehicles could have used the highways, but their movement would have been significantly impaired.[69]

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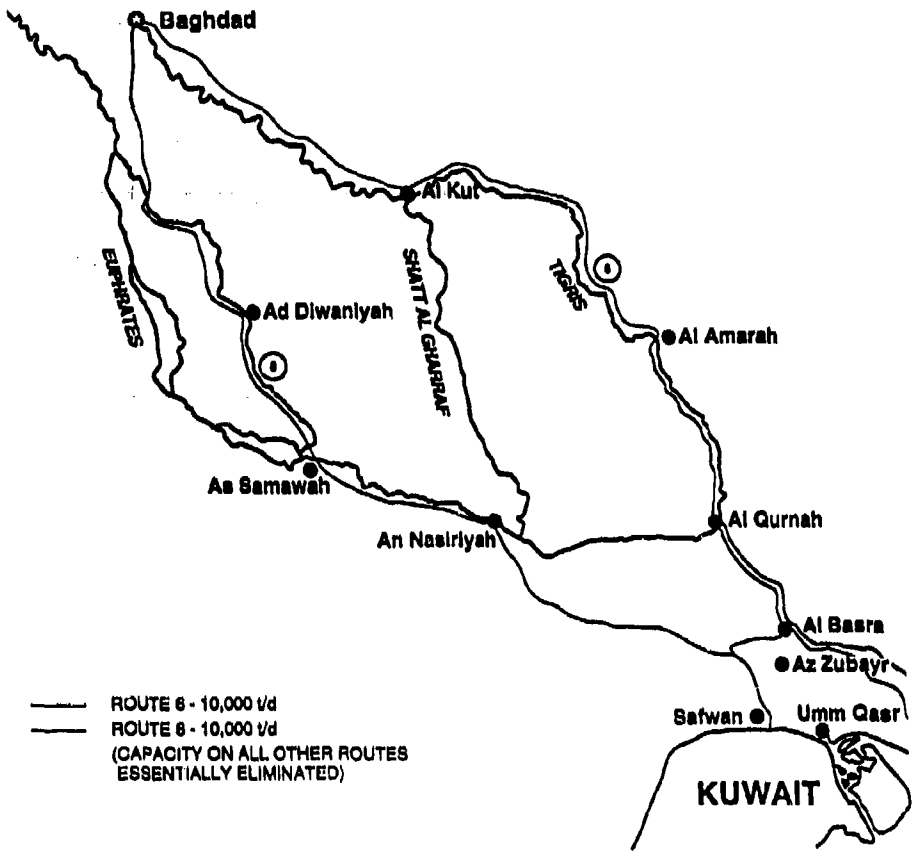
[69](S/NF/REL UK, SA/WN) Rpt, Intelligence and Threat Analysis Center, United States Army Intelligence Agency, *Iraqi Resupply and Sustainability*, ATC-WP-1150-032-91, Nov 1990, p 3, GWAPS, CIM Folder 46; (S/NF/REL UK, CAN, AUS/WN) Memo, Dimon to Distribution, 7 Feb 1991.

Map 6
Baghdad-to-KTO Route Capacities,
28 February 1991



The aggregate *capacity* of the major routes to the Kuwait theater was considerably greater than the actual *supply flow* to the theater. This condition was consistent with the experience of World War II, the Korean War, and the Vietnam War, which showed "[u]ninterdicted transport systems, even where the route network is sparse, are usually characterized by throughput capabilities many times larger than military supply requirements."[70] During the prewar buildup, when total route capacity stood at more than 200,000 t/d, an estimated 20,000 to 40,000 tons of supplies daily

[70]*Air Interdiction: Lessons From Past Campaigns*, p 34.

were moving along the main arteries to Kuwait.[71] Resupply activity utilized only 10 to 20 percent of capacity. In the 3 weeks preceding the start of the Coalition ground offensive, capacity declined from somewhat over 100,000 t/d to around 60,000 t/d. Throughout this same period, the Iraqis, with effort, were able to sustain a supply flow of 10,000 to 15,000 t/d, an amount no more than one-quarter of capacity.[72] At the end of the war, remaining capacity (approximately 20,000 t/d) in theory still could have supported that level of resupply.

Allied air attacks on supply vehicles moving south undoubtedly were a cause of the decrease in supply flow. Convoys backed up at damaged bridges were attacked. During February, various attack aircraft (notably F-16s) flew armed reconnaissance missions along sections of the main highways leading into the Kuwait theater.[73] Besides destroying trucks and their cargo, "road recce" forced the enemy to take steps that hampered resupply. Road recce, and Coalition control of the air in general, placed all military traffic at risk, even if many vehicles escaped attack. Iraqi countermeasures to deal with the air threat had the effect of diminishing the flow of supplies. By the third week in February, resupply movements were largely restricted to the night hours as Iraqi vehicles sought refuge in the darkness.[74] The capability of Coalition aircraft to operate at night, however, undercut the effectiveness of this standard response to air interdiction. In addition, Iraq shifted from multivehicle convoys to single trucks to make its supply transports less detectable and lucrative targets for allied aircraft.[75] Yet this change also reduced the supply tonnage reaching the theater each day.

Despite attrition caused by air attacks on convoys and vehicle parks, the size of the Iraqi truck fleet remained sufficient to resupply the theater.

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[71](S/NF/REL UK, CA, AS/WN) Rpt, DIA, Degradation of the Iraqi Lines of Communication–Baghdad South to the Kuwaiti Theater of Operations, Defense Intelligence Memo 59-91, Feb 1991, GWAPS, CIM Folder 26.

[72]Various Defense Intelligence Agency assessments produced during the Gulf War.

[73](S) Master Attack Plans for Feb, GWAPS, BH, Box 6B, Folders 87, 88, and 89; Desert Storm CSAF Briefs for Feb; F-16 Operations Desert Shield/Desert Storm.

[74](TS/NF/SPECAT) Brfgs, J-2 Daily BDA Assessment for Operation Desert Storm, 19/20-23/24 Feb 1991, GWAPS, NA 353.

[75](S/NF) Rpt, DIA, *Persian Gulf War: Trends and Outlook (19-24 February 1991)*, Defense Intelligence Memo 61-91, Feb 1991, p 3, GWAPS, CBDA Folder 37.

When Desert Storm began, Iraq had approximately 40,000 to 55,000 military cargo trucks, 190,000 commercial vehicles, and another 120,000 Kuwaiti vehicles.[76] According to one prewar assessment, 7,500 light-to-medium trucks in the military fleet alone had a simultaneous lift capacity of 90,000 metric tons.[77] After the Coalition air campaign and ground offensive, Iraq still retained an estimated 30,000 military trucks.[78] An analysis produced shortly before the ground war indicated that Iraq had enough trucks to supply the Iraqi Army in Kuwait in a static defense not involving ground combat.[79] Nevertheless, Coalition air strikes did destroy many of the trucks in the theater and, as discussed later, this contributed to supply shortages among units in the field.

Disruption in the flow of supplies apparently resulted not only from strikes against bridges and convoys but also from damage to the telecommunications system, compounded by bad traffic management. [DELETED][80] To the extent command and control breakdowns did cause resupply problems, this was an unintended though favorable effect of the air campaign, since attacks on communications facilities were designed to prevent Saddam from directing his forces, controlling his subjects, and manipulating world opinion.

Although air interdiction cut both route capacity and supply flow, Baghdad was able nevertheless to sustain its troops while they sat in Kuwait awaiting the Coalition ground offensive (see Figure 23).[81] During

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[76](S/NF) *IRAQ: Ability of LOCs to Withstand an Air Interdiction Campaign* p 2; (S) Intvw, Kurt Guthe, GWAPS, with DIA/DB-8 (now DIR-6), 6 Jan 1993, GWAPS, notes in Guthe's files.

[77](S/NF) Rpt, DIA, *Iraqi Resupply Operations*, Defense Intelligence Memo 149-91, Sep 1990, p 2. This same estimate appears in the intelligence section of the USCINCCENT Desert Storm OPLAN, 16 Dec 1990 (p B-36).

[78]Niland intvw.

[79](S/NF) Paper and brfg charts, Maj Whicker, Maj Draper (HQ USAF Logistics), and Lt Col Harper (JCS/J-4 SMD), Strategic Resupply Between Baghdad and Southern Iraq, 20 Feb 1991 (citing an analysis by the JCS/J-4 Strategic Mobility Division), GWAPS, CHST 11-1.

[80][DELETED]

[81](S/NF) Figure 23 is based on information in background paper on Iraq's Logistics; (S/NF/REL UK, CA, AS/WN) *Degradation of the Iraqi Lines of Communication–Baghdad South to the Kuwaiti Theater of Operations*; Rpt, *IRAQ: Sustainment Capabilities*

the period of the war in which there was no major ground fighting, route capacity and supply flow exceeded the minimum supply requirement. In the days immediately before the ground war, the supply flow to the theater was sufficient to provide an "apparent subsistence level."[82] Had the ground war lasted longer than 100 hours, this level of resupply would have been inadequate to support Iraqi forces in combat–they would have consumed ammunition and oils and lubricants at substantially higher rates. [DELETED][83] Without resupply from outside the Kuwait theater, the Iraqi Army would have been forced to draw down its theater stocks of ammunition, petroleum, oil, and lubricants, as well as food, water, and other critical supplies. The size of those stocks, their availability to units in the field, and the effect of interdiction on both are examined below.

When war broke out, the Iraqi Army had large stores of supplies in the theater. Iraq may have built up in-theater stocks in part to hedge against the vulnerability of its main lines of communications to air attack.[84] By 17 January, depots in Kuwait were estimated to hold over 300,000 metric tons of ammunition.[85] Petroleum, oil, and lubrication storage facilities in southern Iraq and Kuwait had a total capacity of thirty million barrels. Storage capacity for diesel fuel (for which the military had the greatest demand) was 15 to 20 percent of the total.[86] In the theater as a whole, roughly thirty days of food were available.[87] Desalination plants,

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for the KTO; (S) Memo, DIA/DB-8B, subj: Impact of War on Functioning of Iraqi Economy, 22 Feb 1991, Tasker #4724, DB-8B (now DIR-6B) Taskers Files. The breaks in the two bars for supply flow represent the range in the estimates: 20,000 to 40,000 t/d for 17 Jan and 10,000 to 15,000 t/d for 24 Feb. Needless to say, on 28 Feb, the last day of the war, supplies were not moving into the KTO.

[82](S/NF) *IRAQ: Sustainment Capabilities for the KTO*, p 2.

[83](S/NF) *Ibid.* The estimate assumed that 15 of the 42 Iraqi divisions in the KTO would be engaged in "defensive combat."

[84](S/NF) Iraq Regional Task Force, DIA/JS, *IRAQ: Passive Countermeasures to a Coalition Air Campaign*, Defense Special Assessment 572-90, 26 Dec 1990, p 4.

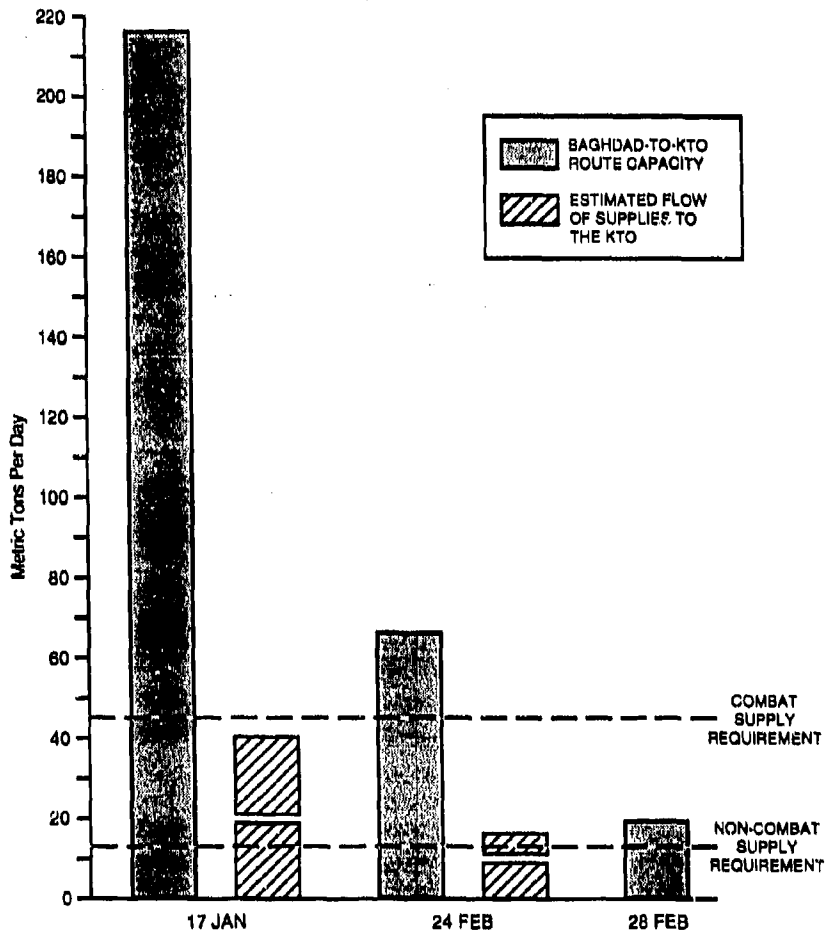
[85](S/NF/WN/NC) Rpt, *The Iraqi Logistical System: Vulnerabilities to Interdiction*, NI IIM 91-10001, Jan 1991, pp 2-3, GWAPS, CIM Folder 51.

[86](S/NF/RMNF) Annotated Brfg, Desert Storm Studies Group, United States Army Intelligence and Threat Analysis Center (Status of the Iraqi Logistics System in the KTO), 2 Feb 1991, GWAPS, CHST 50-3 and CBDA Folder 19; (S/NF/WN/NC) *The Iraqi Logistical System: Vulnerabilities to Interdiction*, p 20.

[87](S/NF/RMNF) *Ibid.*

wells, storage facilities, a pipeline, and tanker trucks provided a supply of potable water that could last for weeks.[88]

Figure 23
Resupply of the KTO vs. Requirements



[88](S/NF/WN/NC) *The Iraqi Logistical System: Vulnerabilities to Interdiction*, pp 4-5.

Aerial bombardment eliminated a relatively small amount of the ammunition stored in the theater.[89] The size of the stockpile, the dispersal of stocks, and the use of protected storage limited the effectiveness of air attacks.[90] [DELETED][91] [DELETED][92]

[89][DELETED] After the 3 March cease-fire meeting at Safwan, Lt Gen Frederick Franks, the VII Corps commander, told Gen Schwarzkopf of the "vast ammunition dumps" found in southern Iraq and said disposal of the captured ammunition might take "weeks." (*It Doesn't Take a Hero*, p 490.)

[90]Although dispersal helped protect ammunition supplies from air attack, in a longer ground war it also might have constrained combat operations by Iraqi forces. The ammunition stocks at the two Ar Rumayla depots accounted for nearly half (150,000 metric tons) of the ammunition stockpiled in the KTO. About 10,000 tons were destroyed by air strikes that damaged more than 125 storage revetments. The bulk was dispersed during the first two weeks of the air campaign, perhaps to locations northwest of Kuwait in Iraq, to points east of Rumayla, and to underground storage in the Wadi Al Batin area. The dispersal of the Rumayla stocks to these sites would, however, have complicated resupply of fighting units, had the ground war lasted more than a few days. [(S/NF/WN/NC) *The Iraqi Logistical System: Vulnerabilities to Interdiction*, p 17; *Final BDA Status Report*, p 101; (S/WN) Msg, DIA/NMIC 070200Z Feb 1991; (S/WN) Msg, DIA, 090200Z Feb 1991, GWAPS, CIM Folder 102; (S/NF/REL UK, CA, AS/WN) *Degradation of the Iraqi Lines of Communication–Baghdad South to the Kuwaiti Theater of Operations*, pp 3 and 4.

[91][DELETED]

[92][DELETED]

The number of days of ammunition on G-Day was equaled or exceeded by the days of supply of other essentials. Despite damage to storage facilities, petroleum, oil, and lubricant supplies in Kuwait remained large enough to support thirty-five to forty days of combat.[93] (The same amount was sufficient for approximately three hundred days of a continued static defense without ground combat.)[94] An estimated fifteen to thirty days' worth of food were available in the theater. The supply of water still could be measured in weeks, rather than days.[95]

From the above figures, it would appear that, allied interdiction operations notwithstanding, the Iraqi Army was adequately provisioned when the ground offensive commenced. Yet enemy prisoners of war in interrogations during and after the war reported their units suffered from supply shortages. Lack of food frequently was mentioned, along with a scarcity of potable water. Shortages of fuel and spare parts occasionally were also noted.[96] These prisoner accounts point to distribution problems *within* the Kuwait theater. Supply problems in the theater may have been due partly to inefficiencies in the Iraqi logistical system. Well before the start of the war, there were units that experienced food and water shortages.[97] Established priorities in the allocation of supplies may also have led the Iraqi command to scant units considered less important. In the Iraqi Army, the Republican Guard had first claim, followed by armored and mechanized units, and then the infantry.[98] Many of the Iraqi prisoners who told of supply shortages came from frontline infantry divisions.[99] These divisions not only had lower priority than the Republican Guard and other armored

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[93](S/NF) *Ibid.* This estimate assumed, again, that 15 divisions would be engaged in defensive combat.

[94](S/NF) *Ibid.* As Lt Gen Thomas Kelly remarked earlier in the war, "when the "Iraqi Army's sitting still . . . they're not burning a lot of fuel." (Transcript, news briefing, The Pentagon, 6 Feb 1991, p 8.)

[95](S/NF) *IRAQ: Sustainment Capabilities for the KTO*, p 2.

[96]Intelligence Information Reports for these interrogations can be found in GWAPS CHST 32-5, NA 286, and the GWAPS computerized database.

[97](S/NF/WN) Rpt, DIA, *Iraqi Capability to Sustain Combat Operations*, 26 Nov 1990, Tasker #2275, DB-8B (now DIR-6B) Taskers Files.

[98]Impact of War on Functioning of Iraqi Economy (Tasker #4724).

[99]For the dispositions of these units, see Map 7 [Deployment of Iraqi Divisions with Kill Boxes Shown].

and mechanized units but were farther from supply centers in southern Iraq, northern Kuwait, and Kuwait City.[100] The Republican Guard and heavy forces in the rest of the army consequently were better supplied.[101]

Even if Coalition air attacks were not the sole cause of distribution problems in the theater, they clearly were an important one. For example, units that had adequate food rations prior to 17 January experienced food shortages after the air campaign began. A battalion of a third-priority unit in the resupply hierarchy–received sufficient if modest rations before the war (soup in the morning, rice and bread at noon, and a "meat-based" meal in the evening). Coalition bombing raids halted all resupply from the brigade level. Lack of food was a key reason the battalion surrendered.[102] Similarly, a brigade of a second-priority unit–had adequate food supplies until air interdiction disrupted resupply, causing a significant reduction in rations (for example, the troops sometimes received bread only once every three or four days).[103] Supply shortages in other units likewise were attributable to the effects of the air campaign.[104]

Unlike the operations against the lines of communications into the Kuwait theater (including the routes below the 31st parallel that linked Al Basra with An Nasiriyah and Al Qurnah), interdiction sorties in Kuwait and surrounding areas in southern Iraq were not aimed at segmenting the transportation net. Kuwait had no railroad. Moreover, the road infrastructure lacked the bridge choke points that characterized the highways and rail line connecting the theater with Baghdad.[105] Nevertheless, in the months leading up to the war, Iraqi engineers constructed new roads parallel to existing routes in Kuwait (including the highway

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[100]Impact of War on Functioning of Iraqi Economy (Tasker #4724).

[101](S) Brfg, Ken Pollack, CIA, to GWAPS staff, Iraqi Perspectives on the Air War, 25 Jun 1992, GWAPS, notes in Guthe's files.

[102][DELETED]

[103][DELETED]

[104]The Gulf War: An Iraqi General Officer's Perspective, p 7.

[105]The Master Target List included three bridges on the main highway from Al Basra to Al Jarrah in Kuwait. Overland bypass of the bridges was possible under dry conditions. They were not struck until late in the war. On 25 Feb, A-6 and F/A-18 strike aircraft hit the bridges to hinder the escape of Iraqi ground forces [Master Target List (RR 37, 38, 39); Interdiction of Selected Targets and Resupply (Tasker #784); GWAPS Missions Database].

between Al Basra and Al Jarrah that served as a major supply artery) "probably to complicate interdiction of these routes in time of hostilities."[106] In addition, other roads in the west that led to Iraq may have been built to provide a secondary avenue to the theater if the main supply lines were blocked.[107] Strikes late in the war against bridges on a bypass to Route 8 (not shown in Map 4) effectively closed this avenue.[108] To the extent Iraqi construction of these roads was a response to the threat of air attack, the effect was unintended and the countermeasure ultimately futile.

Air interdiction of supplies within the Kuwait theater was accomplished primarily through the destruction of trucks deployed with units and attacks on trucks making supply runs. The destruction of trucks was one consequence of the thousands of strikes delivered against Iraqi ground forces by Coalition aircraft of various types. Information from enemy prisoner of war reports suggests that more than half the trucks in the theater were eliminated by allied air attacks.[109] One brigade, for example, lost 60 percent of its vehicles, including seventeen of its twenty-four water and fuel tanker trucks.[110] Trucks may have been more vulnerable to air attack than tanks and armored personnel carriers because the latter were better protected (for example, shielded by revetments) and largely stationary during most of Desert Storm.[111] The loss of cargo trucks made it difficult for units to replenish their supplies of critical items. A captured officer told interrogators he was unable to meet food, water, and even ammunition requirements because of severe attrition of the trucks in his two transport companies. "My division commander kept demanding that I provide supplies," he recounted, "and I told him that out of 80 trucks, I had only 10 left. He told me to do it anyway."[112] Note that the lack of supply trucks at the unit level stood in contrast to the

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[106]*The Continuing Expansion of the Road Network In the Kuwait Theater of Operations*, IA M 90-20050, Nov 1990, p 1, GWAPS, CIM Folder 102.

[107](S/NF/REL UK/WN) *Ibid*, p 3; (S) Rpt, DIA, Directorate for Research, *Kuwait's Highway and Road Infrastructure*, DDB-2010-20-90, Dec 1990.

[108]Connell intvw, 6 Oct 1992.

[109]The Gulf War: An Iraqi General's Perspective, pp 4-5;

[110][DELETED]

[111][DELETED]

[112]The Gulf War: An Iraqi General Officer's Perspective, p 7.

overall sufficiency of the Iraqi inventory of military and civilian transport vehicles. Air operations against military traffic in Kuwait and north of the theater would have hampered any attempts to send replacement vehicles to units short of trucks.

Coalition aircraft (such as F-16s, F-15Es, F/A-18s, A-10s) also attacked supply trucks as they traveled roads in Kuwait. When, for example, supply vehicles were backed up for miles behind a damaged bridge on one of the highways leading to Al Basra, air attacks were launched to wipe out the stalled convoy.[113] Road recce within the theater produced effects similar to those caused by strike aircraft prowling the highways to the north. Under the threat of air attack, trucks began moving at night and in smaller groups.[114] [DELETED][115] The roads in the Kuwait theater were made dangerous by allied control of the air, which, in turn, made Iraqi drivers afraid and, in at least one division, unwilling to make supply runs. "Officers and soldiers who tried to make runs were immediately detected by Coalition aircraft which attacked and destroyed the vehicles. As a result, both officers and soldiers were killed, and [men in the division] refused to go on any further resupply missions."[116] These

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[113](S) Transcript, Gen Norman Schwarzkopf, CENTCOM news briefing, Riyadh, 30 Jan 1991, pp 3-4; (S) USCINCCENT SITREP, 29 Jan 1991, GWAPS, Container 28, CSS Safe 1. This event occurred on 28 January. Four days later, an Air Force historian in the Tactical Air Control Center recorded the following exchange: "LGen Horner tells BGen Glosson to start looking at what happens when we take a bridge or road out–what kind of traffic backs up–Gen Horner says 'we need to start doing that better.'" [(S) Notes: MSgt Theodore J. Turner, CENTAF Tactical Air Control Center, 1 Feb 1991, GWAPS, NA 200.]

[114](S) USCINCCENT SITREP, 28 Jan 1991, GWAPS, Container 28, CSS Safe 1; Transcript, Maj Gen Robert Johnston, CENTCOM news briefing, Riyadh, 4 Feb 1991, p 1; Transcript, Brig Gen Richard Neal, Brfg, CENTCOM, Riyadh, 10 Feb 1991, p 3; (S) 354th TFW FOL/IN MISREP, 21 Feb 1991, Tab B, Desert Shield/Desert Storm Information for Project: "Wayward Warthogs," GWAPS, NA 395.

[115][DELETED]

[116]The threat of air attack induced the same psychological impediment to enemy resupply during the Korean War. Because of U.S. air interdiction operations in that conflict, North Korean commanders were compelled to wage "a constant campaign to sustain the morale of their truck drivers, rewarding some with the honor of 'transportation hero' and punishing 'rightists who [were] fearful of death.' One propaganda leaflet emphasized that 'the loss of one trip due to illness of the driver means that 2,250 men cannot get food for one day.'" [Robert F. Futrell, *The United States Air Force In Korea 1950-1953* (Washington, 1983), p 473.]

effects, in combination, reduced the flow of needed supplies to forces in the field.

Given the above evidence describing the effects of Coalition air attacks against Iraqi supply lines both to and within the theater, what conclusions can be drawn regarding the operational effectiveness of air interdiction in Desert Storm? Strikes against key bridges on the main lines of communications between Baghdad and Al Basra, as well as armed reconnaissance flights along those routes, succeeded in reducing the flow of supplies to the Iraqi Army, even if they did not completely sever those lines and totally isolate the theater. Because of the limited requirements of an essentially inert army, the overall capacity of the supporting transportation net, and the use of countermeasures (temporary bridges and alternate routes), Iraq was able to move sufficient supplies to the theater in the weeks prior to the ground war, despite the air campaign. Whether several more days or weeks of air interdiction operations alone would have eliminated all resupply of the theater is a matter of speculation. The outbreak of large-scale ground combat increased the demand for supplies (especially ammunition, petroleum, oils, and lubricants) to the point where the residual route capacity and daily supply flow would not have been sufficient to sustain the Iraqi Army in a prolonged conflict. Of course, this, too, is a matter of speculation, since the one-hundred-hour ground war ended before such an effect could occur.

At the theater level, the Iraqi Army had sizable quantities of ammunition; petroleum, oil, and lubricants; food, and water when the air campaign began. Allied air attacks did not destroy much of the ammunition and POL stored in the Kuwait theater. The air campaign did, however, disrupt the distribution of supplies, particularly to frontline infantry units. The relentless attacks on enemy equipment–which concentrated on tanks, armored personnel carriers, and artillery–also destroyed a large percentage of the supply trucks used by forces in the field. This reduced their capability to obtain supplies. Coalition control of the air and armed reconnaissance over the roads in the theater made supply runs risky. As a consequence, forces in the southern KTO, notably the infantry divisions, were short of supplies.

Because the Iraqi Army consumed relatively limited amounts of POL and expended little ammunition (other than antiaircraft artillery rounds) during the air war, shortages of food (and occasionally water) were the main result of supply interdiction within the theater. Lowered morale

was probably the most important consequence of the lack of food. (Steady bombardment from the air, harsh field conditions, mistreatment of soldiers by their officers, fear of the military superiority of the Coalition, homesickness, and disagreement with Saddam's war policy also contributed to low morale in the ranks.)[117] The low morale of frontline troops was an important reason for their swift defeat by U.S. and allied ground forces, which, in turn, upset Iraqi plans for countering the Coalition offensive. In short, air interdiction disrupted resupply within the theater, causing food shortages in many units, which helped produce a psychological effect (low morale) that undermined the combat effectiveness of the Iraqi Army.

Attrition of Iraqi Ground Forces

A specific objective of the air campaign was the decrease in combat effectiveness of the Iraqi Army by 50 percent. Central Command Air Forces had designed Phase III of the campaign plan to reduce Iraqi armor and artillery by that planned amount; tables showed the weapons, aircraft, and sortie levels to bring this about. Phase III was not executed as planned, however: Coalition air forces employed a lower sortie rate than planned, used different weapons, and devised different tactics in a much harder-than-planned operation. Not only was the attrition slow in coming, but the actual level of attrition was a highly contested issue, caused by the lack of a reliable method for measuring attrition. By 23 February, most measures showed significant damage to the Iraqi Army, but quite possibly the greatest damage done was even harder to measure. The critical damage was caused by the prolonged bombing of Iraqi positions, resulting in an unwillingness to fight by the less well-trained and capable forces and an inability to defend or maneuver by the most capable forces, even when they did fight. The engaged combat after 23 February is the subject of the next chapter, however. Here the subject is how the attrition took place.

The differences between planning and execution were significant in several respects. First, the planned attrition operations called for up to 1,500 strike sorties a day in order to accomplish the 50 percent attrition in the 6 to 9 days allotted; the wartime average was 500-600 sorties a day,

[117][DELETED]

and only around 200 sorties a day during the first 10 days of the war.[118] Therefore, references to the first three phases of the air campaign starting at the same time are true only to a degree: battlefield preparation sorties started the first night, but the aircraft sorties necessary to bring about attrition on the level planned for were still engaged in Scud targeting, aircraft shelter attacks, and maritime operations for the first 2 weeks of the war. The shift to begin battlefield preparation in earnest was announced by Central Command on 26 January, and the subsequent sortie levels bear out this shift.[119] Good examples are the strike sorties flown into the three key kill boxes--AF7, AE6, and AF6 (see Map 7) --the location of the Republican Guard heavy divisions. The 5-day sortie counts in the late January-early February period into these kill boxes were 666, 565, and 209, respectively, compared to 74, 76, and 3 in the previous 5 days.[120]

Second, the air campaign in the Kuwaiti theater, as executed, attempted to do far more than accomplish equipment attrition. While 50-percent attrition of Iraqi tanks, armored personnel carriers, and artillery was anticipated, those were not the only targets planned for attack in the Kuwaiti theater. The U.S. Army, Marine Corps, and other Coalition ground forces were part of the target nomination process, and these organizations had an entire array of targets for attack, among them, Iraqi Army command posts, supply and ammunition depots, communication sites, and troop concentrations, to name just some of the more prominent

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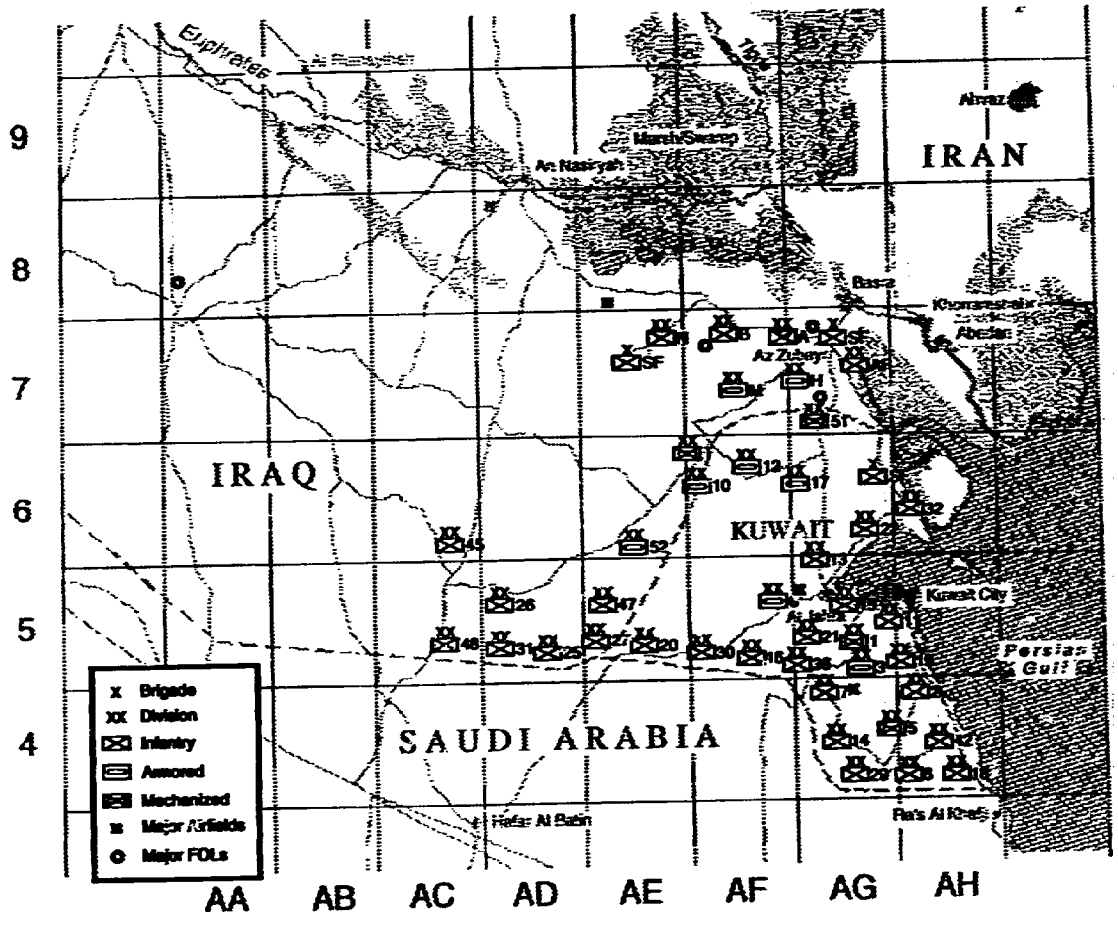
[118](S) Viewgraphs, CENTAF/CC Brief to the SECDEF, 20 Dec 1990, in "General Glosson Briefs," GWAPS, BH 3-60; GWAPS Missions Database. Note: sorties are stated in round numbers to reflect the quality of the database information. Because of differences in reporting and incomplete reports, a small percentage of all sorties that flew cannot be accounted for by category. In other words, if there were a complete accounting of sorties, the numbers of strike sorties (missions) flown into kill boxes would possibly rise, but not by more than 5%.

[119](S) Text of CENTCOM brfg, 26 Jan 1991, GWAPS, CHST 28; Horner comments, 26 Jan 1991, GWAPS, CHP 13B.

[120]The aircraft were nearly all F-16s or B-52s in AFL and A-10s in AE6 and AF6 [(S) GWAPS Missions Database, days 4 through 13 (AFL and AF6) and 7 through 16 (AE6)].



Map 7
Deployment of Iraqi Divisions with Killboxes Shown

ones. In other words, while the attrition calculations seem to have anticipated the air planners having a free hand in focusing the air attacks on Iraqi equipment, such a notion was contrary to the Central Command target nomination system and the role that the corps had in shaping the targeting. It was not a matter of the coalition ground units not seeking the equipment attrition, but they sought that attrition along with the destruction of other elements of the Iraqi Army–all within Phase III and before a ground attack.

A third difference between planning and execution was far more important than numbers of sorties, one that entailed how the targets were to be attacked. The prewar planning computed attrition by relying heavily on the use of air-to-surface missiles–Mavericks–by several types of aircraft (F-16, A-10, and AV-8B) and a variety of special munitions to cause the armor and artillery attrition,[121] In execution, however, the weapons employment was quite different. As Table 12 shows, a significant number of Mavericks were fired, but the A-10s were the only aircraft to employ them to any extent (5,013 of the 5,296 employed). The other major antiarmor munitions counted on, the CBU-89, Gator, was also used to some extent but in nowhere near the scale of the expenditure of general-purpose bombs. General-purpose bombs dropped from medium altitudes were simply not up to the task of destroying targets the size or hardness of armor; the nominal accuracy of the aircraft and bomb systems alone varied from 320 feet for the F-15E to 1,040 feet for the A-10s, even before accounting for sighting error.[122] It was not until these bombs were combined with laser-guidance that armor attrition was accomplished on a sustained basis, and this employment was not planned before the war.

Exacerbating the problems of low sortie rates and inaccurate munitions were the difficulties of executing the medium-altitude bomb

[121]In addition to Mavericks, CBU-89 (Gator) and 30 mm cannons were planned for use against armor; CBU-52 (fragmentation bomb) and Mk-20 (Rockeye) were planned against artillery. (S) Viewgraph, CENTAF/CC Brief to the SECDEF, 20 Dec 1990, "General Glosson Briefs."

[122](S) Viewgraph, from brfg, SAF/AQPF, "Desert Storm Lessons Learned Acquisition," to the Defense Science Board Task Force, 5 Sep 1991, GWAPS, NA 192.

Table 12
Listing of Selected Munitions Employed in Desert Storm*, 17 Jan-28 Feb 1991.[123]

Munitions	Expended			
	Air Force	Navy	Marine Corps	Total
General-Purpose Bombs				
Mk-82 (500 lb)	59,884	10,941	6,828	77,653
Mk-83 (1,000 lb)		10,125	8,893	19,081
Mk-84 (2,000 lb)	10,467	971	751	12,289
Mk-117 (B-52)	43,435			43,435
CBU-52 (fragmentation bomb)	17,831			17,831
CBU-87 (combined effects munition)	10,035			10,035
CBU-89/78 (Gator)	1,105	148	61	1,314
Mk-20 (Rockeye)	5,345	6,814	15,828	27,987
Laser-Guided Bombs				
GBU-12 (laser/Mk-82)	4,086	205	202	4,493
Air-to-Surface Missiles				
**AGM-114 Hellfire (AH-64 and AH-1W)	Army = 2,876	30	159	3,065
AGM-65 All Models (Maverick)	5,255		41	5,296

Notes:

*The selected munitions were those most often employed in the Kuwait theater. Other types of laser-guided bombs and air-to-surface missiles were used in the war, but not, principally, in the Kuwait theater. Totals given are those employed on all targets, however, not just those in the Kuwait theater. See cited tables for a listing and totals of all weapons expended during the war.

**The Navy and Marine Corps also fired a total of 283 BGM-71 TOW munitions from helicopters.

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[123]Table derived from GWAPS *Statistical Compendium*, Tables 201, 202, and 203; also Brfg, HQ DA, ODCOPS, "Aviation Division, Apache in Desert Storm," nd, enclosed in a folder, Army Aviation in Desert Shield/Storm (US Army Aviation Center, FTR, AL: 1992), GWAPS, NA 337. Munitions shown are the principal ones used in the Kuwait theater (some, but not many, of these weapons types were used elsewhere in Iraq). Totals are for the war overall, however, not just those expended in the Kuwaiti theater.

release tactics (often from above 15,000 feet), mentioned earlier,[124] and further compounded by poor weather and the general ineffectiveness of the bomb-damage assessment process. The effect was poor bombing results and a delay in informing the crews and the command structure of what those results were.[125] All in all, Iraqi equipment attrition in the Kuwait theater got off to a bad start.

Figure 24 shows the progress of Iraqi equipment attrition as it was portrayed during the air war. The graphs are taken from one of the briefings that the President and his top advisors received regularly. Charts that were more optimistic were shown and discussed in the theater, but while the numbers varied by the agency making the assessment, the need to increase the attrition rate was seen in both places. The graphs' irregular progression of attrition imposed by the bombing depicts some of the learning that went on in achieving these results. Some of the irregularity can be explained by weather in the target areas, but more often changes in progress were a factor of the tactics employed and the weight of effort dedicated to equipment attrition.

Very poor results were achieved throughout January for the reasons stated. The increased effectiveness evident on the graph at approximately the two-week point was a result of several circumstances, beginning with the increased proficiency of the crews as they gained experience and adjusted to the high-altitude tactics. Another significant occurrence was the destruction of Iraqi equipment achieved during the

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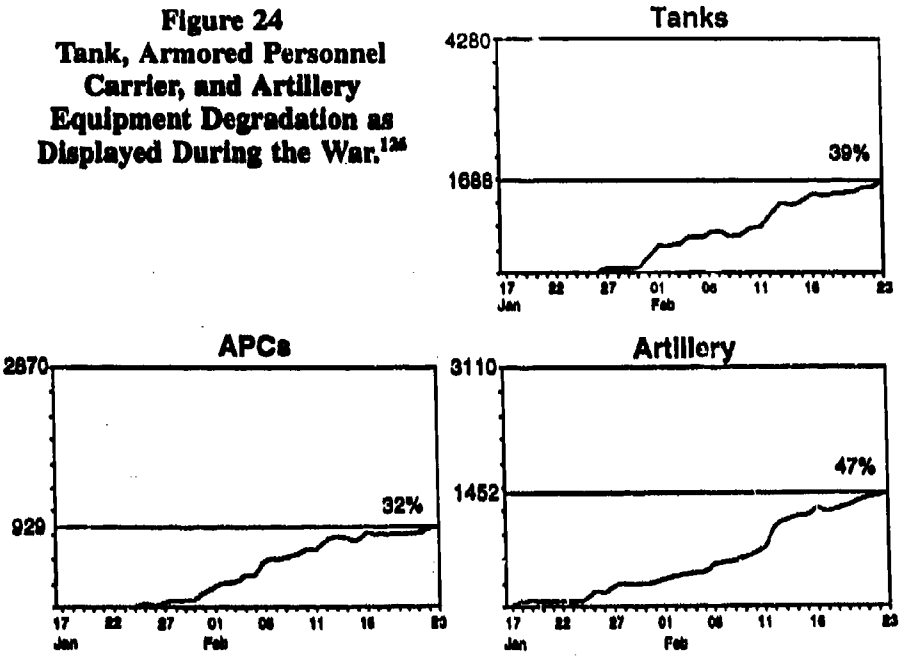
[124]See footnote 7 for a discussion of losses associated with these bombing problems. Actual bombing altitude varied by aircraft and conditions. In general, aircraft flew above 15,000 feet to avoid the antiaircraft artillery threat. Some bombed from level flight at that altitude or above; others released their weapons while dive-bombing below that altitude and recovered back to higher altitudes. Weather conditions, level of darkness, and local area threats all affected the altitudes employed.

[125]The problems with the bomb-damage assessment process are explained elsewhere (GWAPS Command, Control, and Organization report) and will not be repeated here. Crew members involved consistently cite that the best and usually only damage assessment they had was what they themselves observed--usually very little from above 15,000 feet. The B-52 bombing report on the war stated that for the entire war B-52 sorties received information on only 1% of their strikes in the Kuwait theater [(S) SAC/XP, *B-52 Desert Storm Bombing Survey*, 15 Dec 1991, pp 3]. See also the other citations in footnote 7 for the experiences of other aircrews.

Figure 24
Tank, Armored Personnel Carrier, and Artillery Equipment Degradation as Displayed During the War.[126]



Battle of Al Khafji, when the armored vehicles were out of their revetments and moving on roads.[127] The basis of the continued increase in effectiveness were the tactical changes brought into effect.

To increase the lethality of the attacks, some tactical changes were made involved the A-10s, and an even more significant change involving the use of laser-guided bombs. The A-10s, thought to be the most effective aircraft against armor, were directed to decrease their attack altitudes to 4-7,000 feet.[128] The adjustments reflected the commanders' concerns about the problems evident in the graph of attrition up to that point.[129] The important adjustment that led to a far better, sustained attrition rate was the employment of laser-guided bombs against Iraqi

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[126](S) Viewgraph, contained in "J-2 Briefing to the President and JCS," GWAPS, NA 353.

[127]This battle is discussed at length in Chapter 5.

[128](S) 23/354 TFW(P) "Battle Staff Directive No. 26," 31 Jan 1991, GWAPS Microfilm Roll 26554.

[129]It was during this same period that the employment of F-16 killer scouts (Pointers) began, and F-16s were directed to release bombs below 8,000 feet (see Lt Col Lewis point paper, "Corps Air Support at Desert Storm," 3 Jul 1991, GWAPS, CHST 22-15).

armor. Tests were run during the first week of February with the F-111Fs using their infrared sensors at night to detect the hot skin of the tanks (or any other metal equipment) contrasted against the cooler sand that surrounded them. Following these tests, most of the F-111F sorties, half of the F-15E sorties (roughly half were also devoted to anti-Scud operations), and a smaller number of the A-6 sorties were concentrated on "tank plinking."[130] From that point, the number of armor and artillery kills recorded climbed steadily, as the graph indicates. The graphs in Washington and in the theater did not agree, however, for reasons that weapons or release tactics could not fix–the difficulty of confirming bomb-damage assessment.

The several organizations involved each had differing methods of determining estimates. The Army Component, Central Command (ARCENT) began the war by relying on reports from imagery and mission reports by A-10s. When laser-guided bombs were first employed, the aircraft's cockpit video equipment could record the bomb's detonation, and ARCENT used these tapes as confirmation of equipment destruction.[131] To account for uncertainties, however, there was only one-third credit given for an A-10 kill and one-half credit given for a F-111F kill.[132] The Marine Forces, Central Command (MARCENT) employed no formal discounting rules, but their reported attrition figures were consistent with ARCENT reports. By 23 February, for instance, MARCENT was claiming an overall attrition of only 22 percent, while the ARCENT area's figures showed 48 percent.[133] Such a differential was probably realistic, given that fewer precision munitions were employed in the MARCENT area. Meanwhile, the organization responsible for Central Command's official estimate was neither ARCENT nor MARCENT, but the Central Command Joint Intelligence Center. That organization used the ARCENT and

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[130]See Table 12. As the numbers indicate, the use of laser-guided bombs (GBU-12) on Iraqi armor, as well as on all other targets during the war, was mainly (approximately 90%) by US Air Force aircraft.

[131]The video records of these equipment kills were a great improvement over relying only on pilot reports. Of the aircraft used against ground forces, only F-111Fs, F-15Es, and A-6s could provide such evidence, however.

[132]Paper copy, ARCENT viewgraph, Lewis, "Corps Air Support at Desert Storm"; (S) Msg, ARCENT/G2, dtg 170600Z Feb 1991, GWAPS, CHST 50. See also the discussion of laser-guided bombs dropped on Republican Guard armor later in this chapter.

[133](S) "KTO Battle Damage Assessment," as of 23 Feb 1991, GWAPS, CHST 22-37.

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MARCENT inputs to determine the Command's estimate of equipment destroyed, and it was these figures that were displayed by the Joint Staff (Figure 24 on page 209).

While there were some disagreements over estimates among the units in the theater, these were minor compared to the far lower estimates derived by the Washington intelligence agencies. Most disturbing of all, given the objectives of the campaign, the attacks against the Republican Guard were assessed the poorest results. Central Intelligence Agency reporting on 31 January, for example, indicated that up to that date no tanks had been destroyed in the Republican Guard divisions--some ammunition revetments destroyed, several artillery pieces destroyed, a number of trucks damaged.[134] There was, in short, no significant damage relative to the professed importance of the target. The examples in Table 13, below, demonstrate the amount of difference in the estimates that had occurred during the air war. The differences were mainly a result of the various sources available to the organizations. Most Washington agencies used national-level intelligence assets, not pilot reports (DIA also used theater imagery reporting when available). Since almost all Iraqi equipment was emplaced in revetted positions and did not move, and because high-quality assets that could be used to determine the extent of damage were infrequently available, the task was exceedingly difficult. Frequently the available imagery was unable to detect external damage of armored vehicles which had been destroyed.[135] These qualifications, in other words, set the Washington agencies' estimates as the irreducible minimum–what could be clearly seen–of equipment destroyed.

Not surprisingly, the differences in the estimates of equipment attrition were not resolved during the war, and consequently confidence in the numbers produced vanished. General Schwarzkopf refused to have estimated percentages of equipment destroyed displayed in his briefings,

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[134](S) Memo, subj: Bomb Damage to Military Forces and Facilities for 31 Jan 1991, GWAPS, NA 109.

[135](S) DIA, *Final BDA Status Report*, GWAPS CHST 49-1; (S) Bomb Damage to Iraqi Military Forces, GWAPS NA 109.

Table 13
Numbers (percent) of Reported Iraqi Equipment Losses as of 23 Feb 1991: JCS/CIA/DIA[136]

Organization and Report Date	Tanks	Armored Personnel Carriers	Artillery
JCS/CENTCOM	1,688 (39%)	929 (32%)	1,452 (47%)
Central Intell. Agency	524 (12%)	245 (9%)	255 (8%)
Defense Intell. Agency	685 (16%)	373 (13%)	622 (20%)

opting instead for a representation of each division by color-coding, indicating that the division (not the equipment) was 75-100, 50-75, or below 50 percent in effectiveness. The Central Command Joint Intelligence Center prepared the briefing charts, selecting the proper category for each division based on estimates of equipment attrition, desertion rates, and other intangibles, driven by General Schwarzkopf's demand for both objective and subjective evaluations of the target sets.[137] General Horner pointed out that General Schwarzkopf was more inclined to use the *number* of air strikes against a unit as his prime indicator of effective-

[136]Viewgraph contained in (S) "J2 BDA Briefing to the President," GWAPS, NA 353; (S) Memo, subj: Bomb Damage to Iraqi Military Forces and Facilities, 24 Feb 1991, GWAPS, NA 109; (TS) Msg, Maj Gen Richard E. Carr, USAF, Deputy Director for Foreign Intelligence, DIA, *Final BDA Status Report*, 14 Mar 1991, GWAPS, CHST 49-1. The disagreement between the CIA estimates and Central Command's was brought to the White House in February, 1991 (see DOD, *Conduct of the Persian Gulf War*, Final Report to Congress, Appendix C, p 344).

[137]Intvw, author with Brig Gen Charles W. Thomas, Deputy J-2, Joint Staff (during the war the Deputy Director, CENTCOM Joint Intelligence Center), 12 Mar 1992, Pentagon, Wash, DC.

ness, not the damage reported.[138] Using these more general categories, the Central Command charts for 23 February, just prior to the ground offensive, showed almost all of the frontline divisions at below 50 percent effectiveness but most of the rear divisions at above 75 percent.[139]

Who was more correct? How much armor and artillery had been destroyed during the air campaign? After reviewing the data from that time, the next logical step is to compare that information with the facts learned since in order to assess the precision of the wartime estimates. Unfortunately, no such verifying information is available. Much has been learned since the war, but at best the information concerning what occurred is circumstantial evidence, not direct proof. What is possible, however, is to remove some of the uncertainties.

One uncertainty was how much equipment was destroyed or captured in the war by air and ground action. Central Command had estimated the numbers as 3,847 tanks, 1,450 armored personnel carriers, and 2,917 artillery pieces.[140] Here further data are available, because there is photo imagery from 1 March 1991 of the entire theater–something not possible during the war–allowing a definitive count of what equipment survived (that is, made it back to Iraqi controlled areas). A count of the armor still in Iraqi hands on this date subtracted from the amount of equipment counted in the theater on 15 January 1991 (shown in Table 11) gives a rather sound count of how much equipment was destroyed or abandoned (below in Table 14). Comparing these counts with the Central Command estimates gives some significant differences. Central Command, for instance, estimated more tanks and artillery pieces destroyed than the Iraqis were shown as having brought to the theater, and the difference in counts of tanks destroyed was over 1,200. Not shown in the table but of particular note is that these counts show that a disproportionate amount

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[138](S/NF) Intvw, Jamison, et al, with Lt Gen Charles E. Horner, 4 Mar 1992, Shaw AFB, GWAPS, NA 322.

[139]The divisions carried as below 50% effectiveness on the Central Command charts were (see Map 7) all of the frontline divisions from the west to the 7th Division in the east, as well as the 21st and 6th Divisions, just behind the front lines. The following divisions were carried in the 50%-74% category: 8th, 5th, 17th, 47th, 52d, and Tawakalna Divisions (viewgraph, "Operation Desert Storm Battle Damage Assessment," D+38, in Lewis, "Corps Air Support at Desert Storm." A similar depiction is contained in *Conduct of the Persian Gulf War*, p 255.

[140]*Conduct of the Persian Gulf War*, p 294.

of the surviving equipment was from Republican Guard divisions: 39 percent of the tanks and 60 percent of the artillery remaining, compared to the prewar portion of the force that was Republican Guard–27 percent of the tanks and 13 percent of the artillery.[141] One reason for the difference in surviving equipment, particularly the artillery, was the shorter distances the Guard's divisions had to retreat. In most of the theater, the towed artillery simply got left.

Table 14
Operational Iraqi Equipment in Kuwait Theater, dates indicated

Equipment Categories	Tanks	Armored Personnel Carriers	Artillery
As of 15 Jan 91	3,475	3,080	2,475
As of 1 Mar 91	842	1,412	279
Destroyed/ Abandoned (percent)	2,633 (75.8%)	1,668 (54.2%)	2,196 (88.7%)

The pertinent questions that still remain, however, are how much of the equipment destroyed by 1 March was hit by aircraft and, an associated issue, how much was destroyed by 24 February, the beginning of the ground campaign. Nearly all equipment destroyed before 24 February was struck by air; much destroyed afterwards was by a combination of attack helicopters and fixed-wing aircraft (this latter subject is dealt with in the next chapter). Here the information is still far from complete. Two kinds of information provide pieces of the answer, though all sources combined present a picture that is still far from conclusive. Those pieces are the prisoner of war reports that give information on equipment destruction for the individual prisoner's unit and the postwar analyses of what was observed on imagery during the war or by inspection afterwards.

[141] 1 March 1991 equipment totals derived from imagery of the same date. Data provided in (S) brfg, Office of Imagery Analysis, CIA to GWAPS personnel, 25 Jun 1992. [DELETED].

Prisoner of war reports, while fragmentary, present a picture of widespread destruction of equipment in the some areas, particularly the forward divisions, and lesser damage in other areas, though there are almost no reports to give a picture of the Republican Guard areas. There are only reports from seven of the forty-three divisions referencing armor and artillery destroyed by air, and the comments range from around 10 percent (12th Armored Division), to 20 percent (3d Armored and 27th Infantry Divisions), to almost all (52d Armored Division, 25th, 30th, and 48th Divisions).[142] Those claiming less attrition usually said that protective berms made a big difference, since there had been a substantial loss of trucks that were not in berms.[143] It is also clear that those units with the best air defenses–the Republican Guard–were much more difficult targets during the day than the divisions with poor to no defenses–most of the frontline divisions.

Postwar analyses involved use of both photo imagery and battlefield visits. Several battlefield studies of destroyed Iraqi equipment were conducted after the war, though all were far from comprehensive in their access to Iraqi equipment. The largest of the studies, by the Joint Intelligence Survey Team, was able to find only 163 tanks (or 6 percent) of the 2,633 that had been destroyed or abandoned, and it appears that the other teams examined much of the same equipment. These surveys estimated that between 10 and 20 percent of the tanks they examined had been hit by air-delivered munitions.[144] While the surveys are valid for the equipment examined, the results of the survey should be used with caution in determining overall percentages of equipment destroyed, for a reason in addition to the small number of tanks examined. That is, the surveys

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[142][DELETED]

[143][DELETED]

[144]The Joint Intelligence Survey Team conducted its survey in Apr/May 1991. This team examined 145 hits on 85 tanks (78 of the 163 were not hit) and found 28 to have been by air munitions. (S) Memo and attached brfg viewgraphs, Foreign Science and Technology Center, subj: Joint Intelligence Survey Team Report, 14 Jan 1992, GWAPS, NA 167; (S) Marine Corps Research Center, "Armor/Antiarmor Operations in Southwest Asia," Research Paper #92-0002, US Marine Corps, Quantico, VA, Jul 1991; (S) Memo, Lt Col Allan W. Howey, USAF, subj: Tank Kills in the KTO, 26 Feb 1992, GWAPS, NA 167. Note: the Foreign Science and Technology Center has prepared a more extensive report on the information gathered, to be published by the Joint Technical Committee on Munitions Effectiveness, Aberdeen, MD, in 1993.

were restricted to visiting only the eastern part of the theater–the great concentrations of tanks surveyed were around Al Jaber Airfield in Kuwait and the Rumayla Oil Fields in Iraq–leaving unsurveyed the entire front-line positions in the west, up to the approximate positions of the Tawakalna Division.[145] In other words, the surveys validate the statements in the prisoner reports on the areas of less damage (3d and 12th Armored Divisions) but had to omit analysis of the areas prisoners claimed underwent severe equipment damage by air (the other divisions cited above, that were in the western regions).

Another postwar survey used photo imagery of the Republican Guard heavy divisions and sheds more light on the attacks on these vital divisions. The three kill boxes occupied by these divisions (AE6, AF6, and AF7) ranked as the top three in numbers of air strikes, accounting for nearly one third of the total fixed-wing aircraft strike sorties into the entire theater.[146] The survey examined several days'-worth of imagery of the divisions' armor to determine whether it had been immobilized before or after 24 February (during the air or ground campaign). The results are shown in Table 15.

Table 15
Equipment Destroyed or Abondoned in Republican Guard Heavy Division Areas

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[145](S) Joint Intelligence Survey Team Report.

[146]As the theater map indicates, the three Republican Guard heavy divisions were not the only units in these kill boxes. Part, or all, of eight of the twelve Iraqi heavy divisions in the theater were at these locations. GWAPS Missions Database, Table 8, Sorties by Day by Kill Box.

[147][DELETED]

Table 16
Comparison of Imagery and
CENTCOM Estimates, 23/24 Feb 1991

Republican Guard Heavy Divisions (Tawakalna, Madinah, Hammurabi)	Tanks	Armored Personnel Carriers	Totals
Estimated by Central Command as of 23 Feb	388	142	530
Counted by CIA as of 24 Feb (percent of CENTCOM estimate)	166 (43% less)	203 (43% more)	369 (30% less)

Matching the amount of armor destroyed detected by this photo imagery analysis with the amount estimated by Central Command as of 23 February (Table 16) gives the only known direct comparison available of observed and estimated counts of the same equipment at the same time. The table shows some over-counting by Central Command on tanks and some under-counting of armored personnel carriers; overall, the observed counts were about 70 percent of the estimated.

Why these heavy divisions had sustained only 20 to 30 percent armor attrition by 24 February when so many strikes had been flown against them, particularly by aircraft employing laser-guided bombs, can be partially answered by a second study of these same units. This second study examined the divisions' areas for evidence of laser-guided bomb impacts. Of the 239 laser-guided bomb impacts (roughly 5 percent of those dropped) that could be observed, 106 (44 percent) destroyed or severely damaged the vehicle (tanks and armored personnel carriers), and another 40 (17 percent) caused possible damage.[148] This information is

[148]Damage was known to have been done prior to the ground war, since these Republican Guard units moved from their deployment area to engage the Coalition ground forces; the analysis was of the revetments within the deployment area previously occupied by these units. (S) Memo to GWAPS, subj: Effectiveness of Laser-Guided Bombs Against

not surprising: as noted in Chapter 1, with the circular error probable about equal to the distance inside of which laser-guided bombs had to fall to kill a tank in a revetment, a 50 percent success rate was about the best that could be expected.

The lack of further verifying evidence precludes definitive judgements on equipment kills during the air war. Several general conclusions are possible, however. First, and not surprisingly, pilot reports of equipment destroyed, observed at long ranges from the targets, were optimistic. For example, some of the destroyed armored personnel carriers, self-propelled artillery, and trucks were credited as tanks destroyed (more armored personnel carriers were destroyed by air in the Republican Guard area than CENTCOM had claimed), and (as invariably happens) decoys and already-dead vehicles were attacked.[149] Second, although there is little further information to confirm the success rate of Maverick missiles (more than 5,000 expended in the theater), their precision and designed effectiveness against armor targets give credence to the claims for armor kills by these weapons, particularly since each success claimed counted for only one-third of a kill in the ARCENT methodology. Third, attrition of Iraqi armor came from precision-guided munitions (Maverick and laser-guided bombs) and little else; the various nonprecision munitions, with their relatively limited accuracy, may have had success against artillery but not against revetted armor. The battlefield survey teams and pilot debriefings, in fact, observed that the Mk-20 Rockeye submunition, although it had an antiarmor capability, appeared to have a high dud rate because of the release parameters used (medium-altitude releases).[150] The aircraft dropping nonprecision munitions (B-52s, F-16s, F/A-18s, AV-8Bs, and others) also little effect on the counting of reported kills, how-

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Iraqi Republican Guard Armor, 24 Sep 1992, GWAPS, NA 385. See Appendix 2 for the full text of this document and depictions of damage to tanks.

[149]Some, but no extensive, use of tank decoys was reported. (S) "Intel Debriefs," Missions 5007B and 5063B, 30 Jan 1991, 23/354 TFW(P), AFHRA 00885020-23, Microfilm Roll 26552.

[150](S) USAF Tactical Fighter Weapons Center, Tactical Analysis Bulletin 91-2, Jul 91, pp 4-14 and 6-5, GWAPS, NA 216; (S) Lt Col Allan W. Howey, Memo for Record, subj: Tank Kills in the KTO, 26 Feb 1992, GWAPS, NA 167. Evidence included finding Rockeye submunitions lying on the ground all around an undamaged tank. See the GWAPS Weapons, Tactics, and Training report for a further discussion on Rockeye performance.

ever, because ARCENT, at least, did not accept the claims by pilots of these aircraft for computations of attrition.

Finally, it is clear that equipment attrition of the Republican Guard heavy divisions was below the theater average. In general, attrition levels varied among divisions according to a division's location in the theater: attrition was higher for divisions further south; it was also higher for divisions further west in the theater. The highest attrition was in the western frontline divisions; the least in the northeast portion of the theater, including the Hammurabi Division and the 51st Mechanized Division. The trend is evident in the analysis of the Guard's heavy divisions, described above, in which the Tawakalna Division, the closest to the front lines, had significantly higher attrition than the other two, and is borne out in part by the prisoner of war reports. Night attacks employing laser-guided bombs were successful against these deeper units, but Republican Guard equipment was simply a tougher target to attack successfully because of the more effective revetments and superior air defense systems in place. The A-10s might have been able to contribute to a greater attrition in these units, but they did not begin to attack these units in earnest until February, and they were withdrawn from the kill boxes containing Republican Guard units after 15 February because of the surface-to-air missile threat to these aircraft.[151]

The final assessment of how much attrition air power inflicted on Iraqi equipment by 24 February is of necessity only a general estimate. Since a percentage attrition was sought, the estimate must consider not only the number destroyed but the number measured against. Here the larger-than-actual estimates of equipment play a part, because the Iraqi Army had approximately 800 fewer tanks and 600 fewer artillery pieces at the beginning of the air campaign than originally thought–approximately 20 percent fewer. The Central Command estimates, shown earlier, are the best point of departure and are shown in Table 17, with an additional column listing the percentage of destroyed equipment based on actual counts at the beginning of the air campaign. Therefore, Central Command's counts of equipment destroyed by the beginning of the ground war were inflated, but so too was the target base, and the errors are offsetting. In other words, Central Command's *percentages* of equipment destroyed by 23 February

[151]Two A-10s were shot down and one damaged on this date. (S) "Operation Desert Storm A-10 Combat Recap," GWAPS, NA 292.

were in line with later observations, though the *number* of pieces destroyed was inflated. The counts of tanks and artillery pieces destroyed by air are each too high by around 300 pieces of equipment.

Table 17
JCS/CENTCOM Report, Iraqi
Equipment Attrition, a/o 23 Feb 1991

Iraqi Equipment	Number destroyed	Percent destroyed based on estimated total equipment	Percent destroyed based on actual total equipment
Tanks	1,688	39%	48%
Armored Personnel Carriers	929	32%	30%
Artillery	1,452	47%	59%

Whatever the final number of tanks destroyed by air in the war, the continued, postwar focus on tank kills as an important measure of air power's effectiveness is in contrast to the wartime priorities, for artillery, not tanks, were the more important. Artillery was the principal threat to the breaching effort at the beginning of the ground offensive, and Central Command considered these weapons the most likely delivery vehicle for chemical weapons. As a result, armor stood fifth on the ARCENT priority list.[152] In the Marine Corps areas, Lt. Gen. Boomer listened in on aircraft radio transmissions of Marine Corps pilots to ensure they were targeting artillery and not tanks, and he personally briefed the squadrons on the

[152](S) 28th Air Division Desert Shield/Desert Storm Lessons Learned, 7th ACCS Lesson Learned (Ground AOR) 6, "Army Targeting Guidance," GWAPS, NA 354.

reasons for the higher priority for artillery.[153] The senior U.S. ground commanders were convinced of the Coalition's ability to handle Iraqi direct-fire weapons in a war of movement, both by air, since armor on the move was more vulnerable, and by ground, using the superior range and capabilities of the M1A1 tanks. Aircraft proved they had the capability to destroy armor, particularly with the ad hoc measure of employing laser-guided bombs, but if there was a premium on killing tanks, it was not in line with the ground forces' targeting objectives.

While not used as a measure of attrition, Iraqi personnel casualties deserve mention in order to update the size of the Iraqi Army that faced the Coalition ground invasion on 24 February. The only data available for updating the figure given earlier (336,000 Iraqi troops in theater at the beginning of the air campaign) come from the prisoner of war reports. Others have made estimates based on these reports, and this survey agrees with those estimates in all important respects. There are three decrements to consider: soldiers killed, wounded, or deserted. Prisoner reports indicate massive desertions from the frontline units, some across to Saudi Arabia or north to Turkey, many more back to Iraq. Precise numbers of deserters may never be available–the Iraqi high command possibly was not well-informed on this subject, because commanders risked execution if they reported high levels of desertion–but the prisoner interrogations confirm extensive desertion from nearly all the units on the front lines and some of the reserve heavy divisions (including the Republican Guard). Taking account of the higher desertion rates of the frontline divisions, a theater-wide rate of 25 to 30 percent (84,000 to 100,000 deserters) is most likely. Prisoner accounts estimate far lower numbers of troops killed or injured because of the air attacks than the number of desertions: most reports that address the issue indicate that each division lost between 100 and 300 killed, amounting to an estimated 10,000 to 12,000 soldiers killed by the air attacks and perhaps twice that number injured. These decrements leave a remaining Iraqi force at the beginning of the ground offensive of probably not more than 200,000 to 222,000 troops.[154]

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[153](S) Marine Corps Research Center, "Fire Support Coordination During Operation Desert Storm," Research Paper #92-0007 (Part 1), US Marine Corps, Quantico, VA, p 23.

[154]A summary of the interrogations of Iraqi captured general officers estimated that by G-Day there could have been 200,000 Iraqi troops in the Kuwait theater [(S) IIR 6 072 0065 1991]. The House Armed Services Committee report, cited earlier (footnote 20), estimated the following numbers:

Effectiveness of the Iraqi Army by G-Day

If aircraft dropping nonprecision bombs had little effect against Iraqi armor and killed less than 5 percent of the Iraqi troops by the time of the ground attack, what else occurred on the ground as a result of absorbing over 21,000 strike sorties, most of which (see Map 8) were nonprecision strikes? Part of the answer lies in looking at the Iraqi Army's morale, organization, and infrastructure in the theater. Besides the interdiction effort discussed earlier, there was significant but hard-to-quantify damage done to communications, the supply system, and, most critically, the determination of the Iraqi soldiers to fight. The Iraqis did not defect or surrender in droves during the air and ground war because their tanks and artillery were being destroyed (in fact, statements by Iraqi prisoners of war indicate they were grateful for the discrimination of the air forces in aiming at the equipment and not them), but because many were short of food and water and were brought to a sense of futility by the effects of the bombing. The true effects of these attacks, in other words, came from the combination of targets attacked and the intensity with which the attacks took place. That intensity increased during the war, first in the Republican Guard divisions, then in the frontline divisions, with each of 9 principal kill boxes reaching totals of over 100 strikes a day.[155]

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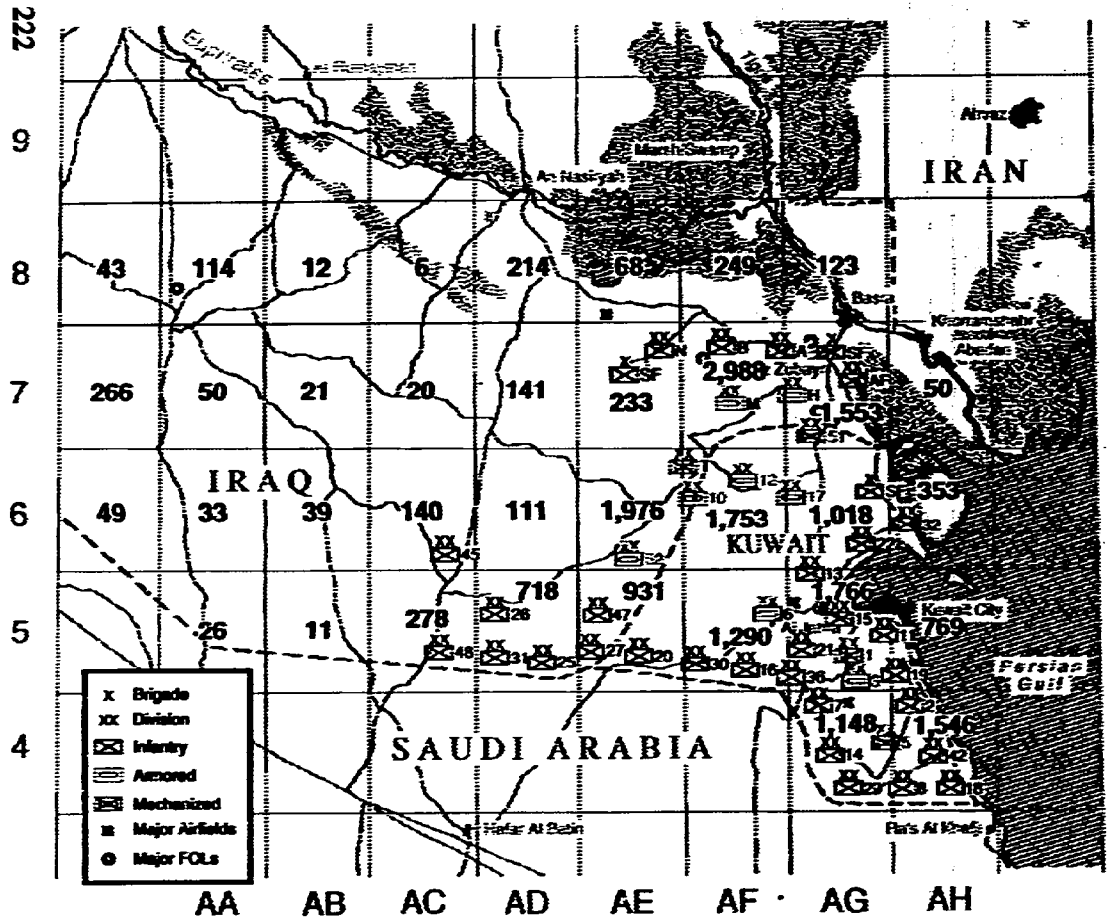
killed	9,000
injured	17,000
deserted	153,000
remaining at the start of ground war	183,000

The differences are that the HASC numbers began with an assumption of more severe undermanning of units than this Survey's estimate, and the HASC estimates on desertions include all desertions from deployment date onward. The Survey estimate shown above (84,000 to 100,000) cites desertions during the air war only. The earlier desertions were included in the 20% estimated as being "on leave" when the war began. As of 19 Feb 1991, there were 2,071 defectors/prisoners of war in Saudi Arabia or Turkey; most had returned to Iraq [(TSU) Defense Special Assessment 172-91, 20 Feb 1991]. Again, all numbers are derived entirely from prisoner of war accounts; no official Iraqi estimates are available.

[155]GWAPS Missions Database, Table 189, GWAPS *Statistical Compendium*.



Map 8
Cumulative Air Strikes by Kill Box, 17 Jan-28 Feb 1991[155] (Total Strikes: 21,391)

[155]Kill box totals are from GWAPS Missions Database and include sortie data for A-10s and AV-8Bs that had reported sorties not by kill box but by grid coordinates. [Approximately 1,200 strike sorties by these aircraft were recorded by grid squares and were not readily convertible to kill box reference. Data from Table 191 (Kill Box Strikes) of the GWAPS *Statistical Compendium* were updated to account for these other strikes.]

Measuring the effectiveness of damage done to unit morale, adequacy of communications, and supply systems proved even more difficult than counting equipment losses. Noted earlier was the Central Command system of depicting Iraqi units as above 75 percent, between 50 and 75 percent, and below 50 percent effectiveness, and Central Command's judgement that the frontline divisions were less than 50 percent effective by the start of the ground offensive. On the same day, however, the briefing provided to the President painted a much more dismal picture. The briefing, while acknowledging that the frontline divisions had suffered more than 50 percent *equipment* degradation (the Central Command chart was displayed), still could not confirm that any of the groups of divisions were degraded even by 25 percent in *overall capability;* the ground forces' command and control was portrayed as largely intact.[156]

A good example of the difficulties in measuring effectiveness of the air strikes came from the attacks on Iraqi theater communications, a target that received continuous attention throughout the war but seemingly had achieved little in measurable damage. While parallel efforts were going on within Iraq to isolate the Iraqi Army from communications with Baghdad, in-theater efforts aimed at preventing the Iraqi strategy from working by preventing divisions and corps from communicating with one another. Cutting off this communication was intended to prevent the theater and strategic reserves from reacting promptly to the Coalition ground attack, but it was not an easy target to destroy, and it was difficult to estimate the effectiveness of Coalition efforts to destroy it because of Iraqi countermoves–actions that included a penalty for the Iraqis.

Prisoner of war reports described Iraqi measures to preserve their equipment: the use of messengers, prohibitions on the use of radios after the start of the air attacks, even death sentences for those who used two-way radios or telephones.[157] As a substitute, however, the Iraqis laid extensive wire, buried throughout the theater, in order to preserve emergency communications. Wire was strung between units–sometimes as

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[156]The charts displayed the divisions by groups: Republican Guard (RG) heavy divisions, RG infantry divisions, other heavy divisions, and other infantry divisions. (TS) Viewgraphs, "BDA-Tactical Forces, Ground Forces"; and "Forces, BDA Assessment," 23/24 Feb 1991, in J2 BDA Briefing to President and JCS, OWAPS, NA 353.

[157][DELETED]

much as fifty kilometers apart. Bombing at times cut the wire, but reports indicate that these lines were often repaired within a day.[158] As a result, the objective, to prevent the Iraqis from being warned of the ground offensive, was not achieved, and the *measurable* effects of those attacks were minimal. One officer, for instance, said he received the order to reposition to face the attack from the west over a field telephone.[159] And, there are multiple sources affirming that communications with Baghdad were continuously available.

Effective communication required much more than the ability to warn another unit of attack, however; it also meant the ability of the warned unit to take some sort of coordinated action. Here, the system collapsed. Reports show that once the units tried to move, wire strung between units no longer sufficed, and the lack of communications became debilitating–units either tried to talk, unsuccessfully, on radios susceptible to jamming or simply did not attempt to communicate with one another.[160] Reports after the battle at Al Khafji give examples of Iraqi units lost in the desert or having their communications jammed when attempting to coordinate actions.[161] Beyond the use of radios for tactical communications, the loss of communications for administrative matters, as explained earlier, also had severe effects.

The air attacks against the supplies of the Iraqi Army were a combination of the interdiction effort and direct attacks on the stockpiles themselves. The results here, as in other cases, were mixed. Prisoner of war reports from frontline forces show a general pattern of units low on food and water and lacking in resupply capability. At the same time, there are other reports of (at least the officers) having plentiful supplies of water and hot meals. Prisoners captured at Al Khafji were described as being in wretched health and malnourished but wearing new uniforms and boots; in the Republican Guard areas, U.S. VII Corps soldiers found

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[158][DELETED]

[159][DELETED]

[160]US signals intelligence personnel depicted the Iraqi Army as having committed "Emcon (emissions control) Suicide."

[161][DELETED]

trailers of quality foods, such as canned mackerel and crackers.[162] Many prisoner reports indicate that most of their trucks broke down for want of spare parts or were destroyed by air attacks, or that drivers refused to travel the roads in the theater. The pattern that emerges from the evidence is not of a starving army but of an organization in which the distribution system has ceased to function: illogical distribution and goods absent, being hoarded, or lying unused. The policy of the Iraqi Army to not use radios or telephones, combined with a beleaguered transportation system, would, of course, accentuate this condition.

In the end, the most devastating effect of the Coalition bombing appears to have been on the morale of the deployed troops, as difficult to measure and define as that is. The pervasive impression left by the interrogation reports of prisoners was the sense of futility felt by the Iraqis after weeks of extensive bombing.[163] When the bombing started, their ground transportation began to crumble. Many, particularly the frontline forces, ran short of water, food, fuel, and all spare parts. Some units had their supply stocks destroyed. Training in the units ceased. Soldiers moved apart from their equipment because they well understood what the targets were. Many captured Iraqis stated they thought the air campaign would last several days to a week at most. When it did not end, the sense of futility and inevitability of the outcome became more apparent.

Even though the numbers of dead and injured were rather low given the extent of the bombing, the fear was always present, both day and night. [DELETED][164] Three-ship B-52 strikes occurred every three hours, day and night, throughout the war. During the course of the air war, many Iraqi soldiers, particularly those in the front lines, decided not to fight. Many deserted, others remained in place, but the effect on the capability of the Iraqi units was the same. The deserters from the frontline divisions told their interrogators that most of those remaining in their units would surrender at the first opportunity, without any resistance. And this is what happened.

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[162](S) Battlefield Reconstruction Center, Asst Chief of Staff, G2, Hq, VII (U.S.) Corps, "Battlefield Reconstruction from Enemy Perspective (24-28 Feb 1991," p 47;

[163]The following paragraphs draw on multiple prisoner of war reports. See footnote 8, this chapter, for the location of these reports.

[164][DELETED]

The ground offensive was over quickly, but there may well have been units qualified to fight and willing to resist. Few of those units were in the front lines, however. When the soldiers and officers in these units decided not to resist, any opportunity for an organized defense in the theater collapsed. The Iraqi strategy called for the operational and strategic reserves to move to resist the points of the Coalition ground attack, but not only were these forces fooled by the direction of the attack but by how fast it was upon them. They were themselves under attack before they had a chance to maneuver or present an organized defense.

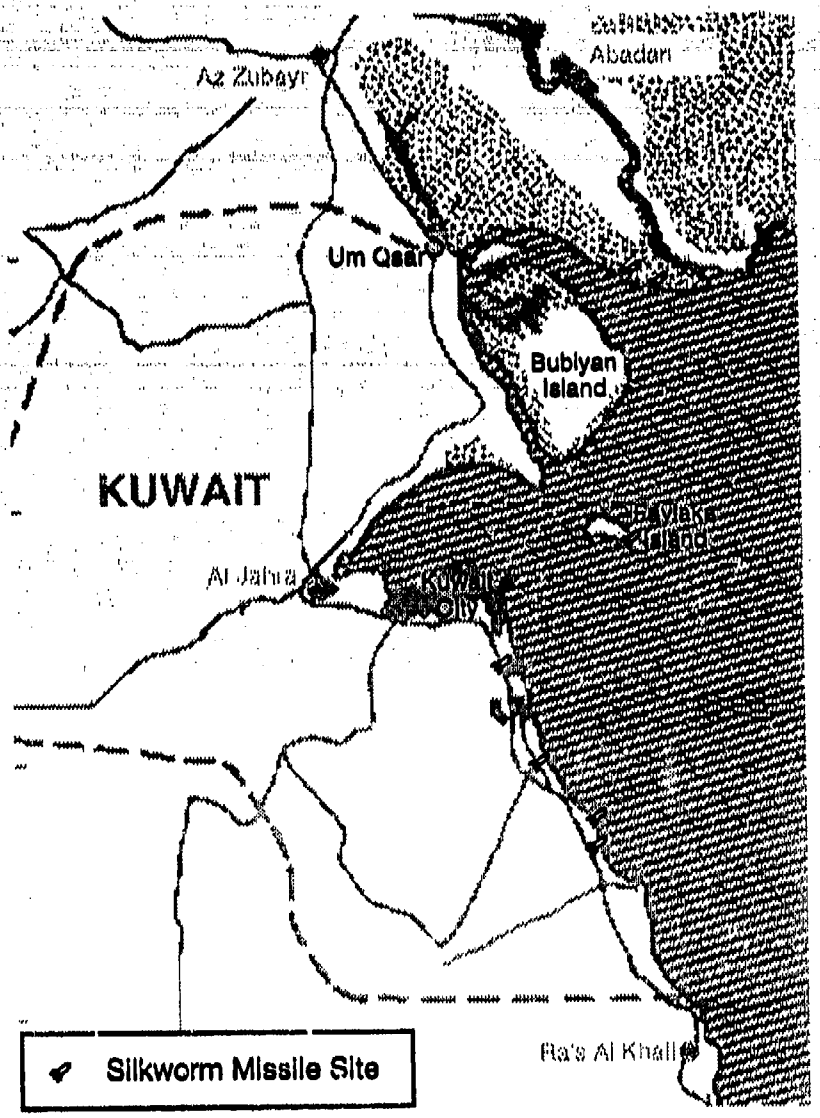
Attacking the Iraqi Naval and Coastal Defense Forces

Coalition aircraft attacked Iraqi naval targets in order to secure freedom of action in the northern Persian Gulf. While the Iraqi Navy was small, even the presence of small missile-firing boats posed a threat to the Coalition battle groups and amphibious forces. Carriers and battleships carried firepower to support the ground attack, and the amphibious forces had to be in position to carry out the strategic deception plan and be ready for landings, if necessary. The targets included Iraqi ports and facilities at Al Basra, Az Zubayr, and Um Qasr, numerous operating locations in Kuwait, on islands and oil terminals; Silkworm missile sites along the coast (see Map 9); and a fleet consisting of patrol boats, missile-firing boats, and mine-laying boats. There were a total of 178 vessels, with the 13 missile boats posing the greatest threat.[165]

United States Navy aircraft prosecuted the attacks against the Iraqi Navy assisted by Royal Navy attack helicopters and other Coalition aircraft. The aircraft carriers involved were the *Midway*, *Theodore Roosevelt*, and *Ranger*, with the *America* joining on 15 February. Strike aircraft attacked naval targets while under the direction of either one of the two controlling operators: the Joint Force Air Component Commander (sorties directed under the daily air tasking order and called theater strike) or the Navy's antisurface warfare commander (sorties for fleet protection

[165]These vessels and facilities were not the only threat to the naval forces. Aircraft with air-to-surface missiles could launch from Iraqi (and possibly Iranian) bases and pose a longer range threat to the fleet. Information drawn from two Center for Naval Analyses reports: (S) Peter P. Perla, *Desert Storm Reconstruction Report, Volume I: Summary*, and (S) Jeffrey Lutz, et al, *Desert Storm Reconstruction Report, Volume VI: Antisurface Warfare* (Alexandria, VA: 1991).

Map 9
Fixed-site Iraqi Naval Targets



(S) Jeffrey Lutz, et al, *Desert Storm Reconstruction Report, Volume VI: Antisurface Warfare* (Alexandria, VA: 1991).

and called maritime strike–these sorties did not appear in the air tasking order). The division was not a rigid one, and, based on the situation, sorties assigned by the air tasking order to a kill box target in the Kuwait theater were at times diverted to attack ships in the Gulf, and antisurface warfare sorties would often strike land targets (Silkworm sites, for instance) that threatened the fleet.[166] The question of the control of sorties is an important one in another context, but for purposes of analyzing results of the strikes, all strike sorties are regarded equally regardless of origin.

Attacks against naval targets were the most intense for the first 2 weeks of the war. During this period (through 2 February), 46 percent of the Gulf carrier strike sorties (474 of 1,021) were devoted to maritime strikes, not counting the theater strike sorties that were also hitting naval targets.[167] Air strikes heavily damaged the port facilities, and later analysis showed that all the missile boats were damaged or destroyed by 2 February.[168] The bulk of the Iraqi missile boat destruction took place between 29 January and 2 February, essentially in two engagements: when Iraqi boats attempted to reposition along the Kuwait coast on 29 January and, a day later, at what became known as the Battle of Bubiyan, when a large Iraqi naval force attempted to flee from the ports of Az Zubayr and Um Qasr to Iranian ports, in a planned escape similar to the flights of Iraqi aircraft to Iran that took place several days prior.[169]

Just as in the case of targets on land, the lack of adequate bomb-damage information prevented a timely assessment of the damage that had resulted to the Iraqi boats. Later analysis showed that all of the missile boats had been damaged or destroyed by 2 February, except for one that escaped to Iran, but not until 17 February could the Navy's antisurface warfare commander declare the threat defeated.[170] Even after the threat was defeated, however, many maritime strikes took place on the

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[166](S) Lutz, *Reconstruction Report*, p 5-1; Center for Naval Analyses Database, strikes by naval aircraft.

[167]S-3 strike sorties are not included. (S) Frank Schwamb, et al, *Desert Storm Reconstruction Report, Volume II: Strike Warfare*, pp D-1 to D-32.

[168](S) Msg, Commander JIF-East to CENTCOM J-2, subj: Battle Damage to Um Qasr, dtg 021855z Feb 1991; (S) Lutz, *Reconstruction Report*, p 6-1.

[169]Intelligence reports indicated that the order to the naval units had come from the Iraqi Naval Headquarters in Al Basra.

[170](S) Perla, *Reconstruction Report*, p 78.

numerous patrol boats that remained, on Faylakah Island, Bubiyan Island and at coastal artillery positions and Silkworm missile sites. Maritime strikes, in fact, increased in the period after 17 February from the level it had been before.[171] As a result of all engagements, 143 boats were damaged or destroyed, including 12 of the 13 missile boats. On the eve of the ground attack, however, estimates judged only 2 of the 7 known Silkworm sites (5 of which were in Kuwait) as destroyed.[172]

The attacks against the Silkworm sites contained many of the same frustrations that were found during the war in the attacks on Scud sites. That is, seven Silkworm sites were identified before the war, but repeated strikes on them did not remove the threat. There were forty-five strikes in all, beginning at the end of January; 80 percent of the strikes were after 7 February, and half of those were during the ground offensive. Just as in the Scud attacks, there was suspicion that the fixed sites were decoys because an increasing number of strikes took place not on one of the identified sites but on suspected sites in adjacent areas.[173] There were only two recorded launches of Silkworms, from a site south of Kuwait City on 25 February, fired probably just prior to the site being overrun: one of the missiles apparently crashed in the sea immediately, and the other was shot down by a missile fired from HMS *Gloucester*.[174] Just as in anti-Scud operations, one cannot judge whether the attacks suppressed launches. The Iraqis may have retained the missiles for use only to repel an amphibious landing, or they may have lacked sufficient targeting data to attack Coalition ships.

In part because of the defeat of the Iraqi Navy, the aircraft carriers moved farther north in the Gulf during the air campaign. From a position in the Gulf roughly east of Bahrain and 285 nautical miles (NM) from Kuwait City, the carriers moved 40 NM miles northwest on 4 February and another 65 NM miles northwest on 14 February, and for the

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[171]Many missions were raids on Faylakah Island in support of a raid on that island that was later cancelled. (S) Schwamb, *Reconstruction Report*, p D-2; (S) Lutz, *Reconstruction Report*, pp 5-2 to 5-8.

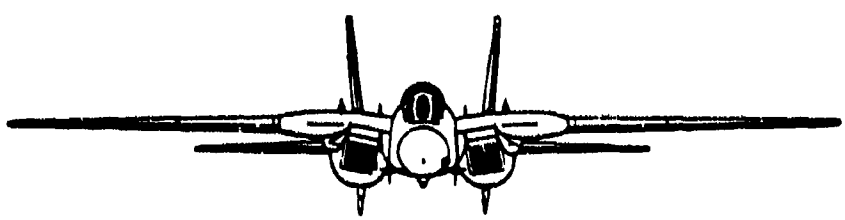
[172](S) Lutz, *Reconstruction Report*, p 4-1; (TS) Viewgraph, "BDA, Tactical Systems, Naval Forces," J2 Briefing to the President and JCS.

[173](S) Lutz, *Reconstruction Report*, pp 5-6 to 5-8.

[174](S) Robert W. Ward, et al, *Desert Storm Reconstruction Report, Volume VIII: C3/Space and Electronic Warfare* (Alexandria, VA: Center for Naval Analyses, 1992), pp 4-6 to 4-10.

remainder of the war launched strikes from an area 185 NM miles from Kuwait City. This closer position allowed the carrier strikes to take place with little need for in-flight refueling except by the carriers' own organic tanking aircraft.[175]

The air attacks on surface vessels brought the same lessons as other ground target attacks concerning the use of precision munitions. The most effective weapon was the Sea Skua missile fired from British Lynx helicopters, and laser guided bombs were particularly effective at hitting small boats, whether moving or stationary. Whereas the battlefield studies after the war commented on the ineffectiveness of Mk-20 Rockeye submunitions, the studies on boat attacks showed Rockeye to be less effective than laser-guided bombs but considerably superior to unguided bombs.[176] And, finally, the referenced Center for Naval Analyses report noted that more laser-guided bombs might have been used if they had been available but that these bombs were reserved for employment against Iraqi tanks.[177] The Navy may have intended such a prioritization, but the low level of employment of these bombs in the Kuwait theater by Navy aircraft does not bear this out. The retention of precision munitions and other special ordnance by the Coalition air forces was more likely in anticipation of the ground offensive and the consequent need for precision in supporting the engaged ground forces.



[175](S) Schwamb, *Reconstruction Report*, pp 1-41 to 1-47.

[176](S) Lutz, *Reconstruction Report*, pp 4-3 to 4-5.

[177](S) *Ibid*, p 6-2.

5

Attacking Moving or Engaged Iraqi Ground Forces

Air power in support of engaged ground forces during Desert Storm took place only during the one-hundred-hour ground war and briefly during the Iraqi incursion into the Saudi town of Al Khafji. Not only was the time involved brief, but conditions under which the engagements took place–against thoroughly demoralized Iraqi troops, many in full flight or surrendering even before being engaged–make any generalizations based on these circumstances questionable. Moreover, the speed of the ground action made a precise accounting of specific actions that took place very difficult. After the war, although some reconstructions of battlefield engagements occurred, no theater-wide analysis was undertaken. Under these conditions, an investigation of air power's role is important, even though judgements about its effectiveness must be very tentative, simply to explain as nearly as possible what happened.

That the subject of air power's use with engaged ground forces can claim only minor attention is itself a major distinguishing feature of this war, a war in which air power was so dominant in every other way. The experience contrasts with all previous U.S. expectations of major conventional conflicts, in which doctrine and operations planning focused on a Soviet invasion in Europe or southwest Asia or an invasion from the north in Korea. Air power employment in those scenarios supported an outnumbered ground force fighting initially on the defensive. It was within this framework of employment that CENTCOM deployed in August 1990; command and control procedures, bombing tactics, and force structures of the Services prepared for air attacks on an invading force. Thus, when the ground war began on 24 February after over a month of attacks on dug-in ground forces, there was a mixture of both the familiar and the unfamiliar in what took place.

Before proceeding, some definitions of the attack missions to be examined are in order. Those two missions are close air support and interdiction. "Close air support" denotes employment of air attacks in direct assistance and in close proximity of ground forces. "Close," of

course, is a relative term; the definition specifies when the missions ". . . require detailed integration of each air mission with the fire and movement of those (friendly ground) forces."[1] That boundary in the Gulf War was defined by reference to a fire support coordination line. This line, a geographic line on the map, encompassed the area in which the ground commander controlled direct and indirect fire, including the air delivery of munitions. Within this line, all air attack sorties were designated by the area's ground commander and were controlled by a ground or airborne forward air controller. Interdiction sorties, with interdiction defined as "An action to divert, disrupt, delay or destroy the enemy's surface potential before it can be used effectively against friendly forces,"[2] indicated those air attacks beyond the fire support coordination line. Such sorties covered the application of air strikes in numerous circumstances: attacking supply lines into the theater, attacking the heavy divisions as they attempted to maneuver, and attacking the Iraqi forces as they attempted to *retreat from* the theater. The distinction between interdiction and close air support is emphasized because this chapter contrasts the close air support sorties with interdiction sorties as a way of illustrating air power's employment. Central Command set the fire support coordination line coincident with the Saudi Arabian border until just prior to the ground offensive, so many issues relevant to the coordination line did not arise until the ground war began.[3]

Of the many differences between air attacks on moving and engaged ground forces and those attacks that occurred prior to 24 February, three are worth special comment here as well as later treatment in this chapter. The first difference was the increased attention needed for air-ground communication in order to attack near the lines of the Coalition forces–the close air support mission. This attention is necessary in every war, but in this war there was the added caution set forth in procedures

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[1] *Department of Defense Dictionary of Military and Associated Terms*, 1 December 1989, p 70.

[2] *Ibid*, p 187.

[3] Some movement of the fire support coordination line occurred in the Marine Corps area, particularly during the action at Al Khafji; there were only a small number of such sorties, and except for Al Khafji these numbers are not significant. Definitions of close air support and interdiction are a complex subject, part of a larger discussion of roles and responsibilities for air support (and the control of those sorties) that while important does not bear on the issues considered here.

similar to those applied to air-to-air engagements and the restrictions on bombing altitudes. In air-to-air engagements, the preference was to let an enemy airplane escape rather than shoot down another Coalition airplane; in air-to-ground attacks, the rule was–if there was *any* doubt whether a ground target was the enemy, don't shoot. Even under these conditions, there were several incidents of fratricide.[4]

A second difference involved the significantly greater vulnerability of Iraqi forces when they were on the move, day or night, compared to when those forces were dug-in and surrounded by air defenses. The Joint Surveillance Target Attack Radar System (JSTARS) aircraft could identify the path of attacking or retreating columns of Iraqi equipment, and the precision weapons on the attack aircraft could hit a moving or stationary target. Moreover, vehicles out of revetments and on the move were susceptible to more weapons, such as aircraft cannon fire and air-delivered mines. Not surprisingly, then, the success of attacks on moving columns of armor was substantially greater than those attacks on similar forces protected by berm, camouflage, and other defensive and deceptive measures. The increased protection gained by these measures was not only significant but possibly underrated.

Finally, there was a difference in the rules for carrying out attacks on the Iraqi ground forces once the ground offensive began. Altitude restrictions were eliminated for the attacking aircraft, and crews were instructed to press the attacks in every way possible, since now the Coalition ground forces could be at risk–but caution was still urged. Lt. Gen. Charles A. Horner's guidance at the time set forth the new rules:

> The weather considerations that were valid last week are no longer valid. There are people's lives depending on our ability to help them if help is required. So I want a push put on. I want people feeling compulsion to hit a target. I do not want fratricide. So if in doubt don't shoot.[5]

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[4]The common term is "friendly fire."

[5](S) Comments from log of 24 Feb 1991, Headquarters, CENTAF Office of History, *Daily Comments of Lt General Charles A. Horner, 17 January through 28 February 1991.* GWAPS, CHP 13B.

Air attacks in support of the ground offensive took place between 24 February and the ceasefire at 0800 on 28 February. During this period, close air support missions assisted the rapid advance of Coalition ground forces, while at the same time large numbers of interdiction missions struck at the reserve Iraqi formations, some moving to defend, others moving to flee the area. In addition to the actions during the ground offensive, the other period that deserves attention involves the actions during the Iraqi incursion at Al Khafji, 29 January to 2 February. Here, too, numerous close air support and interdiction sorties took place against moving Iraqi forces. The analysis of close air support and interdiction considers these two cases.

Al Khafji

What became known as the Battle of Al Khafji originated with the probable Iraqi intention of drawing the Coalition ground forces into a major ground engagement, through which Iraq could turn the war more to its advantage. The battle came at a time, two weeks into the air war, when Iraq had endured attacks both to the strategic targets throughout the country and to its ground and naval forces in the Kuwait theater. While Iraq had expected an initial period of air attacks, those attacks were both longer and more severe than anticipated, and a Coalition ground attack still appeared no closer to getting underway. Saddam Hussein had boasted before the war of the Iraqi advantage in a ground war, in which mounting casualties would split the Coalition and turn the American public against the war. Because Iraqi forces were growing weaker, through both attrition from air attacks and desertions, Saddam ordered a ground attack to induce the Coalition into a ground war, heighten the morale of his own forces by taking the offensive, and to take prisoners as a source of intelligence in order to better determine the Coalition's intentions.[6]

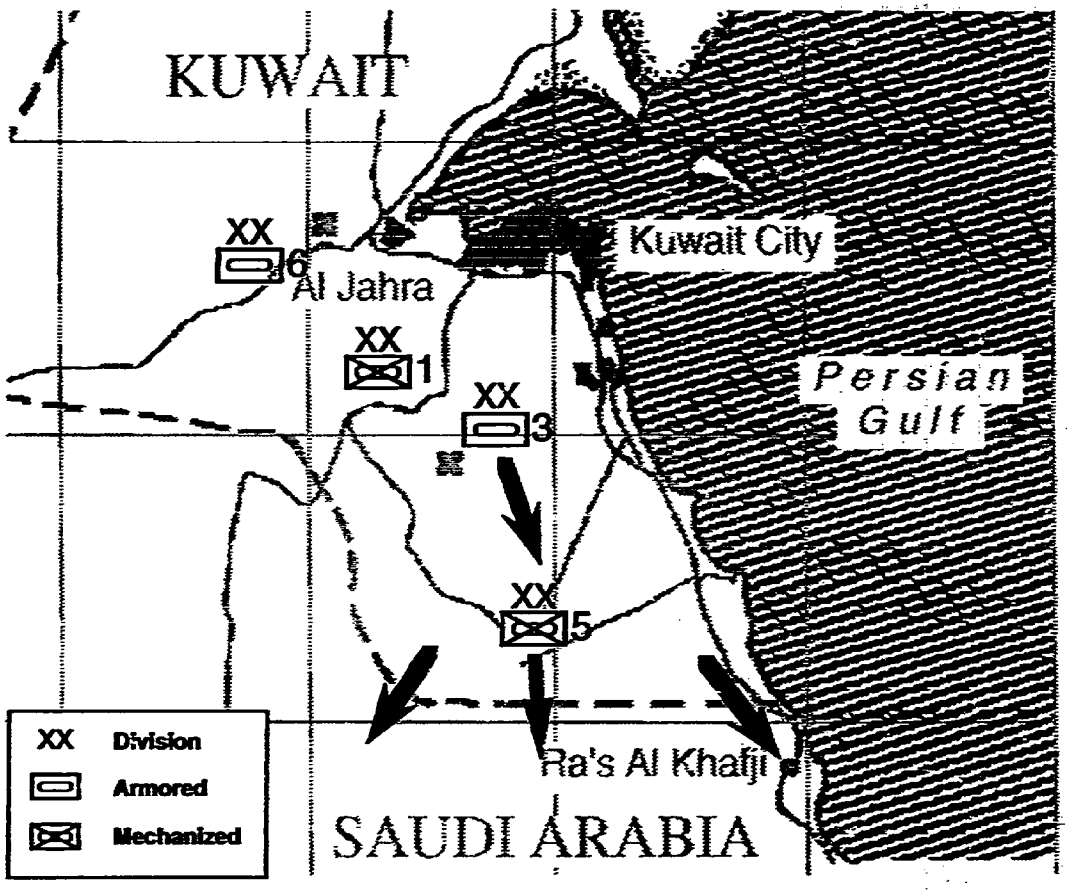
[6]While nothing can be said for certain about what Saddam Hussein's intentions were, this short synopsis follows the widely accepted interpretations of this action by CENTCOM and Washington intelligence organizations during and after the war. Enemy prisoner of war reports are able to provide positive confirmation of this interpretation of events, and no reports dispute it. While the intentions of the Iraqi leadership must remain as speculation, the actions both anticipated and taken by the Iraqi ground forces can be verified.

The ground attack was centered on the actions of the two heavy divisions in the Iraqi III Corps holding southeast Kuwait, the 5th Mechanized Division and the 3d Armored Division. The engagement began with three battalion-sized probes south toward Saudi Arabia by elements of the 5th Division, augmented by other units along the front lines (Map 10); the 3d Division was to follow and reinforce the attack or replace the 5th Division in the attack. Other Iraqi units may have been ordered to support the attack or take actions elsewhere, but the actions of at least the 5th and 3d Divisions can be documented most clearly.[7]

The Iraqi plan must be pieced together by using intelligence estimates and prisoner of war reports because little of this plan was allowed to unfold. Coalition ground forces, along with fixed-wing and rotary-wing aircraft, stopped or turned back two of the three probes and assisted in operations over the next several days to dislodge and drive back the third probe, which had reached Al Khafji. At the same time, reinforcing Iraqi units were turned back both at the border and, in the case of the 3d Armored Division, within Kuwait, as this division attempted to move south. The action was essentially over by 2 February, with air power having played an important part in both close air support and interdiction.

The ground action to stop the several battalion-sized Iraqi attacks generated the first true close air support sorties of the war. The combination of Marine attack helicopters (AH-1W Super Cobras), AV-8B Harriers, A-10s, AC-130 gunships, and F/A-18s, along with a number of ground-fired weapons, concentrated on the Iraqi forces. Few aggregate data are available, but accounts of the individual engagements detail total estimates of up to fifty armored and wheeled vehicles destroyed by

[7]Officers taken prisoner during the battle or after the war from the 5th and 3d Divisions and other units detailed the part each unit was to play. See (S) Intelligence Information Reports. While the officers knew of the battle plan, however, many of the lower ranking soldiers captured were not even aware that they were going into battle.



Map 10
Attacks of the Iraqi III Corps, 29-31 Jan 1991.

Only heavy divisions in the area are displayed.

a combination of air and ground attacks.[8] From these engagements, there also emerged several incidents of fratricide: thirteen Marines and four Saudi soldiers were killed in three incidents, two of which were during air-to-ground attacks. The worst of these occurred when a Maverick missile fired from an A-10, at night, struck a Marine armored vehicle (seven killed and two wounded). The cause was a missile malfunction (the Maverick pitched down and struck the ground behind the aircraft).[9]

Though the recorded close air support sorties were few, there were large numbers of sorties either planned or diverted into the area of southern Kuwait (the area from the Saudi border to just south of Kuwait City) for the next two to three days. While the number of Coalition sorties overall saw little change, the sorties striking killboxes AG4, AG5, and AH4 (Map 10) increased dramatically. For the approximately three days of action relating to Al Khafji, a total of more than one thousand attack sorties of all types, including attack helicopters, were involved in strikes in these three killboxes.[10] The total numbers of sorties for Marine OV-10s (Marine forward air control aircraft) and AV-8Bs nearly doubled their daily average during the time period, achieving levels they would not again reach until the beginning of the ground offensive. On 30

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[8](S) CENTAF Tactical Air Control Center Current Operations Log (hereafter referred to as TACC Log), entries for 29 and 30 January, GWAPS Microfilm Roll 10263. Included in the Log are requests from Gen Khalid himself on the morning of 30 January and again on the evening of 31 January, seeking air strikes close to Al Khafji. Theater reports at the time unaccountably indicate very few close air support sorties being flown during the period (29 January to 2 February). CENTCOM situation reports list a total of only eighteen such sorties–all by Marine aircraft; CENTAF reporting only lists four–and those by Marine aircraft. The numbers were certainly higher, however, since the A-10 wing chronology discusses close air support missions flown in support of ground forces at Al Khafji [(S) Combat Chronology, 23/354 TFW(P), 17 Jan-28 Feb 1991, entry for 30 Jan, AFHRA 00885046-51]. (S) CENTAF Reports, 28 Jan-3 Feb 1991, GWAPS, CHST 72; (S) USCINCCENT SITREPs, 28 Jan-3 Feb 1991, GWAPS, CSS 29 and 30.

[9]Office of Assistant Secretary of Defense (Public Affairs), *News Release No. 504-91*, 13 Aug 1991.

[10](S) GWAPS Missions Database; (S) John D. Parsons, Benjamin T. Regala, and Orman H. Paananen, *Marine Corps Reconstruction Report, Vol IV: Third Marine Aircraft Wing Operations* (Alexandria, VA: Center for Naval Analyses, 1992), pp 18-24, 110.

January, A-10s flew more sorties (293) than they would again on any single day, including during the ground offensive.[11]

Though their daily number of sorties did not change appreciably, many other types of Coalition aircraft took part, on both day and night strikes.[12] Two of these aircraft types, the B-52 and the JSTARS aircraft, were the subject of considerable discussion. Up until that time, the B-52 had been devoted to attacking either strategic targets or the heavy divisions of the Republican Guard. When action began on the border, there were Marine requests for the diversion of B-52 sorties from their scheduled targets to attack the armor formations along the border. After some discussion, the Tactical Air Control Center (TACC) decided not to allow this diversion. The decision was made for two reasons: the low level of effectiveness of the B-52's bombs anticipated against armor formations and a fear of Coalition casualties on the ground because of their proximity to the target. Instead, a B-52 flight was diverted to a target farther to the northwest–a road intersection being used for assembly by Iraqi forces. On this target, the TACC discussion centered not on whether the strike would destroy the vehicles but on the psychological effect of the attack on the formations.[13]

The JSTARS aircraft had been flying nightly since the beginning of the air war, but in the activity surrounding the events at Al Khafji, the aircraft took on added significance. While JSTARS could detect, track, and pass targeting information on vehicle movement throughout the theater, its surveillance of a virtually in-place ground force did not fully use these capabilities. During Al Khafji, that changed. From 29 through 31 January, Iraqi ground movements were a subject of much conjecture. There was a movement of Iraqi forces south in eastern Kuwait, and CENTCOM anticipated that the move was a feint for a larger maneuver to the west,

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[11](S) Entry for 30 Jan 1991, Combat Chronology 23/354 TFW(P); (S) *Marine Corps Reconstruction Report, Vol IV*, pp 20, 26.

[12]There was also an increase in aircraft losses. Early on the morning of 31 January, an AC-130 was shot down while attacking targets over southern Kuwait, with the loss of the entire crew of 14–a loss that by itself accounted for a majority of the USAF combat fatalities during the war.

[13](S) TACC Log, entries on the evening of 30/31 Jan 1991, GWAPS Microfilm Roll 10263.

at the tri-border area, perhaps by the Republican Guard Divisions.[14] This suspicion was supported by pilot reports that the Tawakalna Division had moved from its previous position (and was unlocated) and that the Madinah Division was observed moving south.[15] In this situation, the JSTARS information took on tremendous value, both to evaluate the amount and nature of movement throughout the theater and to track the specific movements of Iraqi forces in southeast Kuwait. The Tactical Air Control Center notes of a conversation between two general officers (one Air Force, one Marine) on 31 January indicate that these two officers had originally thought of JSTARS as a "toy" being tried out in the war, but they now saw how vital that capability could be; a call to the Tactical Air Control Center two days later by Lt. Gen. Walter E. Boomer, the First Marine Expeditionary Force Commander, again praised the JSTARS' performance in this action.[16]

The results achieved by JSTARS and the strike aircraft marked a sharp upturn in Iraqi equipment attrition. While success against Iraqi equipment had until that time been rather meager, the results achieved during the period were, as shown in Table 18, a dramatic turnaround. Notice that approximately two-thirds of the equipment attrition took place outside of the Republican Guard units. The jump in attrition estimates in so short a time was not matched again until the concentrated attacks with precision-guided bombs against Iraqi armor ("tank plinking") began in February.[17]

While a number of prisoner of war reports mention the effects, the most telling one was the comment of a member of the 5th Mechanized Division, a veteran of the Iran-Iraq War, who remarked that his

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[14](S) TACC Log, intelligence brfg on 28 and 29 Jan 1991, and a notation of a telephone call from the CENTCOM J-3, Maj Gen Moore, warning that the Al Khafji attack may have been a feint. GWAPS, Microfilm Roll 10263.

[15](S) CENTAF Historian Notes of TACC Operations, 29-31 Jan 1991, GWAPS, NA 200.

[16](S) TACC Log, entries of 31 Jan and 2 Feb 1991, GWAPS Microfilm Roll 10263.

[17](S) Tactical Air Command Message, dtg 292300Z Jan 1991, and (S) USCINCCENT Intelligence Summary No. 177, 3 Feb 1991, GWAPS, CHST 24. As the bomb-damage assessment difficulties brought out in the previous chapter make clear, these attrition estimates were inflated. Nevertheless, it is the *change*, not the absolute numbers, that is most significant. Moreover, if there was inflation at this time it was more likely to have occurred in the Republican Guard estimates.

Table 18
Iraqi Equipment Destroyed

	As of 29 January	As of 3 February
Tanks	80 (0)	554 (177)
Armored Personnel Carriers	86 (3)	314 (81)
Artillery	308 (5)	425 (28)

Totals include Republican Guard Divisions. The specific numbers for Republican Guard Divisions are given in parenthesis. Source: CENTCOM J-2 Reports.

brigade underwent more damage in thirty minutes than it had in eight years in the previous war.[18]

After its experience at Al Khafji, the Iraqi Army attempted no other attacks. They constructed more berms, dug deeper, dispersed supplies, changed to the use of smaller convoys in the Kuwait theater, moved headquarters locations frequently, and increased the use of decoys in many areas.[19] The Iraqi 5th Division, perhaps the hardest hit, was effectively eliminated; one prisoner report mentioned that the division was withdrawn to Al Basra.[20] Most importantly, the division was not to be a serious factor during the Marine advance in the ground offensive. Perhaps the theater-wide impact of the Al Khafji experience was the effect it had on the Iraqi Army commanders. Their forces dug in to survive, but they had realized that counterattack or withdrawal "was impossible under the gun of the furious Coalition attacks." Iraqi plans for major operations of any sort in the Kuwait theater were discarded as a result of this experience.[21] If the jump in numbers was dramatic, it was no less so for the Iraqi forces that had to undergo these attacks.

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[18]POW Report.

[19](S) USCINCCENT/J2 Message, Collateral Intelligence Report No. 180, 6 Feb 1991, GWAPS, CHST 42.

[20]POW report.

[21]*Ibid.*

Curiously, while an important event for the Iraqi ground forces, Al Khafji made only a slight impression on the Coalition estimates. This was so perhaps for several reasons. First, CENTCOM, for most of the period of the movement of the Iraqi III Corps, was bent on viewing the move as a feint in preparation for a larger attack to the west. Second, at the time, CENTCOM and the Tactical Air Control Center ranked the Scud suppression operations and the attacks on the Republican Guard as the leading priorities and were reluctant to see that focus altered; numerous discussions in the Tactical Air Control Center referred to the need to adhere to the CINC's guidance (focus on the Republican Guard).[22] And third, since most of the damage to the Iraqi units was done not on the front lines but miles back within Kuwait, there was no doubt a lack of awareness of the extent of damage done to the Iraqi units. That damage was more than would have been expected since many Iraqi units were caught on the move. In fact, it was not clear at the time that multiple units were moving. The press briefings at the Pentagon on 1 February and at CENTCOM Headquarters on 2 February say little about Al Khafji; statements by Lt. Gen. Thomas Kelly, the Joint Staff J-3, and Admiral McConnell downplayed both the size of the Iraqi forces engaged and the importance of the action.[23] What was viewed by the Iraqis as a severe lesson in their vulnerability to air power was summarized by CENTCOM as:

> The limited attack of the 5th Mechanized Division which was expected to occur on the evening of 31 January did not materialize. Heavy Coalition air strikes on 5th Mechanized units in attack position caused the Iraqi III Corps to discontinue offensive actions.[24]

The engagement at Al Khafji was not designed as a limited attack, however–it only became that as a result of the impact of air strikes on the Iraqi forces attempting to move. Al Khafji was a major effort to begin the ground war, the only such attempt Iraq made, and the importance of

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[22](S) TACC Log, entries for 29 Jan to 1 Feb, 1991, GWAPS Microfilm Roll 10263. Obviously there had been an appeal to Gen Schwarzkopf, for there is an entry in the CENTAF Historian Notes of TACC Operations from 1 Feb: "CINC said we could start hitting the first echelon vice Republican Guard." GWAPS, NA 200.

[23]Text of briefings and answers to questions, 1 Feb 1991, Pentagon, Washington, DC, and 2 Feb 1991, CENTCOM Headquarters, GWAPS, CHST 28.

[24](S) USCINCCENT SITREP, dtg 012115Z Feb 1991, GWAPS, CCS 29.

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its failure is undeniable. Iraq's only hope was to force an early start to a ground war of attrition before it was itself exhausted. That Iraq's only option was abandoned and not attempted again demonstrated the severity of the loss it suffered. At Al Khafji, air power had gained an important victory not fully appreciated at the time.

The Ground Offensive

While air power employed during the incursion at Al Khafji involved an unexpected action in the midst of competing priorities, the ground offensive of 24 to 28 February presented a different scenario. The date for the offensive was planned, sorties apportioned, and the procedures practiced beforehand, and all air action was geared to supporting the ground offensive. Central Command dedicated an extensive number of aircraft sorties with highest priority given to close air support and to interdiction throughout the Kuwait theater.

Fixed-wing aircraft scheduled for close air support took place in what was called a "push CAS" system: flights of aircraft arrived at locations along the avenue of attack on a continuous basis, sometimes as frequently as every seven minutes. In other words, without waiting for a ground commander to request air support, the sorties were "pushed" to him. If no one needed these aircraft at the time, they would orbit for a short period of time, then proceed on to hit planned back-up interdiction targets–to be replaced in orbit by succeeding flights. On some days, more than six hundred aircraft sorties a day participated in this system, primarily U.S. Air Force A-10s and F-16s and U.S. Marine AV-8Bs and F/A-18s; no U.S. Navy or non-U.S. Coalition fixed-wing aircraft took part in close air support.[25]

Adding to the numbers of aircraft available for close air support were the Coalition attack helicopters, principally those of the U.S. Army and Marines. The previous chapter did not address these aircraft because although they saw some use prior to the ground offensive (including the destruction of Iraqi air defense installations by Army AH-64 Apaches on the first night of the war), their employment in cross-border operations

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[25](S) USCINCCENT SITREPs, 23-28 Feb 1991, GWAPS, CHST 68. Many other aircraft were, of course, capable of conducting close air support, but there was no need to call on them.

was only intermittent until the approach of the ground offensive. Cross-border raids by AH-64s began in the week prior to the ground offensive, and several deep operations (fifty miles or more) took place in the final two days of the war (26 and 27 February).[26] These aircraft were counted on for performing the closest of the close air support, since their ability to maneuver and keep close contact with ground forces made them the most suitable for attacking targets close to the front lines.[27]

The outer limits of the area for employing the close air support sorties were defined by the fire support coordination line, discussed earlier in the chapter. To keep pace with a potentially rapidly changing ground situation, the Coalition ground forces drew up a series of proposed coordination lines before the offensive began based on the planned route of advance, with the movement of the line forward being triggered at a certain time based on the extent of the advance. In a fast-paced advance, as this offensive was to be, the coordination of the movement of this line became crucial in the management of close air support and interdiction sorties, since this line determined the categorization of these sorties.

The bulk of the Coalition aircraft not involved in close air support flew interdiction sorties within the Kuwait theater: against Iraqi forces to prevent them from moving to the front lines or to catch them as they retreated and to strike at supplies, headquarters, and the road and bridge network. Strikes by Coalition aircraft extended throughout the theater, though the U.S. Navy (from the Gulf carriers) and Marine sorties concentrated heavily in eastern Kuwait. Many of the night flyers (F-111s, F-15Es, A-6s, and the night-configured F-16s)[28] struck the killboxes in

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[26]HQ DA, ODCOPS, Aviation Division, "Apache in Desert Storm," nd (hereafter referred to as "Apache in Desert Storm"), enclosed in a folder, *Army Aviation in Desert Shield/Storm* (Ft Rucker, AL: US Army Aviation Center, 1992) (hereafter referred to as *Army Aviation*), GWAPS, NA 337.

[27]Readers may take issue with the term "close air support" applied to attack helicopters. The terms more often used are "deep attack," "air assault," or "fire support." Adding such terms will only complicate the discussion, however, particularly when using those terms for the employment of fixed-wing aircraft. Since all attack helicopter missions were within the fire support coordination line, "close air support" provides at least as adequate a definition of what they did as it does for the fixed-wing close air support.

[28]Two squadrons of F-16s had navigation pods of the low altitude navigation and targeting infrared for night (LANTIRN) system.

the northern part of the theater to further attrit the heavy divisions and interdict the road traffic. The B-52 flights were scheduled round the clock: on the first day to hit breaching sites and along the front lines of Iraqi forces; on subsequent days to strike into Iraq at headquarters and staging areas just south of the Euphrates River.[29] The plan aimed to put maximum pressure on the Iraqi forces, with every type of strike aircraft of the Coalition engaged.[30]

While many of the interdiction sorties planned for the Kuwait theater had specific targets to strike, large numbers of these sorties were scheduled in a similar arrangement to the "push-CAS" sorties. That is, schedulers routed the strike aircraft not to a target but to an area, where they would receive targeting from another airborne aircraft (JSTARS aircraft, F-16 Pointer-Scouts, or F/A-18Ds) performing surveillance in the area.[31] These procedures added great flexibility to the planned air attacks since the airborne controllers could adjust to the tactical situation almost immediately.

Once the ground war got underway, the system needed as much flexibility as possible in order to deal with the conditions. Those conditions generally included light opposition to the ground advance, which in turn generated few targets for close air support aircraft; a rapidly moving fire support coordination line, which forced back the line defining the area open for interdiction sorties and changed the targets of many sorties; and a period of poor weather and restricted visibility due to oil fires, which limited the ability of aircraft to perform close air support and restricted many strikes to radar-aimed releases. Those aircraft so equipped used this less accurate release tactic; those not so equipped had to return to base with their bombs. The conditions faced throughout the ground phase of the war tested the limits of air power's flexibility, though few of the problems encountered were due to active opposition by the enemy.

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[29](S) Master Attack Plans, 24-27 Feb 1991, OWAPS, BH 1.

[30]Though the F-117s and Tornados only marginally so: F-117s continued to hit strategic targets in Iraq, and Tornados were employed principally against airfields in Iraq. The Proven Force F-16s and F-111s could not reach the Kuwait theater, so they continued to strike targets in northern Iraq.

[31](S) Master Attack Plans, 24-27 Feb 1991, OWAPS, BH 1. These procedures were used even more extensively after the first day of the ground offensive, when anticipating likely targets even hours beforehand became ever more difficult.

Close Air Support

The lack of determined Iraqi resistance made close air support a rather peripheral aspect of this war. All the frontline Iraqi divisions crumbled quickly, often with no resistance at all, and as the Coalition corps advanced, they reported light resistance throughout the theater. With the exception of a handful of instances of determined resistance, possibly two in the Marine area of operations and several more in Army clashes with units of the Republican Guard, there were few instances in which the opposition was not handled easily by Army or Marine ground weapons alone.[32] There were, in other words, few "troops in contact" situations to provide examples of how well close air support by fixed-wing aircraft or attack helicopters could be synchronized with ground fire support systems.

The sorties reported by the command as close air support give an erroneous indication of what took place. The daily reporting indicated up to five hundred such sorties in a day, but those figures do not reflect the true nature of these missions.[33] A study of Marine Corps sorties (see Table 19) estimates only 14 percent of these sorties were close air support, while Marine reporting at the time put that figure at over 70 percent.[34] While the information on U.S. Air Force sorties does not allow such a reconstruction, those aircraft faced a similar situation in the Army sector, so the percentage of true close air support was probably similar to the Marine figures. What is clear from reporting is that as early as the first morning, forward air controllers were turning aircraft back to the Tactical Air Control Center as not necessary, and many aircraft returned with their ordnance because they could not be employed anywhere else. The primary close air support aircraft, A-10s and AV-8Bs, saw much less action than planned: A-10s reported 316 of 909, or 35 percent as ineffective (that is, they did not drop their bombs), and AV-8Bs had more total missions canceled or with no drops (143) than they had successful mis-

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[32]A possible exception would be the employment of aircraft (F-16s in one case, A-10s in another) to assist in the protection and extraction of Special Forces personnel operating behind enemy lines.

[33](S) USCINCCENT SITREP, 26 Feb 1991, GWAPS, CHST 68-4. What these figures most likely indicate is the planned employment of the sorties when they were *launched*, not what actually occurred on the sortie.

[34](S) *Marine Corps Reconstruction Study, Vol. IV*, p 74; (S) USCINCCENT SITREPs, 24-28 Feb 1991, GWAPS, CHST 68.

sions (131).[35] Even some of the B-52 sorties scheduled for bombing the breach sites were redirected in flight to other targets because the ground advance had already made those sorties unnecessary.[36]

Table 19
Number of Missions in Relation to the Fire Support Coordination Line (FSCL) During the Ground Offensive

Aircraft type	Inside FSCL	Outside FSCL	Total
A-6E	27 (16%)	141 (84%)	168
AV-8B	44 (18%)	199 (82%)	243
F/A-18A/C	37 (10%)	342 (90%)	379
Total	108 (14%)	682 (86%)	790

Note: Only missions described in Third MAW mission reports are included in this table.

Source: Marine Corps Reconstruction Report, Vol IV.

While the conditions experienced in close air support operations were similar in the areas of Marine and Air Force/Army operations, the employment in each area was different enough to be considered separately. What they had in common was the relatively few instances in which aircraft were cited as a part of the ground engagement. The two areas differed in the manner of combined employment of fixed-wing and rotary-wing aircraft. For instance, several accounts detail how Marines used combinations of AV-8Bs, AH-1W, and, at times, A-10s and F/A-18s in engagements in the Burgan oil fields on 25 February and just south of

[35](S) *Marine Corps Reconstruction Report, Vol. IV*, p 77; (S) Combat Chronology 23/354(P), entries for 24 through 28 Feb. A-10 data are for all sorties; only partial data are available for close air support sorties, but those data indicate the unsuccessful rate was even higher for these sorties. See (S) 354/23 TFW(P), Wing Operations Log, entries of 24-28 Feb 1991, GWAPS Microfilm Roll 26557.

[36](S) History of the Strategic Air Command, 1 Jan-31 Dec 1990, Volume I (HQ SAC History Office, 1992), p 273.

Kuwait International Airport on 26 February.[37] The U.S. Army, on the other hand, employed fixed-wing close air support sorties not in the close-in battle but in areas up to forty miles from the front lines of Coalition forces. Fixed-wing close air support handled this farther area, while artillery, rockets, or helicopters struck the regions more close-in to the ground forces. Examples include the A-10s called in to attack positions on Tallil Airfield on 27 February, prior to its assault by elements of the 24th Division and again when A-10s were called to strike the positions of the Iraqi Tawakalna Division on 26 February, prior to what came to be called the Battle of 73 Easting.[38]

Attack helicopters saw action both in conjunction with the attacking frontline ground forces in all areas and in independent, deep attacks behind Iraqi frontline forces by U.S. Army AH-64s, principally by the XVIII Corps.[39] In several instances, helicopters were employed because they were the only aircraft that could operate successfully, such as in conditions of low ceilings due to weather, blowing sand, or oil well fires. Depending on the nature of the operating areas and the employment doctrine of the force, the helicopters assumed different roles. In the more restricted size of the Marine Corps area, the attack helicopters operated closely with the front lines of the advancing troops. When employed by

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[37]*Hearings before the Committee on Armed Services, United States Senate*, 8 May 1991, Testimony of Maj Gen James M. Myatt (Washington, DC: US Government Printing Office, 1991), pp 60-62.

[38]Jason K. Kamiya, *A History of the 24th Mechanized Division Combat Team During Operation Desert Storm*, p 29; Frank N. Schubert and Theresa L. Kraus, *The Whirlwind War: The United States Army in Operations Desert Shield and Desert Storm* (Washington, DC, Center for Military History, undated draft), pp 304, 311, and 315. While this employment, essentially following Army Air Land Battle Doctrine, can be seen in both VII and XVIII Corps, it more typifies the operation of VII Corps. The VII Corps Commander, Lt Gen Frederick Franks, pointed out after the war that his preference was to employ fixed-wing close air support well ahead of the front line of forces, while using the firepower of his brigades in the close-in battle, in order to attack the Iraqi Army throughout its depth, simultaneously. Intvw, GWAPS staff with Gen Franks, 2 Sep 1992, Ft Monroe, VA.

[39]Attack helicopters employed were the Army's AH-64, Marine Corps AH-1W, the French Army Gazelle, and the British Army Lynx. The Kuwait Air Force also possessed Gazelle helicopters, but they were not employed as attack aircraft during Desert Storm. The Army had AH-1s deployed to the theater, but there is no record of their employment as attack helicopters.

U.S. Army VII Corps, the attack helicopters performed as an integrated maneuver element of a division. In the areas of XVIII Corps, however, the AH-64s engaged in several independent deep operations, apart from the ground elements, against withdrawing Iraqi troops and accounted for significant amounts of Iraqi equipment destroyed in these sweeps.[40] A limitation in the ability for deep sweeps proved to be the logistics and planning required to support these operations, particularly with the ground forces moving so swiftly. As a result, the first such deep raid did not take place until late on 26 February with three more multi-battalion attacks taking place during the day and evening of 27 February. The principal raid on 27 February was by AH-64s on the causeway crossing the Hawr Al Hammar, a key exit route from the theater (to be discussed later), during which the Apaches disabled many vehicles caught in the congestion waiting to cross the causeway.[41]

In summary, close air support was a great assistance to the ground attack, but it was not vital to its success. Because of the nature of the enemy resistance encountered, or the lack of it, there were few instances in which close air support sorties had to drop munitions close to Coalition ground forces to stop an Iraqi attack; the Coalition ground forces controlled the closeness of the combat. The aircraft employed were capable of much more than was called for from them, but the divisions' own artillery and rocket launchers, the superior range of the guns of Coalition tanks and other direct fire weapons, along with the tremendous advantage of thermal imaging sights which allowed Iraqi tanks to be engaged by M1A1s at ranges nearly double the maximum acquisition range of the Iraqis, allowed the Coalition ground forces to handle those few instances of resistance without substantial assistance from the air. Air power's greater effectiveness was in attacking the forces deeper in the Iraqi defense areas, in the regions where these attacks blended with the interdiction strikes.

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[40] *Army Aviation*, p 34; (S) *Marine Corps Desert Storm Reconstruction Report, Volume IV*, p 113.

[41] *Army Aviation*, pp 86-108; "Apache in Desert Storm"; 8th Air Support Operations Group After Action Review, Operations Desert Shield/Storm, nd, GWAPS, NA 577.

Interdiction

Air interdiction sorties during the four days of the ground war took place in conditions of poor weather, rapidly changing target assignments, and the changing priorities of targets in these final hours of the war. During this time, the area open for interdiction sorties constricted as the fire support coordination line moved forward, until, by 27 February, all interdiction sorties were nearly squeezed out of the Kuwait theater (the limit of the theater being 31 degrees north latitude).

Air interdiction operations saw two phases. During the first phase, from the initiation of the ground war to the evening of 25 February, aircraft attacked the reserve heavy divisions (and the other Republican Guard divisions as well) in order to destroy their capability to move or maneuver to meet the Coalition ground forces. Counterattacks by the Iraqi heavy divisions after the frontline divisions had fixed the Coalition attack was thought to be the basis of the Iraqi strategy, as discussed in Chapter 2. The second phase began after intelligence information indicated (and airborne aircraft had confirmed) that a general retreat of Iraqi forces was underway (evening of 25 February). From that time until the ceasefire at 8:00 a.m. local time on 28 February, the focus of air interdiction became one of pursuing and destroying the retreating army.[42]

For the first two days of the ground offensive, air interdiction strikes took place on Iraqi troop concentrations and equipment just beyond the fire support coordination line, while other aircraft prowled the deeper areas of the theater, often at night, receiving cuing by JSTARS aircraft or control/scout aircraft (F-16 Pointer or F/A-18D) to attack any movement of forces. On the morning of 24 February, typical sorties included (Map 11) Jaguar aircraft attacking As Salman, F-16s attacking Al Busayyah, and Kuwaiti A-4s attacking artillery positions in front of the Joint Forces Command-north area; on 24 and 25 February, the Marine Corps and Navy sorties concentrated their attacks at similar distances forward of the fire support coordination line (see Figure 25). Interdiction

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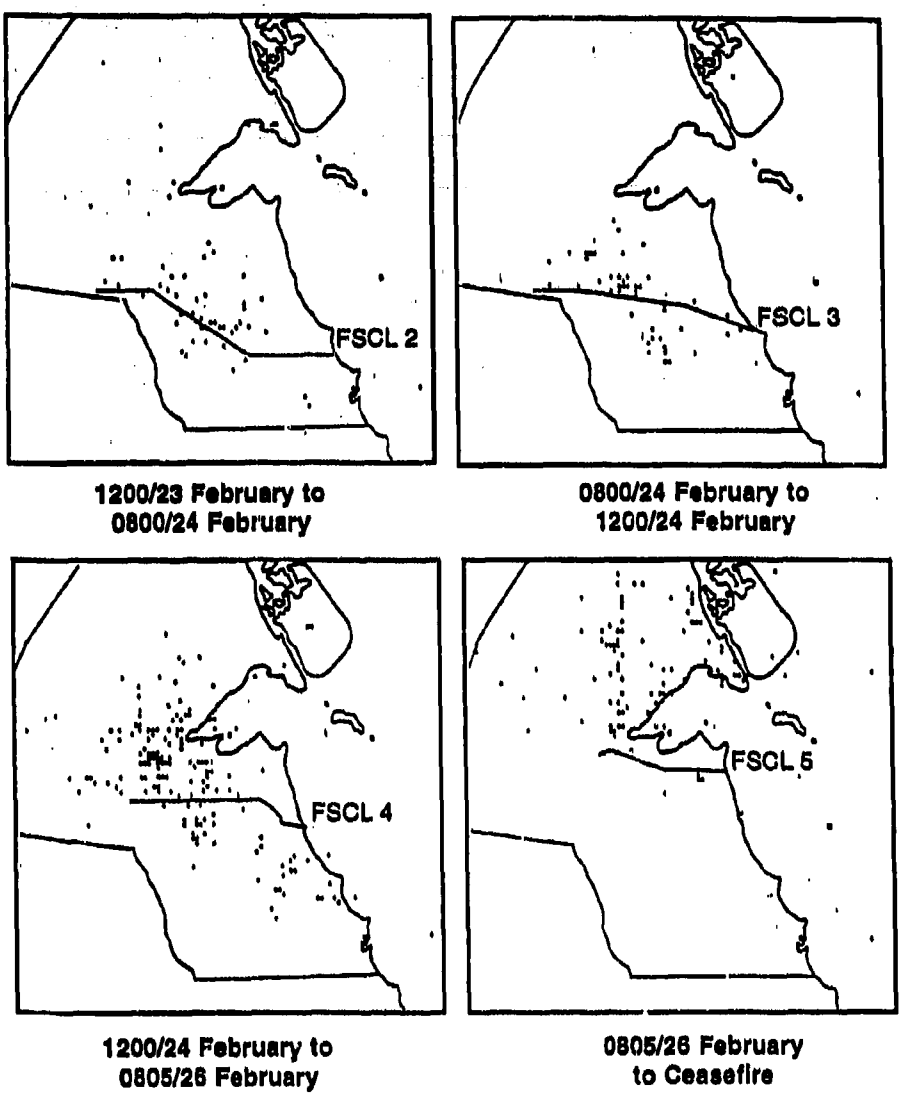
[42]No phases were either planned or announced, of course. The term phases is used simply to describe the unfolding events. Word of the general withdrawal came from communications from the Kuwait resistance in Kuwait City, and aircraft in the region. (S) TACC Log, entries of 25 Feb 1991, GWAPS, NA 215.

Figure 25
Movement of Marine Corps Fire Support Coordination Line, 24-26 February 1991[43]



1200/23 February to 0800/24 February

0800/24 February to 1200/24 February

1200/24 February to 0805/26 February

0805/26 February to Ceasefire

Location of targets attacked by Marine aircraft shown by dots.

[43](S) *Marine Corps Desert Storm Reconstruction Report, Vol IV*, pp 70-73.

sorties moved north and east throughout each day of the ground offensive, as indicated in Maps 11 and 12, staying just ahead of the fire support coordination line, reaching the highways that served as routes into and out of the Kuwait theater. During the first two days, the heaviest concentrations of strikes were in killboxes AF5 and AG5 (280 strikes), principally by B-52s, A-6s, F/A-18s, and F-16s, and at night in killbox AE6 (140 strikes on 24 February alone), principally by F-111Fs.[44]

While it is difficult to account for the movements of individual Iraqi units during the final chaotic days of the war, there is evidence that some units (the first ones out) began an early retreat from the theater and emerged ready for further employment within Iraq almost immediately. The 11th and 15th Infantry Divisions, for example, stationed close to Kuwait City, took part in quelling the Shia uprisings in southern Iraq shortly after the war. There were three special forces units stationed in Kuwait City that, after leaving the theater, moved to northern Iraq to take part in actions against the Kurdish uprising. Of even greater importance, one intelligence estimate points out that three of the Republican Guard divisions–the Baghdad, Al Faw, and the Special Forces Division–departed the theater on the evening of 25 February, while the Coalition ground forces were still far from the positions of these divisions.[45] Lacking is any information on what damage these divisions (and some others) sustained during and after their exit from the theater. For most of these divisions, an estimate of the damage they suffered is unimportant, since the objective was only to clear them from the theater. There was a specific military objective calling for the destruction of the Republican Guard forces, however, so the level of destruction of these three Republican Guard divisions is relevant, but unknown. All that can be said is

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[44]Except for the employment by F-111Fs on 24 Feb of 162 laser-guided bombs on targets in Republican Guard divisions, particularly the Tawakalna Division, laser-guided bombs were not employed to any great extent during the ground war. The capable aircraft (F-111Fs, F-15Es, and A-6s) shifted to mines and other nonprecision munitions. Strike data from: GWAPS Missions Database, sorties of 24-27 Feb 1991; (S) *Marine Corps Reconstruction Report, Vol. IV*, pp 71-2; Center for Naval Analyses USN missions database; ABCCC Log, 25 through 27 Feb 1991, GWAPS, NA 287. The sorties depicted in Figure 25 and Map 11 are estimates only. Data available for Navy and Marine Corps sorties are much more complete than for the other Coalition sorties, including USAF sorties.

[45][DELETED]

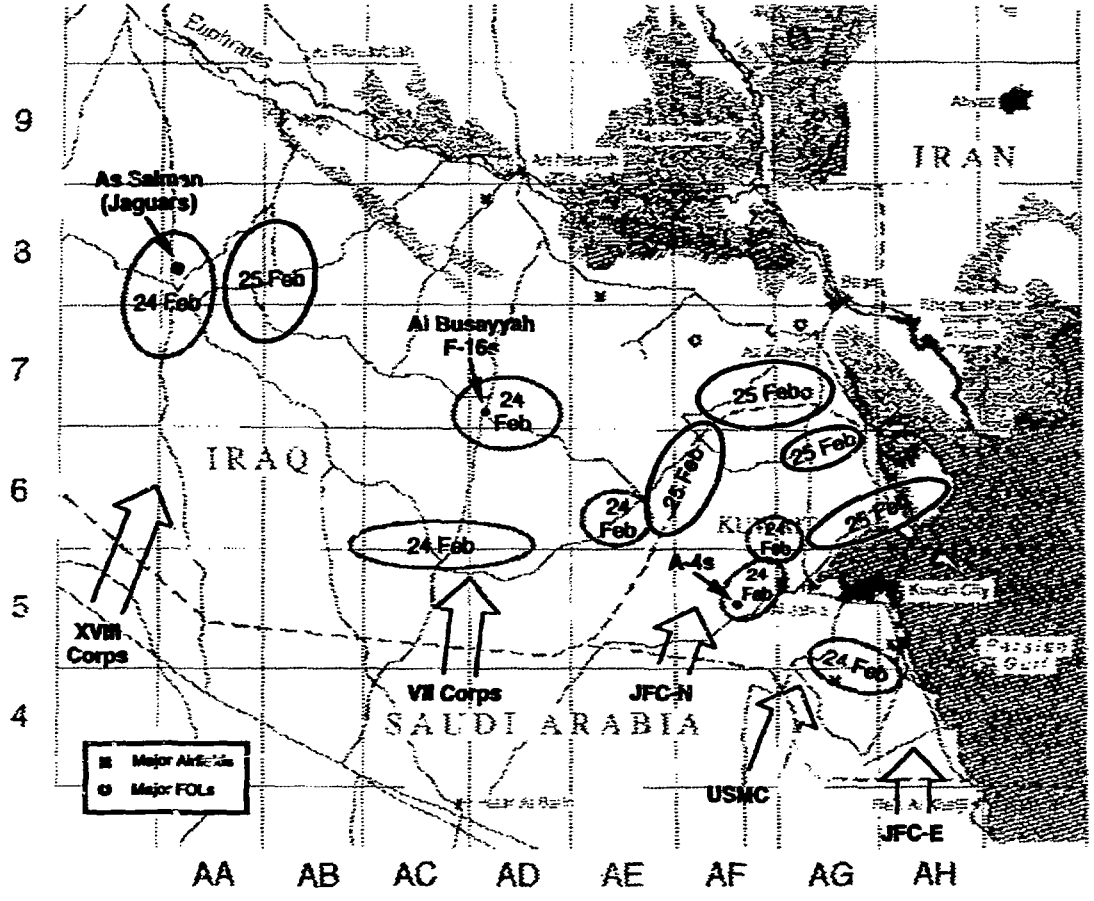


Figure 11
Interdiction Strikes in the Kuwait Theater, 24-25 February 1991

Strikes took place throughout the theater, moving with the fire support coordination line, with the heaviest concentrations being in the areas indicated for strikes on 24 and 25 February. The A-10 and AV-8B strikes are not included.

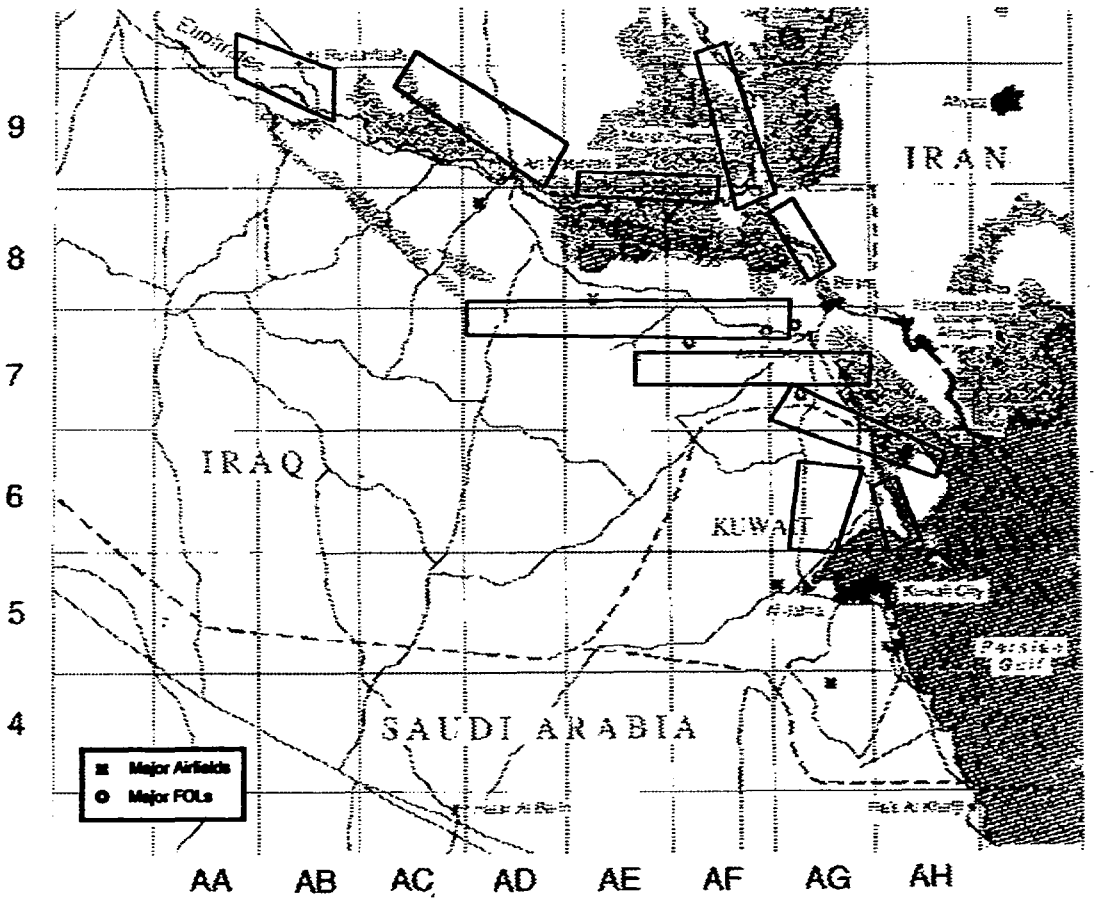


Figure 12
Interdiction Strikes on 26-27 Feb 1991

Boxed areas depict the areas of greatest concentration of strikes. The A-10 and AV-8B strikes are not included.

that, being infantry divisions, they received far less attention in the air campaign than the Republican Guard heavy divisions.[46]

After the general retreat began by many of the Iraqi forces on the evening of 25 February, the interdiction sorties bore down on the retreating columns of Iraqi forces flowing north in trucks, cars, boats, or any other means available to depart the country. The units in the northern part of the theater had the best chance of escaping intact. The forces that followed them, however, became slowed and then stopped at those points where many units had to converge at bridges or roadway choke points.

The first location where air stopped the retreating columns was Mutla Ridge, high ground to the west of Kuwait City and just north of the city of Al Jahra. The major road to Basra passing over the bluffs of the ridge made a natural choke point for the traffic retreating from throughout southeast Kuwait, combining with the traffic fleeing Kuwait City (see Map 13). Once the forward elements of this traffic had been halted by air attacks, the remaining several miles of vehicles came under attack throughout the evening, leaving a scene approximately two miles long of abandoned and burning vehicles. This scene became identified as the "highway of death" by the news media in the immediate aftermath of the war.[47] A count of destroyed vehicles using photos taken on 1 March put the number at more than 1,400, with only 14 tanks and 14 other armored vehicles being among them. Reporters found somewhere between 200 and 300 dead Iraqis at the scene; the other occupants presumably either escaped north or were taken prisoner.[48]

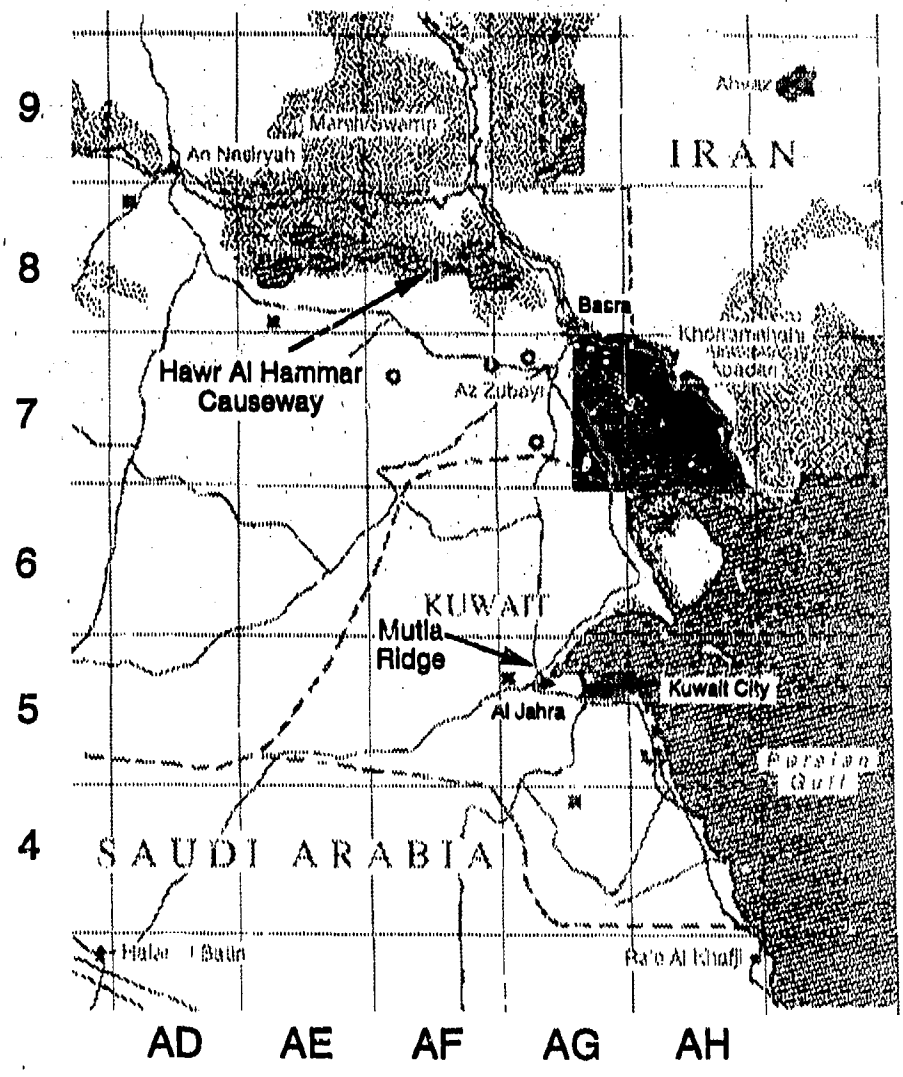
A second choke point for the retreating Iraqi forces occurred at the causeway over the Hawr Al Hammar, the large lake and marshlands northwest of Basra (the probable escape route for the three Republican

[46]Postwar actions by the Republican Guard in suppressing insurgencies within Iraq cannot be automatically attributed to Republican Guard divisions escaping from the Kuwait theater, since there were Republican Guard divisions remaining in Baghdad during the war that would have been available for such activities.

[47]Steve Coll and William Branigan, "U.S. Scrambled to Shape View of 'Highway of Death,'" *Washington Post*, 11 Mar 1991, p 1.

[48]*Ibid.*

Map 13
Choke Points for Retreating Iraqi Troops in the Kuwaiti Theater



Shaded area south of Basra depicts no-strike areas declared on 27 Feb.

Guard divisions referenced earlier). The multilane causeway had been bombed and repaired several times during the war and could sustain only limited traffic. Aircraft, principally F-111s, destroyed enough vehicles to block the traffic on the evening of 26 February, and aircraft strikes continued the following day, most notably a deep attack by AH-64s. Aerial photography two days later showed approximately 550 to 600 vehicles abandoned at the location; as at Mutla Ridge, only 10 to 20 of these were armored vehicles.[49]

The final choke point for traffic out of the Kuwait theater was at the city of Basra. Here, in the final day of the war, with Coalition ground forces moving in from the west and cutting off all escape in that direction, the fleeing Iraqi forces attempted to get through the city and its canals and across the river to the east, the last remaining exit. All bridges over the canal and river were either damaged or destroyed, and traffic stopped at the canal on the western side of the city, with a back-up stretching approximately twenty miles to the west; into this congestion, the remnant of the Iraqi Army, including the remaining Republican Guard divisions, had retreated.

There were no scenes of destruction in Basra or at the canal such as those seen at Mutla Ridge or the Hawr Al Hammar, however, because of conditions that affected the bombing. First, the area west of Basra was not open desert but a more built-up area of farms and small towns. Tanks and other military vehicles took advantage of this situation by parking on neighborhood streets and generally mixing in with civilian buildings in the area.[50] Bombing in this situation was subject to far more restrictions than encountered elsewhere. Second, the weather ceilings in that area, the proximity of Coalition ground forces on 27 February, and the close proximity of the target area to Iranian territory all brought restrictions on the bombing operations. General Schwarzkopf, fearing an incident with aircraft bombing so close to Iran in bad weather, closed the

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[49] *Army Aviation* pp 86-108; GWAPS Missions Database, sorties of 26/27 Feb 1991.

[50] [DELETED]

shaded areas in boxes AG7 and AH7, allowing only attacks on the bridges in Basra (See Figure 13).[51]

During the final two days of the war and the compression of the Iraqi Army into the northeast end of the theater, a conflict arose between Army and Air Force officers in the Tactical Air Control Center concerning the placement of the fire support coordination line (FSCL). Because the dispute affected the employment of air power during these days, it became more than a matter of procedure. One difficulty concerned the coordination line being placed adjacent to the canal at Basra. The Army forces placed the line far ahead of any Coalition ground forces, but with the rapid advance of those forces and the uncertainty of their precise location, the caution is understandable.

A second difficulty concerned the placement of the coordination line by XVIII Corps to the north of the Euphrates River, including the east-west highway in that region (see Figure 26). The line was set there not because of any movement of ground forces but to accommodate an attack on 27 February by AH-64s on the causeway at the Hawr Al Hammar. The Air Force officers in the Tactical Air Control Center objected to the extent of the area north of the river within the boundary of the FSCL, because that area then became closed to interdiction strikes. The road in the area cited carried traffic of Iraqi forces fleeing the theater after crossing the causeway or escaping through Basra. In the end, it took an appeal to General Schwarzkopf to resolve the issue and have the coordination line redrawn down the middle of the river, essentially opening the highway north of the river and the causeway itself to interdiction strikes. It took fifteen hours for this move to be made, however.[52] This report is not the place either to explore fully the doctrinal issues of the fire support coordination line or to fix responsibility for the lack of coordination on its placement. It is the place to note that the placement of the coordination line created a zone of diminished effectiveness for air power. An Army study noted that "short of the FSCL, we could rarely

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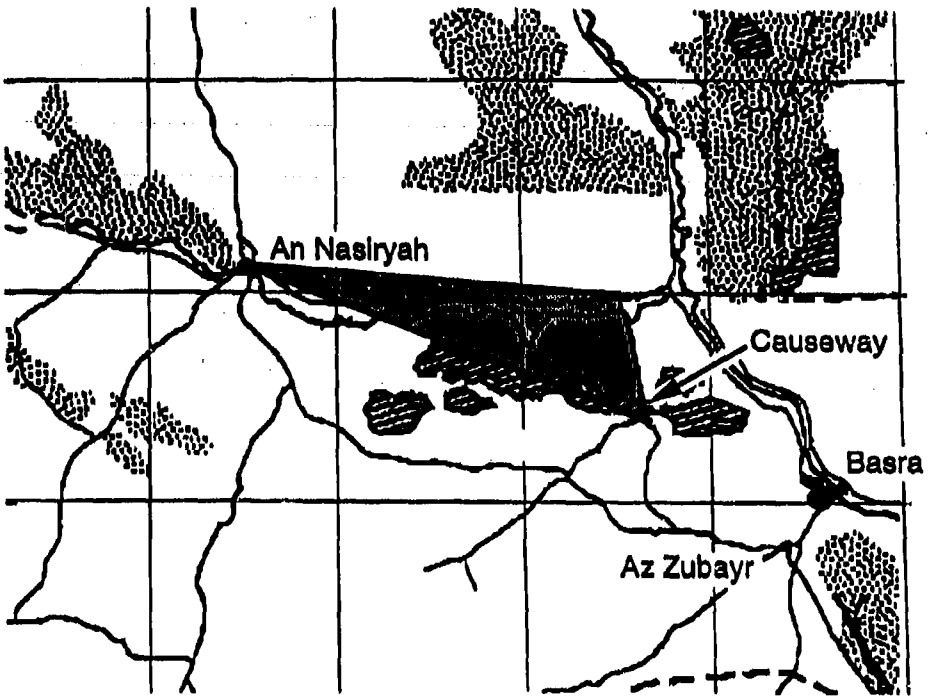
[51](S) CENTAF Historian, "TSgt Barton's Notes from TACC," 25/1020 Feb 1991, GWAPS, NA 200; (S) TACC Log, entries of 27 Feb 1991, GWAPS, NA 215; Airborne Battlefield Command and Control Center LOG, entries of 27 Feb 1992, GWAPS, NA 287.

[52](S) Intvw with Maj Gen John A. Corder, 18 May 1992, GWAPS, NA 361; (S) TACC Log, entries of 27 Feb 1991, GWAPS, NA 215; (S) TACC Historian Transcripts, "TSgt Scott A. Saluda's Notes," GWAPS, NA 200.

Figure 26
Disputed Area of Fire Coordination Line
27 February 1991



Area of dispute of the fire support coordination line, 27 Feb 1991. The shaded area shows the disputed area. The line was redrawn to the southern boundary of the shaded area at 1830 on 27 Feb 1991, but the line had been at the northern boundary for the preceding fifteen hours. Note the location of the east-west highway within the shaded area.

mass air on targets outside of visual range."[53] At the same time, the Air Force officer who was director of night operations in the Tactical Air Control Center, after observing the coordination difficulties, noted that

[53]Rpt, *Operation Desert Storm Lessons Learned, Vol I, Strategic* (Maj Gen Thomas H. Tait Dept of Army Memo, US Combined Arms Command, Ft Leavenworth, KS, 10 Sep 1991), p I-177.

"the safest place for an Iraqi to be was just behind the FSCL."[54] Even if both statements overstate the situation, it is clear that there was such an unintended zone in which Iraqi forces benefitted from the shortcomings of Army/Air Force coordination.[55]

Air Power's Effect on the Iraqi Army

Air power had two important effects on the Iraqi Army during the four days of the ground war, one imposed during the four days, the other imposed during the preceding weeks of the air war. Air strikes during the air war had made the Iraqi forces in some cases unwilling and in other cases unable to maneuver or mount an effective defense. Lack of communications, equipment attrition, and destruction of the theater distribution system had combined to bring these conditions about. The rout of maneuvering Iraqi forces during the engagement at Al Khafji gave those forces a preview of what was in store. During the ground war, concentrated attacks on the Iraqi heavy divisions prevented those divisions from playing any other role than self-defense, and several of these divisions did not even do that. In some instances with the frontline Iraqi divisions, air power had merely to show up to prompt the forces to surrender.[56]

Numerical measures of air power's effects during the four days are subject to even greater uncertainties than those discussed in the previous chapter. Not only did the coordinated air-ground action make attribution of equipment destruction to a particular weapons system far more difficult, but also there was little time to keep up with the pace of events. Central Command did credit aircraft strikes with the following equipment destroyed:

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[54]"Behind the FSCL," meaning just within the boundary encompassing the FSCL. Oral history intvw with Col Michael F. Reavey, 21 Dec 1991, USAF Air Warfare Center, Eglin AFB, FL, GWAPS, NA 336F.

[55]The positioning of the FSCL created no such problem within the Marine area. Besides the more simplified procedures of Marines coordinating among themselves, the FSCL movement was neither as rapid nor over such an extensive area as in the Army area. Whereas the total Marine FSCL movement was no more than 50 miles, the XVIII Corps FSCL moved more than 200 miles in 3 days.

[56]"Soon as air showed up, Iraqis started surrendering." (S) TACC Log entry for 25 Feb 1991, recording comments passed by members of 1st Infantry Division, GWAPS Microfilm Roll 10263.

Table 20
Bomb-damage Assessment from Air Strikes (fixed-wing only)

Date	Tanks	Armored Personnel Carriers	Trucks	Artillery
24 Feb	77	58	245	133
25 Feb	76	66	151	98
26 Feb	170	62	155	103
27 Feb	128	38	401	19
Totals	451	224	952	353

Source: (S) USCINCCENT SITREPs, 24 through 28 Feb 1991, GWAPS, CHST 68.

Equipment destroyed by attack helicopters is not a part of the above totals. While not reported or verified by Central Command, Army aviation reported that AH-64s alone destroyed more than 600 tanks, armored personnel carriers, and artillery pieces during the ground war.[57] No data are available from the employment of Marine attack helicopters, but they were also a prominent part of the attacking force in the Marine area of operations.[58]

To help put these numbers in context, however, consider that Central Command's claims for total equipment destroyed during those four days–2,159 tanks, 521 armored personnel carriers,and 1,465 artillery pieces[59]–are, particularly for tanks, far higher than the actual Iraqi losses. Those equipment loss estimates developed in the previous chapter are brought forward and summarized below in Table 21 for purposes of comparison.

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[57]"Apache in Desert Storm," entries for 26-28 Feb 1991. These claims for the AH-64s do not make clear whether the results achieved were by AH-64s alone or the totals of claims for ground engagements in which the AH-64s took part. It should be pointed out that claims by organizations of each weapon system, tanks, helicopters, fixed-wing aircraft, were substantially higher than those verified by Central Command.

[58](S) *Marine Corps Reconstruction Report, Vol IV*, p 113; *Conduct of the Persian Gulf War*, p 267.

[59](S) Viewgraph, "Equipment Destruction in KTO," 1 Mar 1991, J2 BDA Briefing to the President and JCS, GWAPS, NA 353.

Table 21
Estimates of Iraqi Equipment Status in Kuwait Theater, dates as indicated.

Source of Data	Tanks	Armored Personnel Carriers	Artillery
Possessed on 16 Jan 1991 (Imagery)	3,475	3,080	2,475
In Iraqi control on 1 Mar 1991 (Imagery)	842	1,412	279
Destroyed or abandoned 1 Mar 1991 (the difference between the above)	2,633	1,668	2,196
Destroyed during air war by 24 Feb 1991 (CENTCOM data adjusted downward by 300 tanks and artillery; see Chapter 4)	1,388	929	1,152
Resulting amount destroyed or abandoned during the ground war	1,245	739	1,044
CENTCOM estimate for destroyed during the ground war (total/air)	2,159/451	521/224	1,465/353

Note: 952 trucks destroyed by air; no data for total

Like the assessments made during the air war, two observations are pertinent. First, many armored personnel carriers and trucks destroyed were counted as tanks. Truck data appear particularly low, considering the extent of the destruction at Mutla Ridge and the causeway over the Hawr Al Hammar. Second, while the estimate of *numbers* of tanks and artillery destroyed are excessive, the *ratios* of destroyed by air to total destroyed given in the Central Command estimate may be more tenable (or at least cannot be discounted), particularly if equipment destroyed by attack helicopters is included as part of the totals for air.

[DELETED][60]

The tank attrition was brought about by air action until 24 February (10 percent) and by combined air and ground action, 24 to 28 February (another 30 percent). The principal reason for lower attrition of the Guard's tanks during the ground war relative to the other Iraqi divisions rests with the ability of these units to withdraw without being overrun. With the possible exception of the Tawakalna Division, the Guard's heavy divisions had withdrawn toward Basra and were in Iraqi-controlled territory when the ceasefire took effect on 28 February. In contrast, Iraqi divisions deployed farther south in the theater had little possibility of retreating with any of their still-operable heavy equipment.

Figures for Iraqi troops killed by air attacks during the four days can be no more than speculation. Some further counts can bound the possibilities, however. The previous chapter estimated a total of 200,000 to 222,000 Iraqi troops in the theater when the ground war began. More than one-third (86,000) were taken prisoner.[61] The remnant of the army not killed had fled by 28 February to the pocket west of Basra or across the Euphrates River in Iraq. While there is no count of the size of this surviving force, it was at least large enough to contain within it one-third of the armor (2,254 of 6,555 tanks and armored personnel carriers) originally brought into the theater. Since the survivors were also from infantry divisions that possessed little of this armor, the surviving force could have been a substantial one.[62] There are no data to suggest what portions of those killed were inflicted by air attacks, but the above calculations at least identify the limits.

An accounting of air attack's specific results against troops and equipment is necessary but not sufficient for determining effectiveness. Estimates of air power's worth during the ground war must look beyond

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[60][DELETED]

[61]*Conduct of the Persian Gulf War*, p 294.

[62]This Survey claims no special insights as to the size of the surviving force, but a total of around 100,000 troops is possible. Following from the previous estimates, that would leave an estimated 14,000 to 34,000 Iraqis killed during the ground war.

these calculations; all indications are that the most important contribution of air power in the Kuwait theater *during the ground war*, 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. Those several days of air interdiction did not have that result–the interdiction sorties after 23 February were just a continuation of the campaign that began on 17 January. Nor were the interdiction sorties dissimilar from the close air support sorties flown; sorties of both types were flown often just a few miles apart. What the ground action makes clear is that the Iraqi heavy divisions on which the Iraqi strategy depended were essentially paralyzed or demoralized by air power. The remnants of some were destroyed in place or surrendered with little resistance. Others divisions fled the theater without much of their equipment, while those closer to the border were able to make a more orderly departure.[63] Those that were left with a will to fight were able to do little more than face the attack and return fire, with no hope of maneuvering, being reinforced, or achieving even tactical success. The engagements of the Marines with elements of the Iraqi 3d Armored Division at Kuwait International Airport on 26 February and of VII Corps with elements of the Tawakalna, 12th, and Madinah Divisions on 26 and 27 February were just such desperate actions.

Ironically, one effect that was not decisive in any direct way was the loss of equipment, a key index of bomb-damage assessment used during the war. The Iraqi Army did not run out of tanks, armored personnel carriers, or artillery; in fact, much of the equipment that remained intact at the start of the ground offensive was abandoned, or was at least unoccupied, when the Coalition ground forces reached them. Reports of AH-64 strikes describing the attacks on armor columns note that when firing began on the first tank, the crews of the other tanks began abandoning their vehicles.[64] An antiarmor study done after the war that looked at tank engagements in several regions of the Kuwait theater concluded that in the typical ground engagement the Iraqi tanks were stationary, there was no sign of Iraqi soldiers, except those surrendering, and the Iraqi tanks were not firing.[65] The total number and operability of the tanks had less meaning under those conditions.

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[63][DELETED]

[64]Comment by the XVIII Airborne Corps Aviation Officer. *Army Aviation*, p 153.

[65](S) Battlefield Assessment Team; Armor/Anti-Armor Team, *Armor/Anti-Armor Operations in Southwest Asia*, Marine Corps Research Center, Research Paper #92-002, Jul 1991, p 18; *Army Aviation*, p 153.

Air power had destroyed not only large amounts of equipment. It had destroyed the confidence of the Iraqi soldiers that the equipment would do them any good–on the contrary, the equipment was seen as a magnet for air strikes. Whether or for how long the Iraqi troops could have held on even without a ground attack can be no more than matters of speculation. What is demonstrable is the inability of the Iraqis to react once the ground attack took place and the Coalition forces swept through the theater. This survey could not assess possible differences in Iraqi resistance if the Coalition ground forces had less air support or had there been a shorter air campaign. The survey did determine, however, that air power made that resistance disorganized and totally ineffective.

Finally, the paralysis and disorganization of the Iraqi Army came as a result of air power, not only as described in this and previous chapters, but as applied throughout Iraq to a series of strategic targets. That portion of the air campaign on strategic targets in Iraq is the subject of the next chapter.

6

Attacking the Core of Iraq's Military Power

The "Strategic" Core

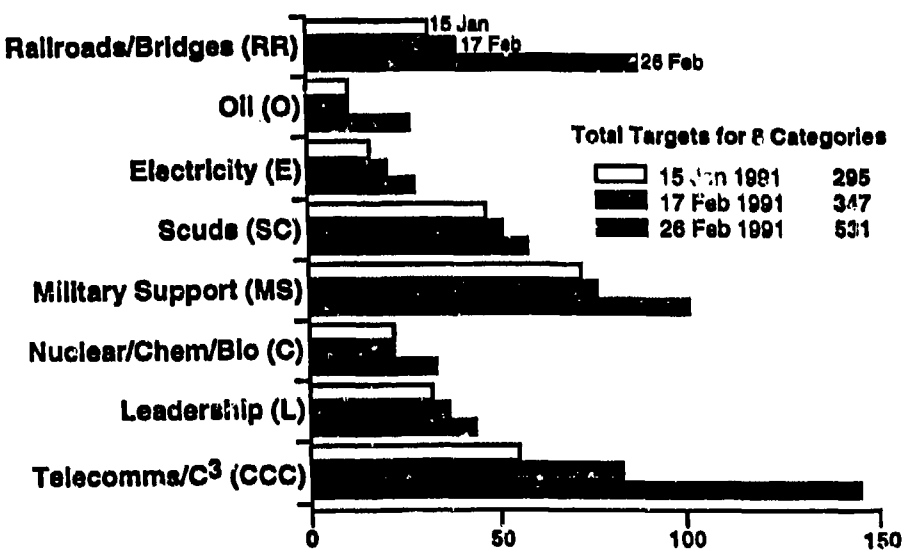
As mentioned in the introduction, achieving air superiority has been a function of air power in which air forces have been largely used as means to other ends. In the case of the Gulf War, the Coalition's rapid attainment of air superiority blinded the Iraqis, reduced their long-range strike options to firing inaccurate Scud variants at Saudi and Israeli cities, and enabled the Coalition to fly large numbers of air-to-ground sorties against targets throughout Iraq and the Kuwait theater with relatively few losses over a period of some six weeks. Similarly, air attack of surface forces has traditionally implied, at most, the use of air power as part of an air-land, air-sea, or air-land-sea team--regardless of how dominant any one team-member happened to be on any particular occasion. By contrast, strategic air attack has been taken to suggest the possibility of directly affecting the will and means of an enemy nation, or its leaders, through the direct application of airborne firepower to selected strategic target sets.

This chapter will examine the effectiveness of Coalition air power during the Gulf War against the eight "strategic" target categories that were perceived by those who planned and executed the Desert Storm air campaign as constituting the core of Iraq's current and future military power. These eight categories--(1) national telecommunications and command, control, and communications (CCC[1]); (2) national leadership facilities (L); (3) Iraq's nuclear, chemical, and biological warfare capabilities and weapons programs (C); (4) various military support facilities

[1]Again, CCC, L, C, etc, are the target-category designators developed by Lt Col David A. Deptula as an alternative to BE (Basic Encyclopedia) numbers (or BENs). Especially for purposes of checking each day's Master Attack Plan, designators like C11 and RR33 were far easier to use than BE numbers such as 0445XX00017, which gave no immediately recognizable indication as to target category. (C11 was the Black Hole's designator for the Baghdad nuclear research center at Al Tuwaitha; RR33 designated the Al Kifl highway bridge over the Shatt Ash Shamiyaa.)

(MS); (5) Iraq's short-range ballistic missile systems (generically termed "Scuds" and designated SC); (6) electric power (E); (7) major oil storage depots and oil refineries (O); and (8) key bridges and railway facilities (RR)–constituted between 60 and 70 percent of the identified, discrete targets in the lists used by Black Hole air planners during the forty-three days of Desert Storm.[2] The principal Black Hole target categories not included in the strategic core were Iraq's strategic air defenses, airfields, naval forces, and Republican Guard units.

Figure 27
Wartime Growth in Core Strategic Target Categories[3]



[2]At least 716 fixed installations with BE numbers were attacked during Desert Storm. In August 1990, the Defense Intelligence Agency's Automated Intelligence Installations File (AIF) contained some 2,200 targets and 3,200 records on Iraqi installations. By January 1991, the AIF had grown to some 3,200 Iraqi targets and more than 5,500 records. Most (but not all) ground and electronic order-of-battle targets attacked during Desert Storm did not appear in the AIF.

[3]See Table 5; source: BH, Master Target Folder, Box 2, Folder 23. Note that targets were not removed from the working target lists even when they had been effectively destroyed.

As Figure 27 illustrates, there was some growth in all eight of the core target categories during the forty-three-day conflict. In some cases this growth was substantial; the CCC and RR categories, for instance, both grew by factors of about 2.6 from 15 January to 26 February 1991. However, even growth of this magnitude should not necessarily be taken to reveal failures in intelligence or planning. The potential for concealment and deception by the enemy, coupled with the inevitable limits to friendly intelligence collection in any finite amount of time, mean that some things inevitably will be missed. At the same time, combat itself will generate additional targets due to such developments as changes in friendly objectives, interactions between the opposing forces, and enemy efforts to protect and reconstitute key capabilities. So the target-set growth evident in Figure 27 does not necessarily provide evidence of intelligence or planning failures at the outset of the Coalition's air campaign.

Figure 28
Core Target Categories and Iraqi Power[4]

Leadership	Key Production	Infrastructure	Population	Fielded Forces
·Leadership (L)	·Electricity (E)	·Railroads & Bridges (RR)		·Scuds
·Telecomms & C^3 (CCC)	·Oil (O)			
	·Nuc/Bio/Chem (C)			
	·Military Research, Prod. & Storage (MS)			

[4]This chart has been taken from a postwar briefing on the planning and execution of the Gulf War air campaign by Lt Col Deptula, who was Gen Glosson's chief planner for Iraqi targets in the Special Targeting Group during Desert Shield and directed the strategic-target planning cell during Desert Storm. Earlier versions of this slide, which correlate the elements of Iraqi power with specific target categories, can be found as far back as the Air Staff's Instant Thunder briefing, given by Col John A. Warden to Gen H. Norman Schwarzkopf and Charles Horner on 17 and 20 August 1990 respectively (see XOXWF, "Iraqi Air Campaign Instant Thunder," JCS-approved version, 17 Aug 1990, copy 10, viewgraph 6). The only notable discrepancy between the August 1990 and postwar versions is that the former specified railroads only under the infrastructure heading.

The connections intended by Coalition air planners and commanders between the eight core target sets and the presumed pillars of the Iraqi military power are depicted in Figure 28. The political-military leadership organs of Saddam Hussein's government, together with its associated means of national command and control, were viewed as comprising the "central nervous system" of the Iraqi regime, especially of its military power. This "central nervous system," as the "political center of gravity" of the Iraqi regime, was seen by at least some of the air planners as offering the quickest and cheapest way of achieving the Coalition's objectives.[5] Next in proximity to the center of Iraqi power came key industrial elements such as the electric-power system, facilities for the production and storage of refined petroleum products, and advanced weapon facilities such as those related to Iraq's nuclear-bomb program. Supporting both Iraqi industry and military operations was the country's transportation infrastructure, whose key elements were identified as railroads and bridges. Beyond infrastructure came Iraq's population and agriculture, and furthermost from the center of Iraq power came the country's fielded military forces. In light of this understanding of the elements of national power, the Desert Storm air planners structured their strategic air campaign against Iraq itself around a selection of "vital" or "key" elements in the country's leadership, industry, infrastructure, and fielded forces. Of the five broad components of national power, only the Iraqi population was not made a direct target of bombing. From President George Bush on down, there was widespread agreement from the outset of the planning process that directly attacking the people of Iraq or their food supply was neither compatible with U.S. objectives nor morally acceptable to the American people, whose support was felt, in light of the Vietnam experience, to be essential to the war effort.[6] Thus, the Coalition's "targeting" of the will of Iraq's civilian population was limited, for the very best of

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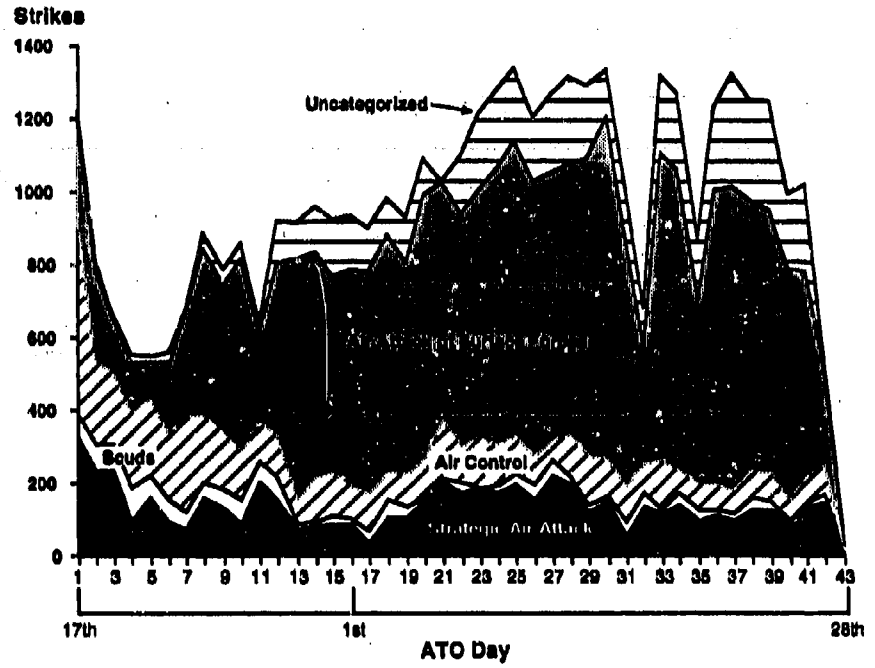
[5]Col John A. Warden, III, *The Air Campaign: Planning for Combat* (Washington, DC: National Defense University Press, 1988), pp 10, 40-5, 53-4, and 138-9.

[6]Intvw, GWAPS with Maj Gen Buster C. Glosson, 9 Apr 1992. Gen Glosson was first apprised of President Bush's desires regarding the Iraqi people in late August of 1990 when he began discussing the possible objectives of an offensive campaign against Iraq with Lt Gen Charles A. Horner. As Gen Horner later recalled: "The President told us all along, limit the loss of life–on both sides. From the first time I briefed him in August [1990] we talked about that. It was an obsession with him." (Barry Shlachter, "A U.S. General Assesses the War After One Year," *Ft. Worth Star-Telegram*, 17 Feb 1992, p 15)

reasons, to psychological operations and indirect effects stemming from the bombing of other core target categories.

Figure 29
Coalition Air-to-Surface Strikes[7]



Source: GWAPS Missions Database, 9 Dec 1992. This chart shows coalition air-to-ground strikes by day (including TLAMs, F-4Gs, and F/A-18 HARM shooters). Sorties that flew but did not deliver any ordnance (due to weather, maintenance problems, etc.) were omitted. An F-111F that dropped four GBU-12s on four separate vehicles in the KTO counted as four strikes; an F-16 delivering unguided ordnance on a single target counted as one strike. No air-to-air sorties are included. The majority of the uncategorized air-to-ground strikes (some 5500) were flown by A-10s, AV-8Bs, or Marine F/A-18s and were predominately against Iraqi ground forces in the KTO.

[7]This figure shows air-to-surface *strikes* in the sense of sorties that actually dropped ordnance on discrete aimpoints. Strikes, once again, can differ from sorties in two ways. A combat air-to-ground sortie that, for whatever reasons, did not release any ordnance on any target would not be reflected in strike counts (that is, it would count as *one sortie* but *zero strikes*). On the other hand, a single combat air-to-ground sortie on which an aircraft like an F-111F or F-15E dropped on, say, three distinct aimpoints during the mission would count as *one sortie* but *three strikes*. Note that the apparent drop in strikes shown in Figure 29 from ATO Day 1 to ATO Day 2 is mainly due to the fact that the war began at night and ATO Day 1 included two nights' worth of operations.

Since the eight core target sets contain the majority of the targets in the Black Hole's master target list with "BE numbers" (Basic Encyclopedia numbers), it may be natural to assume that they consumed the majority of the Coalition's efforts in the air during the Gulf War. Figure 29 shows that, in reality, the eight core target categories (Scuds plus the seven shown as Strategic Air Attack[8]) were a relatively small portion of the total strikes/sorties. In fact, they made up around 15 percent of the total air-to-surface strikes recorded during Desert Storm. Moreover, this percentage overstates the Coalition's daily and cumulative allocation of overall air effort to the eight core strategic categories because it does not take into account pure air-to-air sorties for tasks such as escort of strike packages, offensive fighter sweeps, and combat air patrol, much less combat-support sorties such as air-refueling sorties by tankers or command and control sorties by platforms like the E-3A AWACS (Airborne Warning and Control System) or EC-130 ABCCC (Airborne Command, Control, and Communications). It should be understood at the outset, therefore, that the portion of the Desert Storm air campaign that will be the focus of the present chapter constituted a relatively small fraction of the overall effort mounted by Coalition air forces over the forty-three days of the war.

Before turning to the effectiveness of Coalition air power against particular core categories, there are some further contextual points that warrant mention. First, it should be realized that the target categories used by the Black Hole were not, in general, homogeneous groupings of targets. For example, the Al Karakh telephone switching facility in downtown Baghdad was assessed to be perhaps the most important telecommunications facility in Iraq, and, as would be expected, was put in the telecommunications/C^3 category (CCC28) by the Desert Storm air planners.[9] The second most important telephone exchange in the country was

[8]In Figure 29, strikes against Scuds have been broken out separately from the other seven core target categories (L, CCC, C, MS, SC, O, E, and RR) because it seems more consistent with the historical functions of air power discussed in the introduction to group them under control of the air. For purposes of this chapter, the Scud category will be subsumed under strategic air attack on the grounds that this grouping more closely reflects the perspective of the operational air planners and commanders during the war. Figure 29 enables to the reader to adopt either perspective.

[9]BH, Master Target Folder, Box 2, Folder 23.

Table 22
Examples of Core Target Categories

Leadership (L):

- Presidential residences and palace
- National command and control bunkers
- Ba'ath party headquarters
- Presidential and VIP bunkers
- Government ministries
- Secret police headquarters

Telecommunications/C^3 (CCC):

- Radio relay facilities (RADRELs)
- Telephone exchanges
- Corps headquarters
- Fiber-optic repeater stations
- Satellite receiving stations
- TV, radio stations
- SIGINT and DF facilities
- Ground force command posts
- Barracks

Nuclear/Biological/Chemical (C):

- Nuclear research facilities
- CW or BW bunkers (often at airfields)
- Missile solid-propellant factory
- CW or BW research facilities
- CW or BW production facilities

Military Support, Production, and Research (MS):

- Ammo maintenance and storage
- Army barracks
- Corps logistics sites
- Logistics and transportation facilities
- Tank, artillery, AFV repair
- Fuse factory
- Ammo production plants
- Rocket motor test facility
- Scud production facility
- Fuel depots
- SAM support/storage/training facilities
- Bomb assembly plant

Scuds (SC):

- Scud sites (mostly at airfields)
- SRBM support or launch complexes
- Culverts and SRBM revetments
- Fiber-optic repeater stations

Electricity (E):

- Power generation plants
- Transformer stations

Oil (O):

- Refineries
- SAM support facility
- Fertilizer plants
- Pumping station

Railroads and Bridges (RR):

- Railroad yards
- Ferries
- Rail and highway bridges
- Pontoon bridges

the so-called AT&T building, also located in downtown Baghdad. However, the air planners put this target in the strategic air defense category (SAD31).[10] So even though descriptive labels like "strategic air defense" and "telecommunications/C^3" are, for the most part, broadly indicative of the majority of the targets in particular target categories, many of the core categories turn out to be, as Table 22 indicates, rather mixed or diverse collections. For example, targets that could be plausibly categorized under command, control, and communications (C^3) can be found in two of the core categories in Table 22 in addition to CCC, and almost all of the SAD category discussed in Chapter 3 could be considered C^3. Of course, most of the SAD targets were attacked more to achieve control of the air than to paralyze the Iraqi leadership. Furthermore, leadership targets remained a high priority of the Black Hole air planners right to the last day of the campaign, whereas, after the first week, strategic air defenses became a target of lower priority.

Next, there are some natural groupings among the eight core target categories suggested by the purposes for which they were chosen and attacked. The primary groupings, which will be the subjects of the next three sections, are:

- Leadership and Telecommunications/C^3 (L and CCC)
- Electricity and Oil (E and O)
- Nuclear/Biological/Chemical and Scuds (C and SC)

These groupings can be linked to some of the specific political objectives, constraints, and military objectives that structured Operation Desert Storm (see Table 23). As explained in Chapter 2, military objectives M1 and M4 were the ones that most directly connected with the L, CCC, C, SC, E, and O target categories, as well as with portions of the MS and RR target sets. Attacking leadership and telecommunications/C^3 (L and CCC) was seen by the planners and commanders as the most direct way to affect the ability of the Iraqi regime to control the country and its military forces, electricity and oil (E and O) were perceived as disrupting the ability of Iraq and its military forces to function, and eliminating Iraq's potential and existing capabilities for using weapons of mass destruction (C and SC)

[10]Checkmate Intelligence Target Files, CIT folder #684, "Baghdad AUTO MPUR-RADREL TERMINAL."

was directly relevant not only to defeating Iraq militarily but to minimizing its long-term threat to the Gulf region after the conflict.

Table 23
Desert Storm Objectives and Constraints[11]

Political Objectives:

- P1. The complete, immediate, and unconditional withdrawal of Iraqi forces from Kuwait
- P2. Restoration of Kuwait's legitimate government
- P3. Protection of American Citizens abroad
- P4. Promoting the security and stability of the Persian Gulf

Additional Constraints:

- C1. Minimize Coalition casualties and collateral damage from military operations
- C2. Discourage Israeli military involvement

Resulting Military (Operational Campaign) Objectives:

- M1. Attack Iraq's political-military leadership and C^2 (command and control)
- M2. Gain and maintain control of the air
- M3. Cut Iraqi supply lines
- M4. Destroy Iraq's chemical, biological, and nuclear capabilities
- M5. Destroy Republican Guard forces in the KTO
- M6. Liberate Kuwait City with Arab forces

This organizational approach omits explicit discussion of two of the eight core target categories: military research, production, and support (MS), and railroads and bridges (RR). The omission was intentional. Portions of RR and MS were covered in Chapter Four (air interdiction of Iraqi lines of communication and military support in the KTO) and the remaining portions can readily be subsumed under the other six target categories. For example, Scud-related targets in MS seem best viewed as

[11] DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, (Washington, DC: Government Printing Office, Apr 1992) pp 31, 73, 93, 98, and 100; also see Sections 2-1 and 2-2 in Chapter 2.

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part of the SC target category. Similarly, bridges in downtown Baghdad, attacked in hopes of cutting fiber-optic cabling that was believed to link the Iraqi leadership to mobile Scud units, can be subsumed under L or SC. Therefore, separate discussions of MS and RR did not appear warranted.

Lastly, it should be emphasized that the three groupings that will occupy the bulk of this chapter–(1) L and CCC, (2) E and O, and (3) C and SC–cannot be considered isolated compartments devoid of connections to one another, as well as to other target categories such as strategic air defenses or the Republican Guard units in the Kuwait theater. Granted, attacking the residences and command facilities occupied by Iraq's national leaders can be viewed as a more direct way of achieving the first political objective in Table 23 than shutting down the country's electric power grid. But there are also subtle ways in which attacks on either of these target categories reinforced the effectiveness of attacks on the other. For instance, bombing Saddam Hussein's known residences on the first night of the war undoubtedly prompted the Iraqi leader to begin operating from more secure, alternative locations, thereby making tight, effective command and control all the harder to sustain. At the same time, power-outages, by forcing command and control systems throughout the country onto back-up power, tended to make the necessary communications more difficult and less reliable than normal. So while much can be said about the effects of Coalition air power on each of these three target-category groupings in isolation, trying to judge overall effectiveness in isolation is much more questionable. It is primarily for this reason that conclusions about the *overall* effectiveness of air power against the eight core target categories will be deferred to the end of the chapter.

Leadership and Telecommunications/C^3

Reaching defensible judgments about the effectiveness of Coalition air attacks on Iraq's national leadership and telecommunications/C^3 is especially sensitive to the choice of measures. Unfortunately, there remains some ambiguity as to the specific, concrete aims for which these target categories were attacked by Coalition air forces during Desert Storm.

As was suggested in the previous section, the basic idea behind attacking the two leadership target categories–L and CCC–was to disrupt, to the greatest extent possible, the "central nervous system" of Saddam Hussein's Ba'thist regime. Toward this end, the various governmental

facilities–official residences, government ministries, and command and control bunkers–used by Saddam and his close associates to rule the country, maintain control over the people, and direct military operations were selected as one "central nervous system" target category (labeled L for leadership). The various means of communication by which the Ba'thist leaders communicated with one another, the Iraqi people, the Iraqi military, and the outside world–redundant coaxial and fiber-optic landlines for voice and data, TV and radio stations,[12] microwave radio relays, associated switching facilities (many of which were computerized), and satellite communications stations–were identified as a second leadership target category (labeled CCC for telecommunications/C^3). Given the brutal nature of both the Iraqi regime and its seizure of Kuwait, it made considerable military and political sense to specify, as a military objective of Coalition forces, attacks on these two target categories. Attacking them would directly threaten those most responsible for the occupation and pillaging of Kuwait. At the same time, Coalition air planners reasoned that if the ability of Saddam Hussein and his close associates to exercise close, top-down control of Iraq's military forces could be eroded, the Iraqi regime would find it increasingly difficult to react effectively to Coalition initiatives or to pursue coordinated military operations.

These general expectations, though, do not go very far toward identifying the precise benchmarks against which the effectiveness of Coalition attacks on the L and CCC target categories should be assessed. If, for example, the aim was merely to *attack* Iraq's national leadership and telecommunications/C^3, then Coalition air power was obviously successful in the trivial sense that sorties were flown against these target categories during the war. But more than the logging of air-to-surface sorties was expected from these attacks, and to assess effectiveness it will be necessary to clarify how much more was expected by Coalition air planners and commanders.

A moderate interpretation would be that the more specific aim of attacks on the L and CCC categories was the functional disruption and dislocation of the Iraqi government rather than its complete destruction. The primary effects sought would have been more psychological and

[12]Radio stations could not only be used to rally the Iraqi populace but were correctly assessed by Coalition intelligence to be a conduit for triggering Iraqi agents abroad to initiate terrorist attacks.

functional than physical. By attacking Hussein's known residences and command bunkers on the opening night of the war, as well as government ministries and national C^3 facilities, key members of the Iraqi regime would experience the psychological shock of being the target of accurate bombing; some of them at least would also be forced to relocate and to reconstitute their activities, command, and control through backup systems.

More ambitious interpretations of the aims behind attacking both L and CCC are possible. Consider, first, the L category. A more ambitious reading of the purpose behind attacking this target set would be that the air planners hoped to kill Saddam Hussein, thereby encouraging a major change of the government in Baghdad and policy regarding Kuwait.[13] This more ambitious aim–the "decapitation" of Saddam Hussein's dictatorship leading to a change of government–was proposed by Brig. Gen. Buster C. Glosson's Special Planning Group in mid-September 1990.[14]

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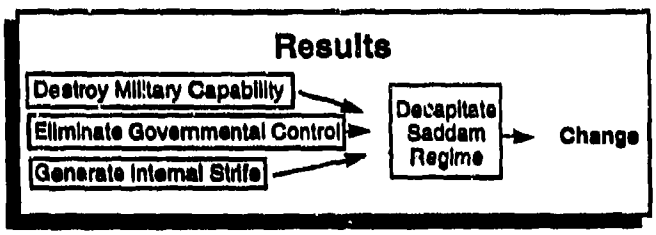
[13]While the international law of war tries to strike a delicate balance between humanitarian ideals and the national-security interests of belligerents, it "recognizes that the business of the military in war is killing people and breaking things" (W. Hays Parks, "Linebacker and the Law of War," *Air University Review*, Jan-Feb 1983, p 26). Since the law of war recognizes governmental "organs for the direction of administration of military operations" as a legitimate military objective (or target), it did not prohibit Saddam Hussein in an Iraqi command post or official residence from being a legitimate target of attack for Coalition air forces during Desert Storm [International Committee of the Red Cross, *Commentary on the Additional Protocols of 8 June 1977 to the Geneva Conventions of 12 August 1949*, eds Yves Sandoz, Christophe Swinarski, and Bruno Zimmermann (Geneva: Martinus Nijhoff Publishers, 1987), note 3, pp 632-633]. See Department of the Air Force, *International Law–The Conduct of Armed Conflict and Air Operations*, Air Force Pamphlet 110-31, 1976, especially Chapter 5. The key factor in whether something can be designated a legitimate military objective and, as a result, a target for aerial bombing is whether it makes "an effective contribution to an adversary's military action" (*ibid*, p 5-9).

[14]BH, Box 3, Fold 4, Gen Glosson Briefs, Tab 1, 13 Sep 1990 Brief to CJCS, viewgraph 17. The viewgraph in question is reproduced below:



By the time the offensive air campaign was briefed to President Bush on 11 October 1990, the notion of literally decapitating the Iraqi leadership had evolved into the twin aims of *destroying* its command and control and *disrupting* its ability to communicate with the Iraqi people.[15] The guidance that General Glosson carried away from the October 1990 briefing was that the president did not support trying to kill Saddam Hussein overtly.[16] Furthermore, upon reflection the air planners realized that making Saddam's death an explicit or major objective of the air campaign would run a high risk of failure. To minimize the possibility of assassination, it was thought that even before the Gulf War Saddam Hussein habitually stayed on the move, conducting state affairs from a variety of locations, seldom sleeping at any one place more than a few times in a row, and occasionally changing his location in the middle of the night. So decapitation per se was thereafter submerged as an explicit aim of attacks on the L targets.

There was a parallel in CCC target category to decapitation in the L category: namely, to sever completely communications between Baghdad and Iraq's military forces in the Kuwait theater. Like eliminating Saddam Hussein, completely severing communications between the Iraqi general staff and Iraqi divisions in Kuwait was a tall order for two reasons. First, the communications systems available to the Iraqis were modern, computerized, and highly redundant. They included, among other elements, the following:

- Coaxial landlines running parallel to the Tigris and Euphrates rivers from Baghdad to Al Basra in the south, extending westward from Baghdad toward Jordan, and connecting the capitol with Mosul in the north;

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[15]BH, Box 3, Folder 4, Gen Glosson Briefs, Tab 2, 11 Oct 1990 Brfg to the President, viewgraph 14.

[16]Intvw, Gen Glosson, 9 Apr 1992. Glosson's recollection, assisted by his personal notes from the war, was that President Bush had clearly stated that removing Saddam Hussein could not be an objective (*ibid*).

- Fixed and mobile microwave radio relays paralleling and backing up the coaxial landlines; and

- Fiber-optic lines, running south from Baghdad along the strategic oil pipeline through Al Basra into KTO, that linked all the major nonmilitary governmental organizations, went to selected military headquarters, and could be tied in with the coaxial lines.

Completely cutting a communications system this redundant and flexible would have been difficult under the best of circumstances. But the circumstances were far from ideal, and even a small fraction of the Iraqis' prewar capability left intact could be expected to suffice for the direction of a largely static field army dug into defensive positions. Secondly, given the prospect of monitoring Iraqi signals traffic, it would not necessarily have been militarily advantageous to cut all communications links between Baghdad and the Kuwait theater, particularly prior to the beginning of the ground war. Here, too, dislocation and disruption, rather than destruction, would appear to have been the more reasonable goal for Coalition air attacks on the CCC target category.

This conclusion can be reinforced by noting that even though the U.S.-led Coalition managed to achieve one of the most lopsided and comparatively bloodless military triumphs in modern history, Coalition air forces did not succeed in toppling Saddam Hussein or completely severing his communications with the Kuwait theater or the Iraqi people during the forty-three-day campaign. Saddam Hussein survived not only the war itself but, in its immediate aftermath, retained enough military power to quell Kurdish and Shiite uprisings in the north and south. Moreover, radio broadcasts to the Iraqi people continued throughout the war[17] and, on 25 of February, 1991, Saddam was apparently able to

[17]Bob Simon, the television reporter who spent forty days in various Iraqi prisons around Basra and Baghdad during Desert Storm, reported that he routinely overheard Iraqi guards listening to Saddam Hussein giving speeches over what he referred to as Radio Baghdad; specific occasions that sparked speeches were the Iraqi "victory" at Al Khafji, the start of the ground war, and the ceasefire [Bob Simon, *Forty Days* (New York: G. P. Putnam's Sons, 1992), pp 71, 94-95, 199, 209, and 218].

communicate a general withdrawal order to his ground forces in Kuwait.[18] So accepting the ambitious aims of decapitation and destruction as measures of effectiveness against the L and CCC targets entails the paradoxical assessment of complete failure by Coalition air power against two supposedly key target systems during one of the most successful campaigns in history. Consequently, it seems more sensible to view these aims as ones that, while understandably hoped for and possible, largely lay beyond the reach of what Coalition air power could reliably guarantee given the law of war and additional constraints under which its air forces operated during Desert Storm.

How effective were Coalition air forces in disrupting or dislocating Iraqi leadership and telecommunications/C^3 with attacks on the L and CCC targets? Before we can begin to answer this question it seems best to look in more detail at the efforts Coalition air forces made against these two target categories over the course of the Gulf War.

The total numbers of Coalition strikes, precision as well as non-precision, against the L and CCC target categories during Desert Storm, are shown in Figure 30. Since the number of CCC targets was roughly triple the number of L targets by the end of the war (see Figure 27), the strikes-per-target level of effort against L was about 60 percent greater than on CCC, even though the CCC category received about twice as many strikes/sorties in absolute terms. This heavier per-target emphasis on L becomes even more pronounced if precision strikes by F-117s, F-111Fs, Tomahawk land-attack missiles (TLAMs), and conventional air-launched cruise missiles (CALCMs) are compared for the two target sets.

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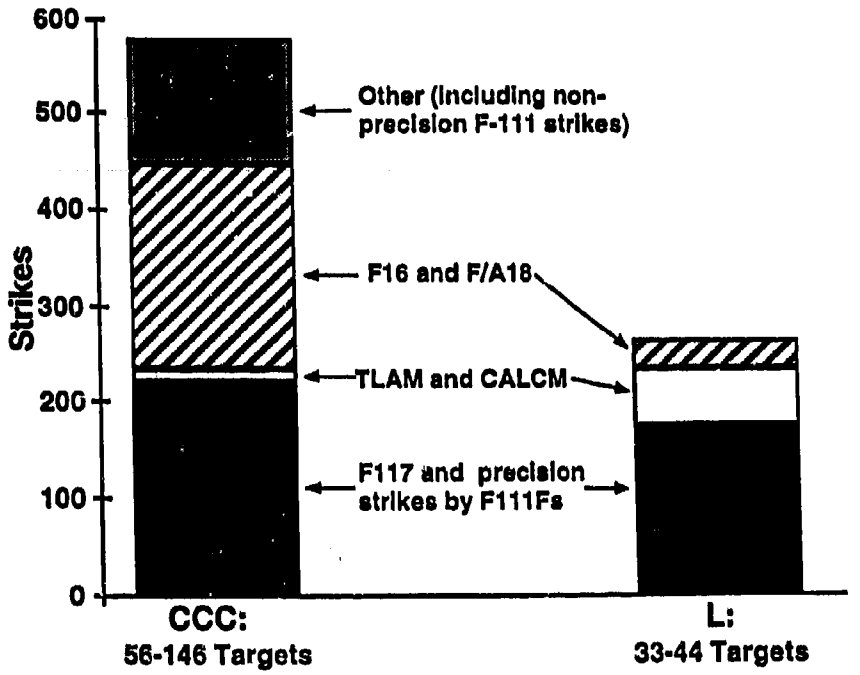
[18]GWAPS microfilm collection, TACC Log, Roll 10263, entry for 25 Feb 1991, 2100Z, III Corps Withdrawal.

Figure 30
Total Strikes Against L and CCC during Desert Storm

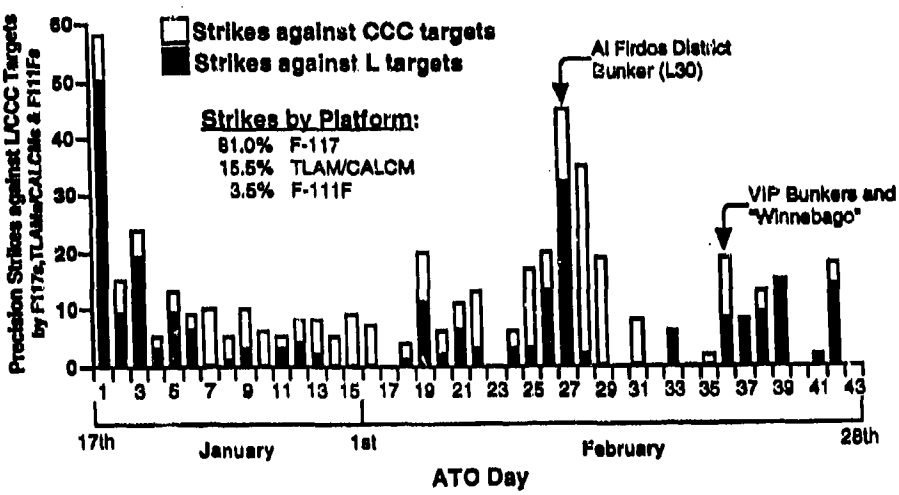


Source: GWAPS Missions Database, Oct 1992.

The vast majority of the precision strikes against the L and CCC target categories was carried out by F-117s dropping laser-guided bombs. Given the hardness, small size, and location of many of the targets involved, primary reliance on the F-117/GBU-27 combination would appear to make considerable sense. Hardened facilities could only be usefully attacked with munitions like the GBU-24A/B and GBU-27, whose I-2000 (or BLU-109) warhead had been designed to penetrate such structures. Large targets like the Al Karakh telephone switching facility in downtown Baghdad (CCC28) were certainly vulnerable to attacks by platforms like F-16s or F/A-18s carrying unguided bombs. However, the air defenses

in downtown Baghdad, as well as the likelihood of collateral damage, made systems such as the F-117 and TLAMs far better choices. Finally, although significant numbers of F-16 and F/A-18 sorties were flown against CCC targets, especially in the Kuwait theater, these platforms did not always have the needed precision. Fiber-optic relay stations offer a case in point; only a precision-guided weapon or a lucky hit against the below-ground junction box really effected a cut in the fiber-optic line. So even if strikes against these relay stations with unguided bombs succeeded in completely destroying the above-ground structures, the fiber-optic line often remained intact unless cut with precision munitions.

Figure 31
F-117, TLAM, CALCM, and F-111F
Precision Strikes Against L and CCC Targets



Source: GWAPS Missions Database.

Figure 31 shows the day-by-day strike totals by F-117s, F-111Fs dropping precision-guided munitions, TLAMs, and CALCMs over the course of the forty-three-day campaign against the L and CCC target sets. Note that the majority of the seventy-five cruise missiles (TLAMs and CALCMs) employed against these targets were expended during the opening days of the air campaign. In fact, over 60 percent of the cruise missiles expended against these two target categories were TLAMs that attacked L targets

during the first three days.[19] What this "front-loading" of cruise missiles confirms is that the hope of Coalition air planners of striking a paralyzing blow against the Iraqi leadership and its telecommunications/C^3 at the outset of the air campaign was largely predicated on the capabilities of the F-117 and unmanned cruise missiles to begin hitting the most important L and CCC targets prior to the establishment of traditional air superiority.

Figure 31, then, provides an overview of the heart of Coalition's air efforts against the L and CCC target categories by focusing on the chronological flow of precision attacks against these targets. The peak effort against Iraqi leadership and its means of communication occurred on Air Tasking Order (ATO) Day 1 (which, again, included the first two nights of air operations against Iraq), with the bulk of the strikes over the first six days falling on L targets. Over the second and third weeks, L targets received less emphasis. CCC, by contrast, got a smaller but steady number of precision sorties over the first three weeks. The level of effort against CCC picked up during the fourth week, only to be followed by a more sporadic pattern for the rest of the conflict.

The climax of the effort against the L target category came toward the end of Desert Storm's fourth week. ATO Days 24-27 saw renewed interest in this target category in the Black Hole. However, the F-117 strikes against the Al Firdos district bunker in downtown Baghdad, which were scheduled as part of ATO Day 27 but actually occurred in the early morning hours (Riyadh time) of 13 February 1991, precipitated a significant tightening of higher-level control over strikes in Baghdad generally and against leadership targets in particular.[20]

The Al Firdos bunker was one of ten secondary leadership bunkers located in the suburban areas of Baghdad. It was located in the Ameriyya section of Baghdad east of the Tigris river, was about 40 meters on a side, had two levels (one above ground and one below), and

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[19]GWAPS Missions Database, Daily Black Hole Counts by "A/C Type," as of late Aug 1992. The last expenditure of a cruise missile against an L or CCC target occurred on ATO Day 15 when two CALCMs were employed against a CCC target (*ibid*).

[20]SMsgt Harold P. Myers and SMsgt Vincent C. Breslin, "Nighthawks over Iraq: Chronology of F-117A Stealth Fighter Operations, Desert Shield and Desert Storm," History Office, 37th Fighter Wing, Special Study 37FW/HO-91-1, 9 Jan 1992, p 26.

was believed to be capable of sheltering about 1,400-1,500 people.[21] The precise role of these facilities was unknown when the war began, they were believed to be hardened against chemical or nuclear attack and capable of functioning as command and control facilities.[22]

None of these bunkers was hit during the opening weeks of the war because they were not thought to be in use.[23] [DELETED].[24] Various delays, including weather, prevented its being struck until the early hours of 13 February.[25] Unknown to Coalition air planners, the upper level of the bunker was, according to the Iraqis, being used at night by families, and the destruction that resulted from the facility being hit by two GBU-27s, both aimed at the same point on the bunker's roof by different F-117s, was reported that morning over CNN (Cable News Network) to have caused hundreds of civilian casualties.[26] Iraqi sources claimed that 200-300 civilians, including over 100 children, died in the bunker[27] and

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[21]GWAPS, Checkmate Target Intelligence Folders, CIT Folder 314, Al Firdos District Bunker.

[22](S/WN/REL UK) Msg, DIA to CENTAF, dtg 011805Z Feb 91, subj: Response to RII-1905, Command Bunkers in Baghdad; also see faxed memo from R Adm Mike McConnell, JCS/J2 to Brig Gen Leide and Brig Gen Glosson, subj: DIA Assessment of Leadership Facilities, 8 Feb 1991 (BH, Box 2, Folder 24, Intel/Tgt Info #1).

[23]As late as 31 January 1991, Checkmate analysts characterized the ten bunkers as "secondary leadership targets" (Additional Leadership Targets List, message from Checkmate to the Black Hole, 311730Z Jan 91; BH, Box 2, Folder 24, Intel/Tgt Info #1).

[24](S/WN) DIA, *Desert Storm Intelligence Bulletin*, "\Possible C3 Bunker Activated (63-91), as of 080330Z Feb 91 (BH, Box 2, Folder 24, Intel/Tgt Info #1).

[25]Intvw, GWAPS with Lt Col David Deptula, 20 and 21 Dec 1991.

[26]Msg, Checkmate to Black Hole, subj: Additional Leadership Targets List, 311730Z Jan 91 (BH, Box 2, Folder 24, Intel/Tgt Info #1, p 3); GWAPS Missions Database for ATO Day 27. The surviving records on L targets in the Intelligence/Target Information folders used by Lt Col Deptula during the war, as well as comments recorded at the time in the TACC and Gen Horner's daily briefings, all confirm this account of how and why the Al Firdos district bunker came to be struck. It was a legitimate military target and Coalition planners had no indications prior to seeing poststrike television coverage over CNN that it had been occupied by civilians.

[27]Middle East Watch, *Needless Deaths in the Gulf War* (Washington, DC: Middle East Watch, 1991), pp 128-129.

were quick to exploit the human tragedy of what had happened. In the wake of dramatic television coverage, the U.S. media soon advocated that further Coalition bombing of targets in Iraqi cities should be curtailed. For example, *The New York Times* editorialized the day after the Al Firdos bunker was hit that it would henceforth "make sense" to limit Coalition bombing "to purely military targets, like enemy troops, tanks and artillery dug in on the battlefield in Kuwait."[28] As Figure 31 indicates, the perceived pressure created by the Iraqi's prompt exploitation of the Western media produced a sharp reduction in Coalition airstrikes against L targets over the next week. Among other changes, General Schwarzkopf thereafter felt compelled to review personally any targets selected for air attack in downtown Baghdad.[29] Consequently, it was not until the final week of the war that air planners in the Black Hole were able to resume their efforts, begun during the fourth week of the war, to "finish off" the L targets. While the degree to which the theater commander's insistence on reviewing all targets in downtown Baghdad complicated or deferred subsequent air operations was modest by comparison with the Rolling Thunder period of the Vietnam war, the net result was a classic illustration of unintended, disproportionate consequences arising from a pair of seemingly routine airstrikes.

Also evident in Figure 31 is the fact that, as late as ATO Day 36, sorties were still being directed against locations at which Saddam Hussein might be present. The best opportunity to have eliminated the Iraqi dictator may well have been on the first night of the war when a number of L targets were struck. But in keeping with the decision against making Saddam Hussein per se an overriding priority of the air campaign, only the more likely locations were covered the first night, usually with a single

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[28]"Damage Control–and Real Damage," *The New York Times*, 14 Feb 1991, p A26.

[29]Intvw, GWAPS with Lt Col David Deptula, 20 and 21 Dec 1991. Deptula's personal notes from the war confirm that Gen Glosson was instructed by Gen Schwarzkopf on 13 February 1991 to begin showing him all targets selected for attack in downtown Baghdad prior to their being struck.

precision munition.[30] So the first night's effort was less than all out, which underscores the earlier judgment that the primary aim of attacking L targets was to dislocate the functioning of Saddam Hussein's regime.

The four F-111F sorties sent against "VIP" (very important person) bunkers and Wanderlodge mobile command posts suspected of being used by Saddam Hussein on ATO Day 36 were, by that stage of the war, a long shot. Still, occasional strikes against such targets, whenever intelligence on Saddam Hussein's possible location was available, did serve to keep the pressure on the Iraqi leader.

Turning to telecommunications/C^3, the initial focus against this target category was the center or core of Iraq's national-level command, control, and communications. As the war progressed, the focus of Coalition attacks moved further and further toward the periphery of Iraqi telecommunications.

Precision strikes against command and control centers (CCC) targets during the opening days of the war concentrated on telephone exchanges, television and radio transmitters, and microwave-relay facilities. The targets on the first couple of nights were mostly in Baghdad or other major Iraqi cities. Over the next few nights, the F-117s in particular began shifting to similar targets along the communications routes leading south and west from Baghdad.

The initial targeting strategy concentrated on communications switching facilities. Because much of Iraq's telecommunications system had been built by Western firms, fairly precise information was available to air planners in the Black Hole. The multistory Al Karakh telephone-exchange building in Baghdad is a good case in point. Hit by F-117s on ATO Days 1 and 5,[31] poststrike reconnaissance eventually confirmed destruction of the building's distinctive minaret microwave tower as well as one quadrant of the upper two floors.[32] The damage had been pur-

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[30]GWAPS Missions Database, ATO Day 1 as of 21 Sep 1992; times on targets cross-checked with CAFMS ATO Database.

[31]GWAPS Missions Database.

[32]Checkmate Target Intelligence Folders, CIT Folder #140, Baghdad MPUR Exchange Al Karakh PTT.

posely focused in these areas because the air planners knew that the switching equipment was on the top two floors.[33]

Notwithstanding the precision and lethality of these initial attacks, however, by the end of the second week of the war it had become increasingly evident to Coalition air planners and intelligence analysts that Iraq's national-level telecommunications system had not collapsed as a result of attacks on central switching facilities and microwave relays.[34] The system turned out to be more redundant, and more able to reconstitute itself, than was foreseen prior to 17 January 1991. Fiber-optic networks and computerized switching systems in particular proved tougher to put out of action than had been anticipated. As a result, a good part of the story of targeting against CCC for the rest of the war consisted of a widening search for other elements in the system that might add enough additional damage to break Iraq's secure landline communications, thereby forcing the national leadership and military units to shift to more vulnerable and exploitable systems such as R-404 mobile microwave relay vans. Increasingly, the air planners began looking for and attacking lower-level elements, such as cable vaults underneath microwave relay towers along the strategic oil pipeline extending into the Kuwait theater. Indeed, new CCC targets, aimed at finally isolating Baghdad from the KTO, were still being proposed in the week immediately preceding the ground campaign.[35] When combined with the explosion of ground-force command and control targets that inevitably occurred as G-Day approached and the growing focus of Coalition intelligence on Iraqi ground forces in Kuwait, the search for the last "straws" in Iraq's national telecommunications/C^3 that would "break the camel's back" goes far to explain the growth of the CCC category from 56 targets to nearly 150 by the end of the war. A further complication was that, prior to the ground war, the much-anticipated Iraqi shift to radio communications, especially in the Kuwait theater, did not

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[33]DIA Brfg to GWAPS, 20 Feb 1992; Intvw, GWAPS with Lt Col Robert Eskridge, 24 Sep 1992.

[34](S) Memo, Lt Gen Thomas W. Kelly, Director of Operations, JCS, to USCENTCOM/J-3, subj: Iraqi Backbone Telecommunications Vulnerabilities; also, handwritten note from Checkmate to the Black Hole, 28 Jun 1991 (GWAPS, BH, Box 2, Folder 24, Intel/Tgt Info #1).

[35](S) Memo, Brig Gen John A. Leide to Brig Gen Glosson, subj: Counter-C3 Strikes to Support Ground Campaign, 23 Feb 1991; (S) Adm Mike McConnell, JCS/J2, Proposed C3 Targets//Msg 5, 192000Z Feb 1991 (GWAPS, BH, Box 2, Folder 24, Intel/Tgt Info #1).

occur because of strict adherence by Iraqi commanders to communications-security doctrine that prohibited their use.[36]

Coalition attacks mounted against bridges in downtown Baghdad for the purpose of trying to sever telecommunications cables thought to be routed underneath bridge roadbeds illustrate the sorts of things that were eventually tried in order to sever Baghdad's secure landlines to the Kuwait theater. By late January, planners in the Black Hole had identified the Ahar and Al Jumhuriyya bridges in downtown Baghdad as carrying fiber-optic cables across the Tigris that, if cut, might disrupt Scud missile firings and help to isolate the national leadership.[37]

Weather impeded several early strikes against these two bridges, and it was not until the second week in February that F-117s finally managed to drop entire spans of both the Ahar and Jumhuriyya bridges. Decisions were made to prevent the other downtown bridges across the Tigris river from being dropped.[38] Doing so would not only have degraded the leadership's telecommunications links to other portions of the country but would have effectively cut the Iraqi capital in half. What operational or strategic effects this additional disruption could have been expected to have, beyond making life more difficult for the average Baghdadi, is unclear. In any event, decision makers in Washington appear to have concluded that these effects were not worth the adverse media publicity that a systematic attack on Baghdad's bridges would, in all likelihood, have produced.[39]

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[36]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, pp 151-52; also Adm McConnell, Proposed C3 Targets//Msg 8, 222255Z Feb 1991 (GWAPS, BH, Box 2, Folder 24, Intel/Tgt Info #1).

[37]37th Fighter Wing electronic database; Intvw, GWAPS with Lt Col Robert Eskridge, 23 Sep 1992; Intvw, GWAPS with Lt Col David Deptula, 24 Sep 1992.

[38]At least one other Baghdad bridge was damaged before the prohibition against further strikes on bridges in downtown Baghdad could be fully implemented.

[39]GWAPS could find no unequivocal documentary record of bombing restrictions emanating from Washington. The likely reason is that this sort of guidance, which probably consisted of emphasizing that targeting in Baghdad should henceforth be carefully reviewed, was communicated to the theater over STU III (secure) telephones.

The following week, Central Air Forces intelligence (CENTAF/IN) suggested to General Glosson that cutting the Sinek, Saddam, and University bridges in Baghdad might finally enable Coalition air strikes to isolate key communications centers in the Iraqi capital from the Kuwait theater by severing coaxial cables.[40] Coming after both the discomfort generated by media coverage of the dropping of the Ahar and Jumhuriyya bridges, as well as the tragic strike on the Al Firdos bunker, this suggestion was one that Coalition air forces were unable to exploit.

Given this overview of the Coalition's air efforts against the L and CCC target categories, how effective were the attacks on Iraqi leadership and telecommunications/C^3? Even by the final week of the campaign, the destruction and damage that was assessed to have been imposed on these two target sets was only partial. Figure 32 depicts the bomb-damage assessment prepared for the President and the Joint Chiefs of Staff (JCS) by JCS/J2 (Intelligence) to cover the day of the war designated 22/23 February 1991 in Washington. Though just before the beginning of the ground offensive, it reflects the judgment that some forty-five L and CCC targets were still "operational." Among other things, Saddam Hussein was still alive and in power, Scud launches had not ceased,[41] and, while the Iraqi leadership in Baghdad probably lacked the volume of communications and overall "connectivity" with the Kuwait theater necessary for the real-time direction of extended offensive operations against mobile Coalition forces, links to the Kuwait theater had, apparently, not been completely severed.

These facts suggest that while *some* disruption and dislocation had undoubtedly been imposed on the Iraqi leadership by the attacks on L and CCC targets, the regime's ability to function was neither paralyzed nor broken by the time the Coalition's ground offensive began on 24 February 1991. This assessment raises the obvious question: *How much* functional disruption and dislocation was achieved by the bombing of the government's key facilities and means of communication? Unfortunately,

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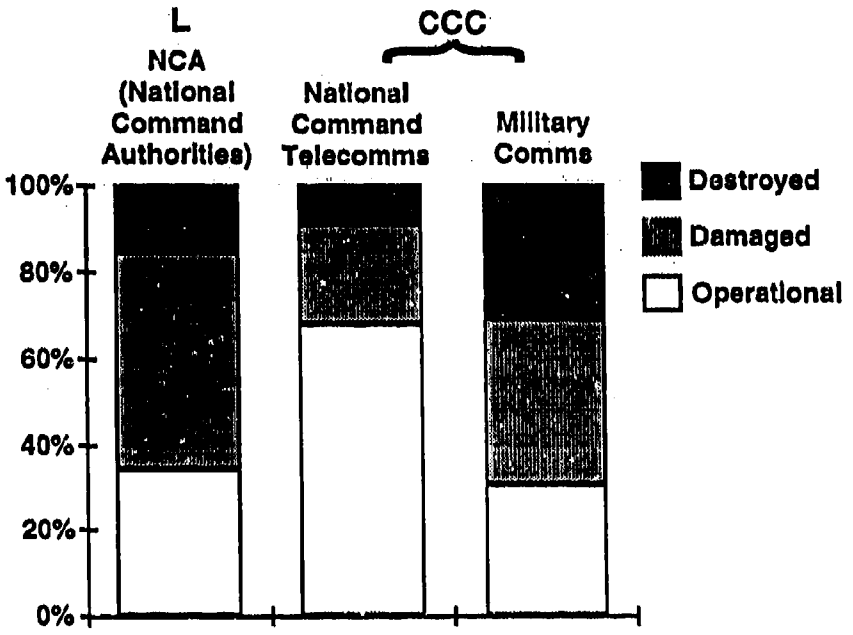
[40](S/NF) Memo, Brig Gen John Leide to Brig Gen Glosson, subj: Isolating Iraqi Comms in the KTO, 18 Feb 1991 (GWAPS, BH, Box 2, Folder 24, Intel/Tgt Info #1, p 2).

[41]The last Scud launches occurred on 25 February 1991 [(S) Defense Science Board (DSB), Office of Director of Research and Engineering, *Lessons Learned during Operations Desert Shield and Desert Storm* (for comment draft), May 1992, p 118].

Figure 32
JCS/J2 BDA Assessment for 22/23 February 1991[42]



the only response supported by the evidence is the unsatisfying, but unavoidable, answer that, in the absence of detailed information from the Iraqi side, a precise assessment of the extent of disruption and dislocation imposed by Coalition air strikes cannot be given.

Common sense, of course, would argue that the nearly 850 strikes carried out against L and CCC targets must surely have inflicted significant disruption and dislocation of the Iraqi government. Of the 480 strikes involving precision-guided munitions, most were conducted by F-117s.

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[42] J2 BDA Brfg to President and JCS, extracted from viewgraphs for 22/23 Feb 1991, GWAPS, NA 353. Note that the target totals used by JCS/J2 for this day's briefing were lower than those held by the Black Hole air planners at this stage of the war. This same viewgraph also showed some 16 "psychological" leadership targets as being operational.

Accurately hitting government ministries, command and control facilities, headquarters, and communications centers with 2,000-pound laser-guided bombs must surely have had considerable impact. Beyond the visceral fear of being killed or maimed that individuals in targeted facilities undoubtedly experienced, many elements of Saddam Hussein's government were forced to relocate and shift to back-up communications. For example, key elements of the Iraqi regime are thought to have relocated one or more times during the war, and some of their personnel are believed to have been killed by air attacks. And immediately after the war, not only did rebellions against Ba'thist rule break out among the Kurds in the north and Shiite Muslims in the south but Western reporters observed that, for the first time in years, ordinary Iraqi citizens were willing to criticize Saddam Hussein openly.[43] So, despite the fact that the rebellions were brutally suppressed and the regime's iron grip over the Iraqi people reestablished, Desert Storm did shake Saddam Hussein's regime and temporarily loosen its control. How close did the strikes against L and CCC targets categories per se come to disorganizing or paralyzing the regime? Without some access to the other side of the hill, it does not seem possible to provide even a rough answer to this question.

Electricity and Oil

During World II, American and British strategic bombing of Nazi Germany's oil industry and electric power system was generally aimed at constraining the ability of the Nazi war economy to supply German forces in the field with the weapons, ammunition, and fuels needed for modern, mechanized warfare. The German oil industry was attacked, first and foremost, to inhibit the flow of fuel and lubricants to German military forces.[44] By mid-1944, these attacks not only succeeded in bringing about severe shortages of aviation gasoline for the *Luftwaffe* but, as a by-product, began to cause drastic reductions in the output of petroleum-based chemicals.[45] German electric power, in contrast with Germany's oil industry, was never a major or high-priority strategic target at any

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[43]Chris Hedges, "After the War: Iraq in Growing Disarray, Iraqis Fight Iraqis," *The New York Times*, 10 Mar 1991, pp 1 and 14.

[44]Galbraith, et al, *The Effects of Strategic Bombing on the German War Economy*, p 74.

[45]*Ibid*, pp 81-82.

time during the war, mainly because Allied economic analysts believed that the system was not very vulnerable to bombing.[46] Nevertheless, after the war, the U.S. Strategic Bombing Survey (USSBS) found that even the modest and occasional attacks carried out against German public utilities had made electric power "a limiting factor in the production of oil, electric steel, aluminum, nitrogen, and other vital military raw materials."[47] As a result, the USSBS concluded that electric power, while not an easy target set to have attacked, had in fact contained enough bottlenecks and limitations to have made it "an excellent strategic bombing target"–one which, if it had been significantly damaged, would "have had a decisive effect" on the ability of Germany's "industrial economy to continue to supply the needs of war."[48]

This history was known to individuals like Col. John Warden and others who participated in the Air Staff's August 1990 concept plan (Instant Thunder) for an offensive air campaign against Iraq.[49] In fact, this history goes a long way toward explaining why electric power and oil production were originally selected as strategic target categories for Desert Storm.

By the time the Coalition's air campaign began on 17 January 1991, however, the military purposes for going after Iraqi electricity (E) and oil (O) had evolved considerably beyond those that motivated British and American strategic bombing of German oil and, to a lesser extent, electric power during World War II. In the case of Iraq's electric power system, Coalition air planners had reached the judgment that its loss would degrade Iraqi military capabilities in several key areas, as well as depress the morale of the Iraqi people in ways that might serve to loosen Saddam

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[46] *Ibid*, pp 123-124.

[47] *Ibid*, p 125.

[48] *Ibid*, p 126. This lesson about the "missed opportunity" presented by German electric power is one that came to be inscribed on the US Air Force's institutional memory (see Hansell, *The Air Plan That Defeated Hitler*, pp 286-297). The irony of the USSBS' conclusion about the opportunity offered by German electric power was, of course, that air planners like Haywood Hansell had originally made this target system the number one priority in the AWPD-1 plan of August 1941, and fourth priority (behind the German air force, submarines, and transportation) in the 1942 update of AWPD-1 (*ibid*, p 259).

[49] Intvw, GWAPS with Col John A. Warden, Washington DC, 21 Feb 1992. Warden was familiar with Haywood Hansell's *The Air Plan That Defeated Hitler*, Albert Speer's *Inside the Third Reich*, and the USSBS.

Hussein's political grip on the country. Militarily, the idea was that, by forcing the entire country abruptly onto back-up power, the Iraqi leadership would find it harder to function, their computerized telecommunications might suffer disruption or damage due to power surges or fluctuations, and Iraq's strategic air defenses might be similarly degraded. At the same time, since the production and storage of chemical and biological weapons was believed to be a large consumer of electricity,[50] Iraq's ability to produce, maintain, or employ such weapons would be hurt as well.[51] As for civilian morale, some of the air planners, including General Glosson, felt that "putting the lights out in Baghdad" would have psychological effects on the average Iraqi.[52] Among other things, by demonstrating that Saddam Hussein could not even keep electricity flowing in Baghdad, it was hoped the Ba'th Party's grip on the Iraqi population could be loosened, thereby helping to bring about a change in regime.[53]

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[50]Although the amount of electric power consumed by chemical and biological weapons production and storage was never precisely quantified prior to the war, intelligence studies consistently noted that these activities would be severely hindered if denied electric power. See (S/WN) DIA, *Special Analysis: Degradation of the Iraqi Electric Power Network*, undated.

[51]These leveraged, interconnected effects appear to have been the primary military purposes for attacking Iraqi electric power by 17 January 1991 (Lt Col David Deptula, discussion with members of Task Force 6, 4 Nov 1991). In Deptula's view, the foremost reasons for going after Iraqi electric power was to force Iraq's centralized command and control, as well as it strategic air defenses, to shift to back-up power.

[52]The notion of using bombing to influence the enemy population has been a recurring theme in American military thinking. The conclusion to the USSBS' summary report on the European war noted that strategic bombing had "brought home to the German people the full impact of modern war with all its horror and suffering" [USSBS, *Over-all Report (European War)*, p 107]. Early in 1965, Gen William Westmoreland argued strongly in favor of attacking North Vietnam's transportation infrastructure below 20° North on the grounds that "interrupting the flow of consumer goods to the southern DRV [Democratic Republic of Vietnam] would carry to the NVN [North Vietnamese] man in the street, with minimum loss of civilian life, the message of U.S. determination" [Department of Defense, *United States-Vietnam Relations 1945-1967*, Part IV.C.3, *Evolution of the War: The Rolling Thunder Program Begins* (Washington, DC: Government Printing Office, 1971), p 75].

[53]This particular aspect of the rationale for attacking Iraqi electric power was tightly coupled in the minds of the air planners with the attacks on the L and CCC targets. According to participants, there was considerable discussion in Checkmate of the results that could be expected from attacking electric power. Some, especially those who had traveled in the Mideast, argued that Iraq was a Third World country in which fields were still plowed by hand, and that the loss of electricity in Baghdad and other cities would

By the eve of the conflict, the principal reason for attacking Iraq's production and storage of refined petroleum products appears to have been to prevent any further flow of fuels to the Iraqi military. This objective was linked to electricity. Coalition planners never doubted that most governmental and military systems would have back-up power generators. But back-up systems, they reasoned, would be fueled largely with gas or diesel, so it made sense militarily to do what could be done to constrain the flow of fuel to back-up power generators throughout the country once the fighting began.[54]

Coalition planning of attacks against both electricity and oil targets was constrained by a conscious desire, originating with President Bush, to minimize long-term or permanent damage to Iraq's economic infrastructure. This constraint led to a general understanding among the air planners and targeting specialists that the focus of attacks on Iraqi electric power should be on transformer/switching yards and control buildings rather than on generator halls, boilers, and turbines in order to minimize recuperation time after the conflict ended.[55] Similarly, attacks on oil production were supposed to be limited to refined-product storage, with distillation and other refining areas only being aimpoints if they produced military fuels.[56] In the case of electric power, the self-imposed restriction against hitting generator halls or their contents was not widely observed–especially during the first

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have little effect on popular morale; others argued that the affluence created by petrodollars had made the city populations psychologically dependent on the amenities associated with electric power (discussions with Col E. Michael Kiraly and Lt Col Frank Kistler, both of whom participated in the Checkmate discussions and were subsequently assigned to the GWAPS). Gen Glosson independently reached the view that "turning the lights off in Baghdad" would affect Iraqi morale based on discussions with Arab officers whose countries joined the Coalition (Intvw, GWAPS with Gen Glosson, 9 Apr 1992).

[54](S) Intvw, Center for Air Force History (CAFH) with Lt Col David Deptula, 8 Jan 1992, preliminary transcript, p 41.

[55]Memo, Brig Gen Buster C. Glosson, subj: Target Guidance. This memo dealing with E and O targets, is perhaps the clearest statement of Glosson's intent regarding electric power and oil; it concisely links military objectives to aimpoints. Unfortunately, this memo was not distributed to all the combat units involved with these targets until early February 1991.

[56]Glosson, Target Guidance memo.

week or so of the war[57]–in large part because the planners elected to go after the majority of Iraq's twenty-five major power stations and the generator halls offered the most obvious aimpoints.[58] Much the same sort of thing occurred with oil targets: in a number of instances, crude-oil distillation towers were hit despite the informal policy to minimize long-term damage.[59] Both discrepancies illustrate the gap that inevitably exists between specifying a target such as the As Samawah petroleum refinery and the specific aimpoints to be hit there.[60]

Regarding the E and O target systems themselves, the Iraqi electrical power system consisted of about twenty-five major generating plants (with collocated transformer and switching yards) and over 140 transformer stations (not collocated) that were linked together on a national grid. Part of that grid consisted of six plants and eleven transformer stations that were hooked together on a 400 kilovolt (kV) "super grid," with the remainder being connected by 132 kV lines. There were also a number of other small plants that served regional customers and were not part of the national grid. The largest power stations were in the Baghdad area, although there were other large-capacity plants located in the north-

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[57]That damage to boilers and generator halls did occur has been well documented by both Coalition wartime reconnaissance and postwar site inspections by members the international study team that surveyed many bombed facilities from 23 August to 5 September 1991 [(S/WN) Walid Doleh, Warren Piper, Abdel Qamhieh, and Kamel al Tallaq, "Electric Facilities Survey," Oct 1991, Appendix A; DIA, *Desert Storm BDA Imagery Review*, DDX-2900-489-91, Vol 3, pp 48-53].

[58]Discussions with Capt John Glock. Capt Glock was an intelligence officer in the Black Hole before and during Desert Storm; he subsequently served with GWAPS. After the war, intelligence analysts suggested that simultaneously hitting as few as three major plants probably would have been enough to force Iraq's power grid to shut down. Most national or regional electric power grids can only handle the loss of two major facilities without having to shut down to avoid system-wide damage, as the 1965 blackout of the northeast US demonstrated [(S/NF/WN), *Targets in Iraq*, downgraded to S/NF/WN, GWAPS, CHP 35; also postwar discussions by members of Task Force 6 with CIA electric-power specialists]. This minimal targeting strategy, however, was not used during Desert Storm.

[59]DIA, *Desert Storm BDA Imagery Review*, Vol 3, pp 12-13 and 27-29.

[60]While the Black Hole planners did try to specify aimpoints in certain circumstances and cases, the selection of desired mean points of impact (DMPIs) was often left either to officers responsible for turning master attack plans into detailed ATOs or to weapons officers in the units flying the missions.

ern and southern regions of Iraq. Most plants had steam (or thermal) generators powered by oil-fed boilers, but the system also included gas-turbine generators as well as a few hydro-electric plants located on the Tigris or Euphrates rivers or their tributaries. Some plants contained both thermal and gas-turbine generators.

Iraq's electric power system was thought to have a prewar installed capacity of 9,500 megawatts (MW).[61] However, the system as a whole operated at much less. The industry standard in the United States and Europe is to operate electric power plants up to 70 percent of installed capacity. It was believed prior to the war that the heaviest demand ever levied on the Iraqi system had been 5,160 MW in 1990–less than 55 percent of installed capacity.[62] In sum, the Iraqi electric power system was a relatively modern, redundant, and flexible system that had served the needs of Iraq with few of the service interruptions or brown outs typical of many other third-world countries.[63]

Iraq's petroleum refining capacity was twice the amount needed to service its own domestic and military needs. At that time, Iraq was, at 3.0 million b/d, the second largest oil producer in the world, with only Saudi Arabia producing more. Further, 90 percent of Iraq's refining capacity was concentrated in three refineries–Bayji , Basra , and Baghdad with the remaining capacity divided up among eight smaller refineries spread throughout the country. There was also oil storage at about a dozen other sites (some of it underground), and a network of pipelines and pumping stations to move both crude and refined petroleum products around within Iraq. In addition, there were pipelines for exporting oil through Turkey, Syria, Saudi Arabia, and the Persian Gulf. Of special interest were the pumping stations along the Iraq-Saudi Arabia Pipeline (IPSA) that ran from the Ar Rumayla oil field through southeastern Iraq (paralleling the Wadi Al Batin) to the border with Saudi Arabia and then across Saudi Arabia to the Red Sea. This system supplied the oil that the

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[61]Walid Doleh, Warren Piper, Abdel Qamhieh, and Kamel al Tallaq, "Electrical Facilities Survey," Oct 1991, p 1 in International Study Team, *Health and Welfare in Iraq After the Gulf Crisis: An In-Depth Assessment*, Oct 1991.

[62]Doleh, et al, "Electrical Facilities Survey," p 1.

[63]Doleh, et al, "Electrical Facilities Survey," Appendix A, "Reports of Sites Visited," pp 1-15.

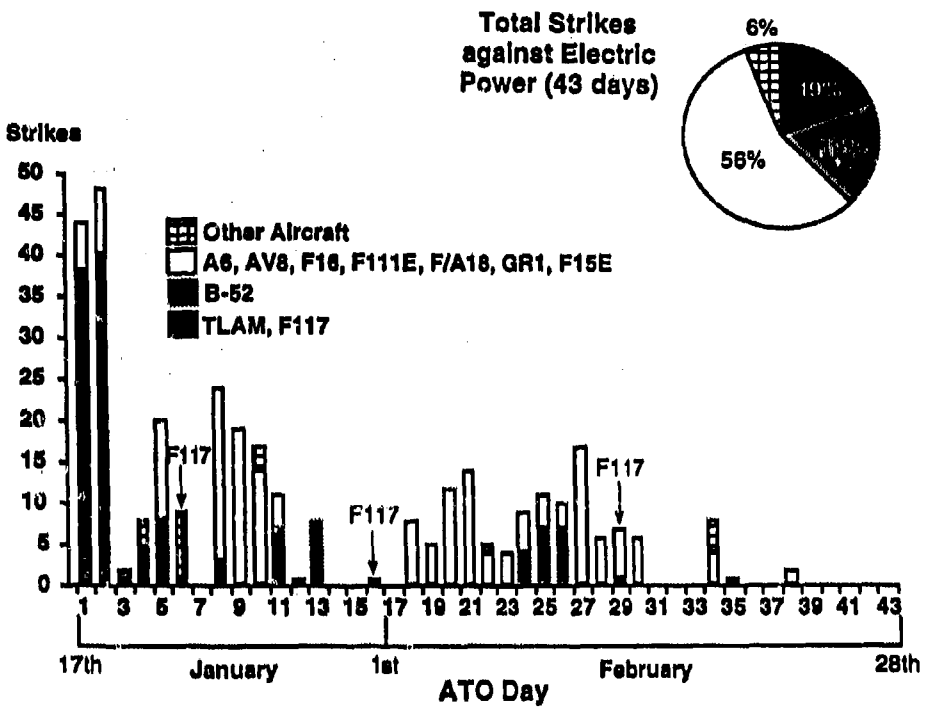
Iraqis intended to use to fill the fire trenches in southern Kuwait in the event of a Coalition ground attack.

Destroying the distillation towers at the three main refineries in Bayji, Basra, and Baghdad would drop Iraq's refining capacity to well below the amount needed for internal use. If refining at these three locations could be eliminated, Iraq would lose its capacity to produce high-quality fuels and lubricants, presumably forcing the Iraqi military to begin slowly consuming its on-hand stocks. Coalition planners realized, of course, that Republican Guard divisions and other units in the KTO had supply dumps for fuel and other petroleum products. They also realized that Iraqi consumption would not be high as long as Iraqi forces remained dug in and static. But, again, given the uncertainties Coalition planners faced going into the conflict about Desert Storm's likely duration and character, there seemed defensible military reasons for taking steps to ensure that there would be little or no flow of additional fuels and lubricants to these forces.

How did Coalition attacks on Iraqi electric power and oil unfold? Figure 33 shows the pattern of attacks against electric power over the forty-three days of the air campaign. Based on target-intelligence folders kept during the war and other information available to GWAPS, it appears that some eighteen power plants and nine transformer stations were struck during Desert Storm.[64] Figure 33 further indicates that the heaviest weight of effort against electric power was mounted during the first few days of the campaign–due, once again, to the air planners' presumption that abruptly cutting commercial electricity would impair Iraqi telecom-

[64]This count was based on correlating the GWAPS Missions Database with the Checkmate Intelligence Target (CIT) folders kept during the war.

Figure 33
Coalition Attacks Against Iraqi Electric Power



Source: AIF strike counts, GWAPS Missions Database, Dec 1992.

munications, chemical and biological weapons facilities, and strategic air defenses. Strikes over the first three days also included the majority of the precision strikes made against electric-power targets. [DELETED].[65]

Naturally the power plants hit first were, for the most part, those with the larger capacities. Eleven power plants, over half of those eventually

[65]Evidently, F-111Fs made no precision attacks on electric power. Proven Force F-111Es, by contrast, flew some 40 sorties against electric power plants in northern Iraq, delivering Mk-82s, Mk-84s, and CBUs (cluster bomb units).

attacked, were struck on the first two Air Tasking Order (ATO) days. During this same period, seven of the nine transformer stations eventually attacked were hit. [DELETED].[66]

Many of the electric power plants and transformer/switching yards hit in the first few days were in and around the city of Baghdad. After the first week, however, electric power was attacked more intermittently, and Coalition efforts shifted increasingly to facilities outside the Baghdad area. Most Iraqi power plants were hit two to five times. Much of the reason for the restrikes stemmed from difficulties in confirming the desired levels of damage using imagery during the first two weeks of the war. A targeting concern that inevitably surfaced was a desire to impose enough damage to prevent the Iraqis from putting electric power plants back into operation prior to the end of the war. For example, the hydro-electric power station on the outskirts of Samarra was evidently not generating electricity when the war began. However, after generator units there were put back into operation in late January, the plant was attacked and, according to international observers who surveyed the site after the war, extensively damaged.[67]

One plant, the Hartha thermal power plant in Basra, was struck more than a dozen times.[68] The large number of attacks against this particular plant seems to have occurred mainly because air planners feared that this facility could supply power to the oil pipeline pumps that would be used to fuel the Iraqi fire trenches in southern Kuwait. As a result, it was designated a "dump target" for U.S. Navy and Marine aircraft to ensure repeated attacks.[69]

Some of the same overall patterns evident in Coalition air attacks against Iraqi electric power can be seen in the attacks on Iraqi production

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[66]Doleh, et al, "Electrical Facilities Survey," pp 7 and 9.

[67]*Ibid*, p 8.

[68]The international study team that visited this plant after the war reported that Hartha was hit thirteen times (*Ibid*, p 11).

[69]Intvw, GWAPS with Gen Glosson, 9 Apr 1992.

and storage of refined petroleum products. For example, the use of precision munitions like TLAM and precision-capable platforms like the F-117 against oil targets was largely concentrated in the first week of the air campaign, and attacks tended to fall off during the final weeks of the war. But, as Figure 34 shows, there were also differences between the attacks on oil and those against electricity. The effort against oil was even more of a nonprecision endeavor than that against electricity, and the peak day came in the second week rather than the first two days.

Coalition attacks against oil targets were carried out by a wide variety of aircraft, and the primary munitions most of these aircraft delivered on these targets were gravity (or "freefall") unguided bombs. On several occasions there were large raids consisting of upwards of sixteen F-16s or 8-12 GR-1s. Additionally, a number of multicell B-52 strikes were conducted against oil targets, usually in sparsely populated regions of Iraq or where the area of the facility was large enough to accommodate the long "train" of bombs laid down by B-52s dropping from high altitude. Finally, Navy A-6s and F/A-18s were involved in attacks on Iraqi oil, as were British Buccaneers and even A-10s.

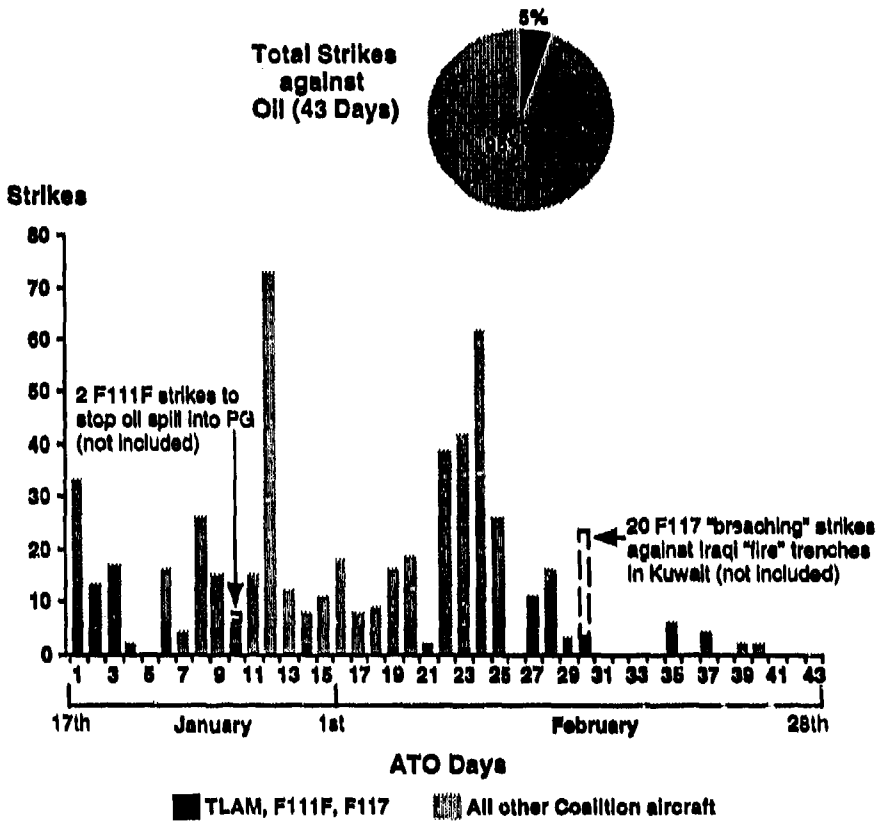
The few precision attacks on oil refining capability were mainly carried out by Tomahawk land-attack missiles (TLAMs), F-117s, and F-111Fs.[70] TLAMs hit the distillation towers at the Al Basra and Bayji refineries during the first two days of the war, and F-117s used GBU-10s against similar aimpoints in the Dawrah refinery in Baghdad on Air Tasking Order Day 21.[71]

As Figure 34 indicates, however, there were some oil-related targets that were struck during Desert Storm for reasons other than destroying Iraqi petroleum refining capacity or central stores of military fuels and lubricants. One such occasion was the use of F-111Fs in late January 1991 to stop the oil spill into the Persian Gulf created by the

[70]Some precision attacks on oil targets were also carried out by British Tornados employing laser-guided bombs; Buccaneers provided the laser designation for these strikes.

[71]GWAPS Missions Database, as of 19 Sep 1992.

Figure 34
Coalition Attacks Against Iraqi Oil



AIF strike counts, GWAPS Missions Database, 9 Dec 1992.

Iraqis.[72] Another was the employment of F-117s on ATO Day 30 to interdict the oil and manifolds that fed the "fire trench" barriers which Iraqi ground forces had dug in southern Kuwait to impede a ground

[72]TACC [Tactical Air Control Center] Log, 28 Jan 1991, GWAPS microfilm roll 10263. The cited entry stated that pilot reports indicated that the F-111 strike on the oil spill had been successful.

offensive by Coalition forces.[73] In addition, a portion of the strikes against oil shown in Figure 34 were against oil storage in the Kuwait theater rather than at "strategic" oil targets like the petroleum refining and storage complexes at Bayji.

How effective were Coalition air efforts against the E and O target categories? In the case of electricity, the available evidence indicates that the immediate military objective of rapidly shutting down the generation and distribution of commercial electric power throughout most of Iraq, thereby forcing the Iraqi leadership and military onto back-up power, was achieved. Ultimately, almost 88 percent of Iraq's installed generation capacity was sufficiently damaged or destroyed by direct attack, or else isolated from the national grid through strikes on associated transformers and switching facilities, to render it unavailable; the remaining 12 percent, which was resident in numerous smaller plants that were not attacked, was probably unusable other than locally due to damage inflicted on transformers and switching yards.

Figure 35 provides an estimate of the actual drawdown of electric power availability to Iraq's national power system over the course of Desert Storm. It was based on three sources: strike data in the GWAPS Missions Database, bomb-damage assessment data in Checkmate Intelligence Targets folders, and reports from site visits to sixteen major power plants and five switching stations in Iraq conducted by the International Study Team from 25 August to 4 September 1991.[74]

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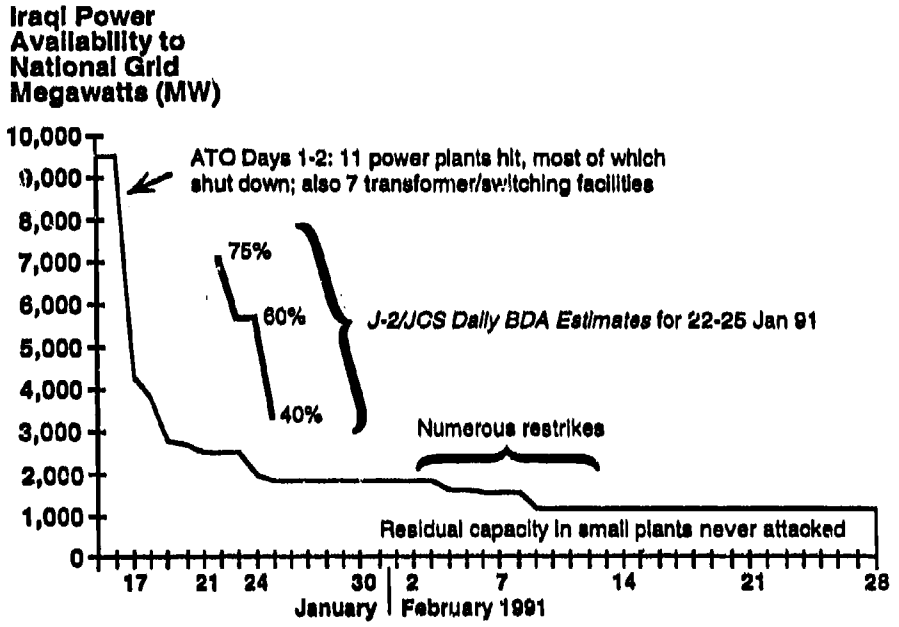
[73]This particular episode illustrates some of the "counting rule" anomalies that eventually emerged in the GWAPS databases. A total of 23 F-117 strikes were flown against the oil-distribution system feeding the "fire trenches" that the Iraqis built in southern Kuwait. Since three of those strikes were against elements of the Iraq-Saudi pipeline that had been identified as part of the Black Hole's oil (O) target system, they ended up being reflected in statistical summaries drawn from the Missions Database as strikes against petroleum. But because the remaining 20 strikes were against elements of the trench system itself, these "breaching" targets did not end up being catalogued in the database as strikes against petroleum. While this anomaly is minor in a database containing more than 40,000 strikes, it does reveal the sorts of cataloguing problems that inevitably occurred. These anomalies are generally masked by the level of aggregation the reader will find in the summary data of the GWAPS Statistics report.

[74]Doleh, et al, "Electrical Facilities Survey," p 1.

Figure 35
Estimated Drawdown of Iraqi Electric Power[75]



Over the first ten days of the Desert Storm, the drawdown shown in Figure 35 is considerably steeper than most Coalition estimates made during the war, largely due to the incorporation of International Study Team reports on what actually occurred at specific plants. Of the nine power plants hit on the first night, most sustained enough damage to take them off line for one reason or another. The large-capacity Bayji (1,320 MW) and Musayyib (1,280 MW) plants, for example, stopped operating shortly after they were attacked according to Iraqi postwar testimony. However, in a number of cases–Bayji, Baghdad Dawrah (740 MW total), Baghdad South (382 MW), and Baghdad Taji (140 MW)–most of the generators and turbines survived the initial attacks but were isolated from the grid. By the time this initial obstacle had been removed, enough

[75]Sources: GWAPS Missions Database; CIT folders; Doleh, et al, "Electrical Facilities Survey"; and *J-2/JCS Daily BDA Estimates*.

additional damage had been done to the generators, turbines, and transformers to keep the plants from delivering power for the rest of the war. Also of note is the fact that some power plants went off line before being forced to do so by bomb damage. For instance, the manager at Nasiriyah (840 MW) reported that he isolated his plant from the grid and ceased operations on 19 January even though the facility had not sustained enough damage to prevent power generation.[76] Naturally these sorts of second-order effects were initially difficult for Coalition intelligence analysts to detect–particularly using imagery.

After the steep drop in electric-power availability during the first week, follow-on attacks not only kept the system down but gradually reduced it to less than 15 percent of prewar capacity. While exactly when the national grid (the 400 kV supergrid plus the 132 kV transmission system) went down remains unclear, there is strong evidence that it did. Bob Simon, the CBS correspondent who was captured along the Saudi-Kuwait border and spent forty days as a prisoner, reported afterwards that the electricity was off in the prisons he occupied in southern Iraq and Baghdad, including the headquarters of the Iraqi intelligence service; further, power was still off in the Al Rasheed hotel on the day he was released.[77] Maj. Rhonda Cornum, the U.S. Army doctor shot down during a helicopter rescue mission on 27 February, witnessed the same lack of commercial power after she was captured. She saw no lights in Basra, in Baghdad even the traffic lights were out, and, when she initially arrived in the capital, surgeons there could not initially operate on her due to the absence of electricity.[78]

Naturally, this sort of detailed, first-hand information was not generally available to Coalition air planners and commanders during the war. Estimates of the status of Iraq's electric power system had to be based on reconnaissance, and there was some uncertainty during the first week of Desert Storm as to the degree of shut-down achieved. Aircrews

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[76]Doleh, et al, "Electrical Facilities Survey," pp 12-13. Iraqi engineers voluntarily shut down power plants in order to protect vulnerable components–in some cases from perturbations in the grid system and in other cases in hopes of avoiding further Coalition air strikes.

[77]Simon, *Forty Days*, pp 97, 228, and 230.

[78]Rhonda Cornum, *She Went To War: The Rhonda Cornum Story* (Novato, CA: Presidio Press, 1992), pp 50, 117, 139, and 155.

and weather satellites began indicating that most cities in central and southern Iraq were blacked out by the second night of the air campaign. Yet Lt. Col. David Deptula's personal notes from the late afternoon (Riyadh time) of 18 January 1991 recorded concern on the part of theater intelligence analysts that Iraq's electric power grid might be coming back up.[79] An entry for the next day (19 January) indicates that he had received high-level intelligence from Washington that both electricity and, as a result, water were off in Baghdad. But not until 23 January did Deptula appear to have become convinced that 50 percent or more of the system was off line in central and southern Iraq.

Due to the lack of precision munitions, the drawdown of commercial electric power in northern Iraq was undoubtedly more gradual than in the central or southern regions of Iraq. U.S. pilots flying missions from Turkey into northern Iraqi (Proven Force) occasionally reported seeing illuminated towns in that part of the country, and Proven Force F-111Es were still attacking power plants there during the first week of February 1991.[80] Nevertheless, the available evidence indicates that electric power in *central and southern Iraq* was largely shut down during the initial days of the war, just as the planners had hoped. The lights in Baghdad were quickly turned out.

Did "turning the lights out in Baghdad" impose the discernible frictions on the Iraqi leadership or affect popular attitudes toward the regime? Electric power was a "leveraged" target category in the sense that a relatively modest number of strikes shut down the bulk of Iraqi commercial power in a very short period of time. However, the information available to GWAPS did not reveal any hard evidence of such cross-category effects.

How much damage was ultimately done to Iraq's electric power system? Coalition policy on electric power was, once again, to minimize long-term damage to Iraqi electric power. Yet one criticism raised after the war was that the bombing of electric power had "contributed to"

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[79]Source: Lt Col Deptula's personal notes, which were still in his possession as of Oct 1992. Lt Col Rich King, who worked damage assessment from Washington during the war, commented in January 1992 that, by 22 January 1991, it was clear to those funneling BDA to the Black Hole that electric power had gone down in central and southern Iraq.

[80]AIF strike counts, GWAPS Missions Database.

70,000-90,000 *postwar* civilian deaths above normal mortality rates over the period April-December 1991–principally because of the lack of electricity in Iraq for water purification and sewage treatment following the ceasefire.[81] By May 1991, for instance, the Harvard Study Team reported sharply increased levels of gastroenteritis, cholera, typhoid, and malnutrition in Iraqi children due to the delayed effects of the Gulf War.[82]

By comparison with most previous wars, the Coalition's bombing of core strategic targets in Iraq was remarkably precise and discriminate. Even those who charged after Desert Storm ended that the bombing of target systems like electric power had been "unnecessary" readily conceded that, based on extensive postwar site inspections of the physical damage inflicted, the strategic air campaign had not only been precise, efficient, and legal but had resulted in very few civilian casualties.[83] Greenpeace's estimates of country-wide Iraqi civilian casualties caused by Coalition bombing totaled 2,278 dead and 5,976 injured.[84]

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[81]"Tactical Bombing of Iraqi Forces Outstripped Value of Strategic Hits, Analyst Contends" *Aviation Week & Space Technology*, 27 Jan 1992, p 63. The most vocal advocate of this view has been William M. Arkin, director of the nuclear information unit of Greenpeace International. The estimate of 70-90,000 additional deaths was derived from a survey of some 90,000 Iraqi households conducted in 1991 after the war. Based on these data, the additional deaths above the January 1991 "norm" were calculated for April-December 1991 (Arkin, GWAPS intvw, 19 Oct 1992). The final death total due to the "indirect detrimental health effects" of the war cited by Arkin was 111,000 (Beth Osborne Daponte, "Iraqi Casualties from the Persian Gulf War and Its Aftermath," p 2).

[82]Harvard Study Team, *Harvard Study Team Report: Public Health in Iraq after the Gulf War*, May 1991, pp 12-13.

[83]Arkin, for example, has stated that the air war was "clean on a strategic level," and that he could find "no evidence of indiscriminate attacks on cities or civilians, intentional damage for postwar leverage on the government of Saddam Hussein or extensive collateral damage of civilian structures near targets" ("Tactical Bombing of Iraqi Forces Outstripped Value of Strategic Hits, Analyst Contends," pp 62 and 63). After the war, Arkin was able to inspect "13 of the targeted leadership and command bunkers; 49 of the 170 command, control and communications sites; 16 of the 20 oil refineries and distribution facilities, and all of the 75 railroad and auto bridges" hit during the war (*ibid*, p 62).

[84]William Arkin, brfg slide titled "Civilian Casualties and Damage," presentation given to GWAPS personnel, 31 Oct 1991.

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Table 24
Damage Summary against Selected Electric Power Plants

Power Plant	Attacking Platforms	Boilers	Generator Halls	Turbines	Transformers	Switching Yards	Other
Ajaji Thermal Power Plant (TPP) Bayji (1320 MW)	TLAM		X	X	X	X	X
Al Musayyib TPP (1280 MW)	B52, F16, A6	X	X	X	X	X	X
Al Nasiriyah TPP (840 MW)	GR1	X					X
Al Basra TPP Hartha (800 MW)	F15E, A6, F/A18	X	X			X	X
Baghdad TPP/GTPP (Gas Turbine Power Plant) Dawrah (640/100 MW)	TLAM	X	X	X		X	X
Al Mawsil Hydroelectric Power Plant (HPP) (750 MW)	B52, F111, F16	NA	X		X	X	X
Al Hadithah HPP (660 MW)	A6	NA	X	X	X		X
Baghdad TPP/GTPP South (382 MW)	TLAM		X			X	X
Dibbs TPP/GTPP (60/210 MW)	B52, F111	NA	X	X	X		X
Kirkuk GTPP Mulla Abdullah (240 MW)	F111		X	X	X	X	X
Al Mawsil (Mosul) GTPP (240 MW)	B52, F16, F111	NA		X	X	X	X
An Najaf GTPP (189 MW)	F/A18, GR1, A6, A7	NA	X	X		X	X
Baghdad GTPP Taji (140 MW)	TLAM	NA		X	X	X	X
Samarra HPP (84 MW)	A6	NA	X	X		X	X

Sources: Checkmate Intelligence Target (CIT) folders; International Study Team reports; GWAPS Missions Database. BDA on three other plants—Baghdad GTPP East, Al Hillah GTPP, and Az Zubayr GTPP—was not available.

Nonetheless, damage against Iraqi power plants was fairly widespread (Table 24). As categories, boilers and generator halls at the plants attacked were hit about as often as transformers and switching yards. There was also damage to other, less critical, components such as gantry cranes, warehouses, petroleum-storage tanks, and water-conditioning systems (the "Other" category in Table 24). Since the stated policy of Coalition air planners was to target transformers and switching facilities in lieu of boilers and generator halls, it does appear that more damage was done than had been originally intended. Indeed, much of this "additional" damage seems explicable in terms of the difficulties encountered in making everyone involved fully cognizant of what was intended, the

practical tension between initially shutting down Iraqi electric-power plants and then insuring that they could not resume operations, long-standing preferences for generator halls as aimpoints,[85] and uncertainties about both bomb-damage assessment and the exact degree of damage required to "turn the lights off in Baghdad."[86] Still, more damage was probably inflicted on this target system than was absolutely necessary from an engineering standpoint to achieve the desired effects.

Unfortunate and unintended as this additional damage may have been, the question at issue concerns postwar charges of Coalition responsibility for what was estimated to be tens of thousands of additional deaths among Iraqi civilians due to the lack of electricity for water and sewage treatment after the ceasefire.[87] Regarding this question, the essential point to be made is that war is not an engineering enterprise whose results can be calculated in advance. Faulting the air commanders and planners who ran this portion of the air campaign for "overkill" not only ignores this essential point but, in addition, demands of them an impossible degree of predictive foresight regarding the second-order or unintended consequences of military operations. The defensible Coalition presumption from the outset was that *if* Saddam Hussein's forces were decisively defeated, then the Iraqi leader would not long survive the war in power. On this assumption, the air planners and commanders reasonably presumed that, once an accommodation had been reached with the new government in Baghdad, members of the Coalition could provide the parts and anything else necessary to restore electric power speedily throughout Iraq after the war. In the event, of course, the political outcome turned out to be something that no one foresaw: Saddam Hussein both retained power and continued to defy

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[85]In general, US targeting officers had been trained to prefer large aim-points like generator halls to small ones like transformers–largely on the basis of historical experience with unguided bombs.

[86]Although more than half of the Iraqi power plants eventually struck were hit on the first night of the war, no power plants in central or northern Iraq appear to have been imaged prior to 21 January 1991 (GWAPS, CIT folders on electric-power targets, particularly folders 262 and 256, which are the only two instances of imagery against this target category prior to 21 January 1991).

[87]Arkin's comment in early 1992 was that "You can't separate neat and clean bombing from postwar deaths. People just died in a different way because of the efficiency of the attacks" ("Tactical Bombing of Iraqi Forces Outstripped Value of Strategic Hits, Analyst Contends," p 63).

the United Nations, thereby himself causing economic sanctions to be left in place that prevented Coalition assistance in reconstruction or humanitarian relief. To attribute responsibility for Iraq's increased mortality rate in the aftermath of a major military defeat solely, or even primarily, to the damage inflicted on Iraq's electric-power system ignores the Iraqi government's responsibility for its own prewar and postwar decisions. Besides seizing Kuwait in the first place, in the aftermath of Desert Storm Iraqi government and Ba'th party officials were given priority on goods, the reconstruction of Baghdad was given priority over conditions elsewhere in the country, and Saddam Hussein's refusal to accede to UN conditions on the sale of Iraqi oil prohibited this source of funds from being used to buy medical and food supplies for the Iraqi people.[88]

Furthermore, all indications are that, despite the continuation of United Nations sanctions, the Iraqis were able to restore commercial power considerably faster than had been anticipated. For example, it was initially thought that two years would be required to repair the main power plant in Baghdad. But by mid-1992 this plant was reportedly working at 90 percent of its prewar capacity, and, despite a blazing hot summer, there was not one power blackout in Saddam Hussein's capital, even though almost everyone in Baghdad who had an air conditioner was running it at full blast.[89] Consequently, not only was the effort against electric power effective but the speed with which the Iraqis have been able to restore capacity without external assistance provides additional evidence that the damage inflicted by Coalition air strikes on this target system was not excessive.

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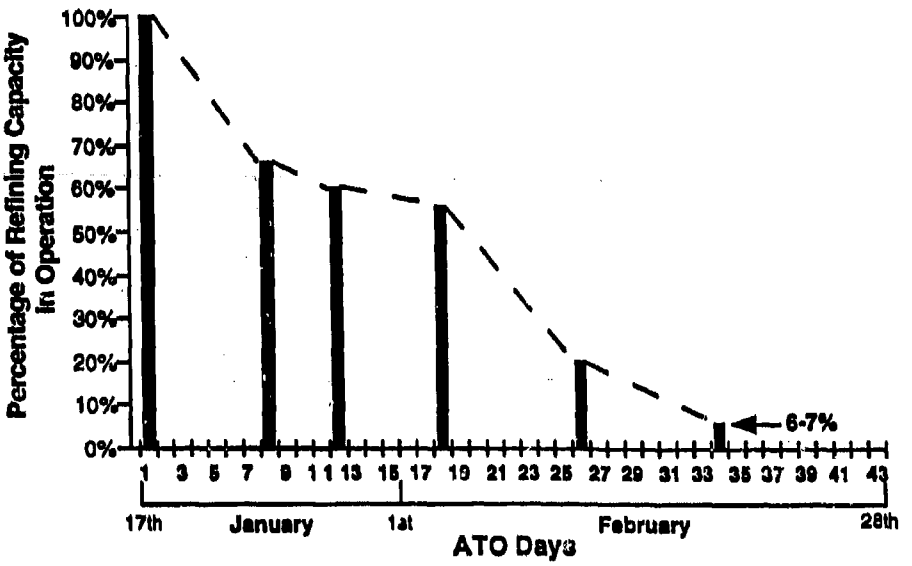
[88]"Strategic Campaign Focused on Targets and Cut Casualties, Pentagon Maintains," *Aviation Week & Space Technology*, 27 Jan 1992, p 64.

[89]Marie Colvin, "Saddam Erases the Scars of War," *London Sunday Times*, 4 Oct 1992, p 16.

Figure 36
Drawdown of Iraqi Petroleum Refining Capacity[90]



How effective were Coalition efforts against Iraq's production capacity and stored reserves of refined petroleum products? Overall, Coalition efforts against Iraqi refining capacity appear to have been considerably more effective than those directed against stores of refined products that could be put to military use. Iraq's refining capacity was concentrated in the three large facilities at Bayji, Basra, and Baghdad. [DELETED][91]. This judgment was based primarily on damage to distilla-

[90][DELETED]

[91]Most plants had sustained only light damage but were still judged inoperable. Other plants were considered inoperable because the piping or water handling systems associated with the distillation process had been badly damaged even though the distillation towers were still intact.

tion towers, which resulted from a very small number of precision strikes. For the most part, attacks on strategic oil targets by aircraft delivering nonprecision munitions focused on oil-storage tanks. Given the small level of effort expended to disable over 90 percent of Iraq's refinery capacity, this aspect of the air campaign appears to have been both highly leveraged and effective relative to the immediate military objective of eliminating refining capacity.

Efforts to eliminate Iraqi stores of refined petroleum products were considerably less productive due to the large stores of refined products available to the Iraqis when the war began. [DELETED].[92] These quantities meant that the number of storage tanks and individual aimpoints that would have to be hit in order to eliminate refined products was quite large–even if the military goal was merely to prevent any additional fuels and lubricants from getting to Iraqi forces in the Kuwait theater after Desert Storm started. Although tank "farms" and individual storage tanks were generally large enough for fighter-bombers like the F-16 to hit from medium altitude with "dumb" bombs,[93] the size of the target set and the modest number of sorties expended (fewer than 400) against stored petroleum limited the total amount of damage that could be inflicted.

How enduring was the damage inflicted on Iraq's oil industry? As of October 1992, Iraqi officials claimed that crude-oil production was back to 800,000 barrels a day (b/d) and could be increased to 2 million b/d (about two-thirds of Iraq's prewar capacity).[94] In addition, restored refineries were supplying more than enough gasoline and heating oil for both Iraq's domestic needs and exports to Jordan. So there is no evidence of lasting infrastructure damage to Iraq's oil industry from the air campaign.

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[92]Memo 59-91, subj: Degradation of the Iraqi Lines of Communication–Baghdad South to the Kuwaiti Theater of Operations, Feb 1991, GWAPS, CIM, Folder 26.

[93]At Basra and Baghdad, for example, hand counts from the Missions database indicated that a total of 48 nonprecision bombs destroyed some 33 storage tanks.

[94]Colvin, "Saddam Erases the Scars of War," *London Sunday Times*, 4 Oct 1992, p 16.

Finally, how close did the bombing of this target category come to achieving the aim of limiting the fuel and lubricants available to Iraqi forces for military operations? For the most part, the Iraqi Air Force chose to sit out the war on the ground. Hence its demands for fuel were minimal. As for Iraqi ground forces in Kuwait, they had access to Kuwaiti oil facilities and continued to operate the Kuwaiti refining facilities and use Kuwaiti stocks. Eventually, Coalition air forces began bombing selected Kuwaiti oil facilities to limit Iraqi use of Kuwaiti stocks. Even so, the amount of diesel fuel thought to have been available for ground operations at the outset of what turned out to be a one-hundred-hour ground campaign was believed to have been sufficient for weeks, if not months, of combat.[95] Prior to that time, of course, most Iraqi forces in the Kuwait theater were dug into static positions, and their POL (petroleum, oil, and lubricants) requirements were minimal. Given the initial stocks available and the limited demands made on petroleum consumables, Iraqi forces do not appear to have experienced major, or even significant, shortages of POL during Desert Storm. True, individual units experienced local shortages due to distribution problems, but these limited problems, to which Coalition air power undoubtedly contributed by striking other targets such as bridges, were not the result of attacks on refineries and major petroleum depots.

Was the strategic effort against Iraqi oil wasted or unnecessary? Again, it is crucial to recall the uncertainties under which the air planners and commanders labored at the time. On the evening of 16 January 1991 there was little certainty as to how long any aspect of the war might last or how well the fourth largest army in the world might resist Coalition efforts to liberate occupied Kuwait. If the ground campaign had become protracted, the efforts against oil might have eventually paid military dividends on the ground. Mercifully, the ground war was far too brief for such effects to manifest themselves. Nonetheless, there were sound military reasons for taking steps to limit the availability of refined fuels and lubricants as a hedge against the possibility that the war would not

[95][DELETED]

go as favorably for the Coalition as it did. The effectiveness of these efforts lay, therefore, mainly in limiting the Iraqis' ability to wage a protracted ground campaign. It was prudent to have done so, but attacking oil refineries and storage in Iraq bore no significant military results given the Iraqis' eventual inability to mount a coherent or protracted defense on the ground.

Nuclear/Biological/Chemical Targets and Scuds

An explicit military objective of Desert Storm was to destroy Iraq's chemical, biological, and nuclear capabilities (see Table 23). In the short term, destroying Iraq's existing capabilities for chemical and biological warfare addressed the U.S.-led Coalition's generic military objective of destroying Iraq's capability to wage war. Eliminating Iraqi chemical and biological weapons was viewed by Coalition planners and commanders as being critical to minimizing Coalition casualties during the conflict, especially in the event that a ground campaign proved necessary. Looking further ahead, the destruction of Iraq's nuclear program and modified Scud ballistic missile capability was linked to the long-term political objective of promoting the peace and stability of the Persian Gulf region.

The consensus reached by the U.S. intelligence community in final months of 1990 was that Iraq, with the most extensive chemical and biological warfare (CW and BW) efforts in the Third World, had the munitions and delivery means for both types of weapons.[96] The evidence was clearest in the case of Iraqi chemical weaponry. Iraq had begun full-scale indigenous production of chemical munitions in the mid-1970s. During the Iran-Iraq war of 1980-88, Iraqi forces had made tactical use of chemical weapons against Iranian troops in some key battles, as well as against its own Kurdish insurgents and civilians.[97] And, by the eve of the war, Iraqi means for delivering chemical munitions were known to

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[96][DELETED]

[97]Michael Eisenstadt, *"The Sword of the Arabs:" Iraq's Strategic Weapons* (Washington, DC: Washington Institute for Near East Policy, 1990), Policy Paper No. 21, p 6. By the end of the Iraq-Iraq war, authority for the employment of chemical weapons is thought to have been delegated down to Iraqi corps, if not division, commanders (*ibid*). Such delegation of authority indicated that tactical employment of chemical weapons had become routine for Iraqi forces by the end of this conflict.

include aerial bombs and cluster munitions, artillery and mortar shells, and short-range rockets. [DELETED].[98] [DELETED].[99] [DELETED].[100]

Iraq's biological weapons program dated from the late 1970s, but pre-Desert Storm estimates as to its exact nature and status were much less certain than those on chemical weapons. It was believed that Iraq had developed anthrax spores and botulinum toxin as agents, and that Iraqis were pursuing other toxins and live agents. Enough research, production, and storage facilities suspected of being involved with biological weapons had been identified at various locations (Salman Pak, Taji, and two facilities at Abu Ghurayb) to suggest that such agents had been produced in militarily significant quantities.[101] But whether weapons had been produced for specific delivery systems was unclear in late 1990.[102] Thus, while Coalition planners recognized some possibility that anthrax or botulinum might be employed against their forces, this possibility appears to have been regarded as considerably more remote than the chances of chemical weapons being used by the Iraqis.

Iraqi interest in nuclear energy can be traced back to 1959 when the Soviets agreed to provide a small nuclear research reactor. Construction of the an IRT-2000 reactor began at Al Tuwaitha in 1963; it went into operation during 1968.[103]

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[98][DELETED]

[99][DELETED]

[100][DELETED]

[101]Eisenstadt, *"The Sword of the Arabs:" Iraq's Strategic Weapons*, pp 7-8.

[102]DCI, "Chemical and Biological Warfare in the Kuwait Theater of Operations: Iraq's Capability," p 7. After the war, UN Special Commission inspectors found "conclusive evidence that Iraq was engaged in an advanced military biological research programme" (Ekeus, rpt S/23165, 25 Oct 1991, p 5). However, no evidence of "actual weaponization" was found by the UN (*ibid*).

[103]Jed C. Snyder, "The Road to Osiraq: Baghdad's Quest for the Bomb," *Middle East Journal*, Autumn 1983, p 565.

In the end, the IRT-2000 did not satisfy Iraq's nuclear appetite. By the mid-1970s the Iraqis were enjoying enormous increases in revenue from oil exports, and they struck a deal in 1976 with the French to supply two more nuclear reactors, the larger being a 70 megawatt (thermal) reactor that the French dubbed *Osirak* and the Iraqis *Tammuz*.[104] Given Iraq's vast oil reserves, this reactor did not appear to correspond to any legitimate Iraqi nuclear-power requirement. Additionally, Osirik (also frequently spelled Osiraq) was to run on highly enriched (93 percent) uranium which, if diverted, could have been used in a nuclear weapon. And, finally, evidence emerged that Iraqis had begun acquiring "massive" amounts–eventually an estimated 250 tons–of uranium ore concentrate (yellowcake) from Brazil, Portugal, and Niger.[105] This material was neither subject to International Atomic Energy Agency (IAEA) safeguards nor directly usable as fuel to power Osirik/Tammuz. If irradiated in Osirik, though, the yellowcake could be reprocessed to extract weapons-grade plutonium.[106] It was these sorts of possibilities that prompted the Israelis to bomb the Osirik reactor on the afternoon of 7 June 1981, before it could be used to begin producing material for nuclear weapons.

After the Israeli strike on the Osirik reactor, the Iraqi nuclear-weapons program was believed in the West to have been mostly dormant until sometime in the late 1980s, when evidence emerged that Pakistan and Brazil had constructed gas-centrifuge enrichment facilities in Iraq.[107] In reality, the picture eventually pieced together after the war by IAEA inspectors operating under United Nations Security Council resolution 687 was that the overall Iraqi response to the bombing of the Osirik reactor had been to restructure the program so as to minimize its vulnerability to accurate bombing by switching from work on a plutonium bomb to an enriched-uranium device. Toward this end, Iraq had embarked in

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[104]*Ibid*, pp 567 and 576. Saddam Hussein selected *Tammuz* after the month in the Arabic calendar during which the Ba'th party came to power in 1968 (*ibid*, p 567).

[105]Eisenstadt, *"The Sword of the Arabs:" Iraq's Strategic Weapons*, pp 10-11.

[106]Snyder, "The Road to Osiraq: Baghdad's Quest for the Bomb," pp 577-578.

[107]Eisenstadt, *"The Sword of the Arabs:" Iraq's Strategic Weapons*, pp 11-12.

1981 on a clandestine uranium enrichment program involving three parallel tracks: electromagnetic-isotope separation (the "EMIS" or "calutron" method), chemical enrichment, and gaseous-centrifuge enrichment.[108] Not only were these redundant methods for producing fissile material independent of nuclear reactors, but each track could be made less vulnerable to air attack than the Osirik reactor had been by such tried-and-true methods as concealment, dispersal, decoy facilities, and hardening. (Of course, reactors were still useful to the overall program as potential sources for the short-lived isotopes of hydrogen, polonium, and plutonium that can be used as fission initiators, the devices that produce the neutrons needed to initiate nuclear fission.[109])

Consequently, by January 1991 Iraq had accumulated over 25 pounds of highly enriched uranium (roughly one-third of the amount required for a weapon[110]); start-up was underway for industrial-scale electromagnetic isotope separation at two sites (Tarmiya and Ash Sharqat);[111] materials and equipment for 20,000 modern centrifuges had been acquired, and centrifuge isotope separation was scheduled to begin in 1991;[112] atomic-bomb design and associated manufacturing facilities were well

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[108]Kay, "Arms Inspections in Iraq: Lessons for Arms Control," p 2; also, Security Council, rpt S/23947 (of the 11th on-site inspection, 1-15 Apr 1992), p 18.

[109]Devices that produce neutrons without short-lived nuclear isotopes are commercially available. However, these "external" initiators require more precise timing to produce a nuclear explosion than do weapons relying on isotope initiators.

[110]John Phillips, a weapons designer from the Los Alamos National Laboratory, estimated that the Iraqis would have needed around 35 kilograms of enriched uranium for a successful bomb (notes from intvw, Stephen P. Rosen with John Phillips, 26 Jun 1992). The estimate of 35 kilograms is a conservative one. A more sophisticated design than that Phillips attributed to the Iraqis, based on his participation in UN Special Commission inspections in Iraq after the war, could theoretically work with smaller amounts of fissile material.

[111]Each of these two EMIS facilities was later assessed as having the capacity to produce 15 kilograms of highly enriched uranium per year once in operation; the Ash Sharqat facility was 85% complete when it was destroyed during the Gulf War (Ekeus, rpt S/23165, 25 Oct 1991, p 21).

[112]Ekeus, rpt S/23165, 25 Oct 1991, p 21.

advanced; and preliminary research had begun on the fusion boosting of fission warheads with lithium-6.[113] The Iraqi nuclear program, in short, was massive,[114] for most practical purposes fiscally unconstrained, and closer to fielding a nuclear weapon than was generally realized when Desert Storm began.

On the eve of the Gulf War, however, understanding of the true scope and status of the Iraqi nuclear program was much more limited. On the one hand, prewar intelligence assessments were correct in estimating that Iraq did not yet have an operational nuclear weapon.[115] Although the evidence was compelling by then that the Iraqis were pursuing uranium enrichment, they were not yet thought to have enough nuclear material for a fission device, and their nuclear program was not judged to have completed *all* of the design, engineering, and nonnuclear testing necessary to field a weapon comparable, especially in reliability, to those long possessed by countries like the United States.[116] On the other hand, the Iraqi nuclear program was unquestionably larger, further along, and less vulnerable to destruction by precision bombing than Coalition air commanders and planners or U.S. intelligence specialists, realized going into Desert Storm. The Black Hole's 16 January 1991 target list contained only two nuclear targets: the large complex at Al Tuwaitha and the uranium-ore mine some 300 kilometers northwest of Baghdad at Al Qaim.[117] After the war, IAEA inspectors operating under the UN Special

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[113]Kay, "Arms Inspections in Iraq: Lessons for Arms Control," p 2.

[114]After the war it was determined that the Iraqi nuclear program had employed over 20,000 people (Kay, "Arms Inspections in Iraq: Lessons for Arms Control," p 2).

[115][DELETED]

[116](S/NF) For example, American nuclear weapon designers have long stressed building devices that would achieve very close to the precise yields desired. The possibility that Iraqi designers might not care nearly as much about achieving a precise yield illustrates one of the inherent uncertainties in the US estimates of how soon Iraq might have fielded nuclear weapons if Desert Storm had not occurred

[117]GWAPS, BH, Box 2, Folder 53, Master Target Folder. There were other targets, such as Tarmiya and Ash Sharqat, that did have BE numbers in the AIF going into the war. But because their role in the Iraqi nuclear program was not initially understood they did not appear in the Black Hole's prewar master target list as nuclear targets. Tarmiya was subsequently added as a "suspected" nuclear facility. Ash Sharqat, too, was picked up as a target but it appears to have been identified with the Scud rather than the nuclear program. And Al Atheer was not added until the final days of the war.

Commission would eventually uncover more than twenty sites involved in the Iraqi nuclear-weapons program of which sixteen were described as "main facilities."[118] But, on the eve of battle, the roles of sites such as Ash Sharqat (electromagnetic isotope separation) or Al Atheer (nuclear weapons design and associated high-explosives development) were not understood; in fact, incontrovertible or "conclusive" evidence that Iraq's nuclear development program aimed fielding "an implosion-type nuclear weapon linked to a surface-to-surface missile project" was not obtained until the sixth IAEA inspection (21-30 September 1991).[119]

The final component of Iraq's drive to acquire so-called weapons of mass destruction was a ballistic-missile program aimed at acquiring the means to deliver mass-destruction weapons throughout the Middle East. The Iraqi ballistic-missile program was based on a mix of imported and indigenous equipment and technologies. By the time Kuwait was seized, two distinct ballistic-missile programs were underway in Iraq. The first, a liquid-fuel program, was based on Iraqi modifications to the Scud-B short-range ballistic missile, which the Soviets had exported widely to countries throughout eastern Europe and the Middle East, including Iraq.[120] Prior to Desert Storm the Iraqis were thought to have developed two extended-range variants of the Scud-Bs obtained from the Soviets: the Al-Hussein and the Al-Abbas.

The Al-Hussein was first used by the Iraqis during the "war of the cities" phase (29 February-20 April 1988) of the Iran-Iraq war, when

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[118]Security Council, rpt S/23215, seventh IAEA on-site inspection (11-22 Oct 1991), 14 Nov 1991, pp 8 and 63.

[119]Ekeus, rpt S/23165, 25 Oct 1991, pp 4 and 18; also Security Council, rpt S/23215, 14 Nov 1991, Figure 2, p 8.

[120]Scud B is the NATO code name for the SS-1C variant of the R-17/R-300 family of short-range ballistic missiles that the Soviets developed as an army/front-level asset [*Jane's Strategic Weapon Systems*, ed Duncan Lennox (Coulsdon: Jane's Information Group, 1990), JSWS Issue 03]. Scud-As, which probably derived in part from the German V-2, were first observed in 1957. Scud-Bs were initially deployed with Soviet ground forces during the mid-1960s. The Scud-B consists of a single-stage, liquid-fueled rocket some 36.9 ft in length, weighing about 14,000 lbs at launch, and using inertial guidance. The Scud-B was thought capable of delivering a payload of over 2,100 lbs to a maximum range of 300 km (164 NM) with a circular error probable of about 900 m (or 2,950 ft). The Scud-B was long assessed by NATO as being capable of delivering high-explosive, chemical, or nuclear warheads. Soviet Scud-Bs were carried on, and could be fired from, an eight-wheeled MAZ-543 vehicle, also known as a transporter erector launcher (or TEL).

some 189 were fired at six Iranian cities over a period of eight weeks.[121] This Scud-variant basically doubled the maximum range of the Scud-B from 300 to 600 kilometers by reducing the payload from 800 to under 180 kilograms and adding an estimated 1,000 kilograms of fuel.[122] The Iraqis had employed unmodified Scud-Bs against Iran as early as October 1982. But the 300-kilometer range of the imported Scud-B did not allow the Iraqis to reach the Iranian capital of Tehran, whereas the Iranians were able to reach Baghdad with their Scud-Bs.[123] The Iraqi Al-Hussein, therefore, appears to have been developed as a crash program in response to Iranian attacks on Baghdad with Scud-Bs in March of 1986, and, by all indications, Western intelligence agencies were unaware of this program until scores of Al-Husseins began hitting Iranian cities such as Tehran in February and March of 1988.[124]

The Al-Hussein's estimated circular error probable of more than 2,000 meters, coupled with a conventional payload limit of less than 180 kilograms of high explosives, argued that the missile was of little utility except as a terror weapon. Barring a lucky hit, the Al-Hussein's tiny, inaccurate warhead offered little capability against most military targets. Nonetheless, it did prove effective enough in 1988 to persuade the Iranians to cease using Scud-Bs against Baghdad, thus ending the war of the cities. The Al-Hussein's warhead was accompanied by a one-ton missile body, which normally separated just prior to impact and landed nearby with a terminal velocity over four times the speed of sound. Against Iranian civilian populations, the damage randomly inflicted by the missile body and its warhead in urban areas did evidently suffice to achieve the Iraqis' strategic purpose of deterring Iranian Scud attacks against Baghdad.

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[121]According to the Iranians, 135 (71%) of the 189 of the modified Scuds fired during the war of the cities fell on Tehran (W. Seth Carus and Joseph S. Bermudez, Jr., "Iraq's Al-Husayn Missile Programme," *Jane's Soviet Intelligence Review*, Jun 1990, p 242; this citation is to the second part of a two-part article).

[122]Carus and Bermudez, "Iraq's Al-Husayn Missile Programme," May 1990, pp 205 and 206.

[123]*Ibid*, Jun 1990, pp 245 and 246. The Al-Hussein was about 1.3 meters longer than the Scud-B, and it was thought by the Iranians that three Soviet-supplied Scud-Bs were needed to build two Al-Hussein's (*ibid*, May 1990, pp 205 and 206).

[124]*Ibid*, May 1990, p 207.

On 25 April 1988, the Iraqis successfully test fired an upgraded variant of the Al-Hussein, the Al-Abbas.[125] Over two meters longer than the original Scud-B, the Al-Abbas reportedly achieved a range of about 800 kilometers (437 nautical miles), and the Iraqis claimed that was substantially more accurate than the Al-Hussein, or even the Scud-B. Subsequently, after the 1991 Gulf War ended, the Iraqis declared to the United Nations that they had also developed a slightly shorter-length version of the Al-Hussein, the Al-Hijarah, and that a few Al-Hijarahs had been fired during the fighting. The evidence from Desert Storm indicated that this third variant of the Scud-B had about the same range as the Al-Hussein.

These three missiles–the Al-Hussein, Al-Abbas, and Al-Hijarah–made up the liquid-fueled component of the Iraqi ballistic missile program by the early 1990s. During Desert Shield, the demonstrated inaccuracy of the Al-Hussein from the Iran-Iraq war led Coalition intelligence analysts, air planners, and commanders alike to assess Iraq's extended-range Scud variants as only of use as terror weapons. Armed with high-explosive warheads, as opposed to chemical or other "mass-destruction" weapons, they were almost universally viewed as being militarily insignificant.[126]

The other component of the Iraqi's ballistic missile program aimed at developing a space-launch vehicle and a family of indigenously produced, solid-fuel rockets. By the end of 1989 the Iraqis had announced that they were working on the Al-Abid satellite-launch vehicle and the Tammuz 1 ballistic missile, for which they claimed a range of 2,000 kilometers. While little was known about the Tammuz 1 prior to the Gulf War, Iraqi television footage of a test of the Al-Abid's first stage revealed a three-stage missile with a cluster of five motors–probably versions of the Scud-Bs–making up the first stage.[127] In addition, the Iraqis had, with foreign help, built the research, development, test, and production infrastructure to support both their liquid-fueled and solid-propellant missile programs. This infrastructure included a primary research and development center near Al Mosul, engineering workshops around Falluja, rocket-motor test facilities near Karbala, and solid-fuel

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[125]*Ibid*, Jun 1990, p 245.

[126]Intvw, CWAPS with Glosson, 9 Apr 1992; H. Norman Schwarzkopf, *It Doesn't Take a Hero* (New York: Bantam Books, 1992), p 417.

[127]Carus and Bermudez, "Iraq's Al-Husayn Missile Programme," Jun 1990, p 246.

production at places such as Latifiyah.[128] Like Iraq's nuclear program, to which it was linked, the ballistic-missile effort was ambitious and well advanced by the eve of the Gulf War.

Militarily, there were at least two critical areas of uncertainty concerning Iraq's ballistic-missile capabilities in the months preceding Desert Storm. One concerned Iraqi order of battle–especially the numbers of fixed and mobile launchers the Iraqis possessed, as well as the number of operational missiles. The other area of uncertainty had to do with how the Iraqis might choose to employ these weapons against Coalition forces should Saddam Hussein refuse to relinquish Kuwait in response to diplomatic and economic pressure.

Even two years after the war ended, uncertainty remained regarding some of the numbers. In the case of launchers, by October 1990 U.S. intelligence community estimates included some twenty-eight fixed launchers in western Iraq, around a dozen Soviet-supplied MAZ-543 TELs (transporter erector launchers), and a smaller number of Iraqi-built MELs (mobile erector launchers) based on modifications to the Saab-Scania tractor-trailer. When the conflict finally began in January 1991, however, the known fixed launchers at places in western Iraq like the H-2 airfield and Wadi Al Jabariyah were not used by the Iraqis. Hence, the figure that turned out to be most critical for Coalition air forces tasked with suppressing Scud launches during Desert Storm was the number of mobile launchers.

On the eve of combat, the estimated total number of mobile launchers (TELs and MELs) had climbed to the mid-thirties.[129] In retrospect, this estimate appears to have been reasonably close to reality. Certainly it was of the right order of magnitude. While higher than the nineteen mobile launchers that the Iraqis eventually admitted possessing to United Nations inspectors after the war,[130] it was not inconsistent with postwar

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[128]Eisenstadt, *"The Sword of the Arabs:" Iraq's Strategic Weapons*, p 22.

[129]Discussions with Capt William Bruner, who tracked Scuds in the Black Hole during Desert Storm and served with GWAPS for several months during 1992

[130]The Soviets have stated that they sold eleven MAZ-543s to the Iraqis. After the Gulf War the Iraqis declared a total of nineteen TELs and MELs to the United Nations. UN Special Commission teams destroyed ten of these mobile launchers and confirmed that the Iraqis had destroyed the other nine (Col Douglas Englund, transcript of "Street

U.S. intelligence estimates as to how many operational mobile launchers the Iraqis possessed at the outset of the air campaign.[131]

After the war, UN Special Commission teams verified the destruction of around 140 missiles. Assuming that roughly three of the Soviet-supplied Scud-Bs were needed to produce two extended-range Scud variants, these missiles would account for 140-210 Scud-Bs, depending on the portion that had been converted to extended-range variants. Some 88 extended-range missiles were fired during Desert Storm, which would account for another 130 of the original airframes, and the almost 200 extended-range Scuds fired during the 1988 war of the cities would cover another 300. Altogether, the missiles destroyed by the UN and those fired in 1988 and 1991 account for 570-640 Scud-Bs. Since the Gulf War, the Iraqis have consistently claimed that all these airframes were expended in the Iran-Iraq war prior to the war of the cities. But at least some participants in the postwar inspections under United Nations auspices believed that 100-200 missiles remained in Iraqi hands, as well as a few mobile launchers.[132] Robert Gates, then head of the Central Intelligence Agency, concurred, stating in a December 1992 speech that Iraq still retained "ballistic missiles and missile launchers" that had not been declared to the United Nations as required by UN Resolution 687.[133]

Going into Desert Storm, though, the greatest uncertainties concerning Iraqi ballistic-missile capabilities concerned how they might be employed. While the prewar intelligence estimates tended to be silent on these matters, the most generous interpretation of Coalition planning to deal with Iraq's modified Scuds would be that the air planners in Riyadh were led to the following assumptions about likely Iraqi ballistic-missile

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Stories," CBS television, 1 Oct 1992).

[131](TS) Scud brfg to GWAPS, 18 Aug 1992; (S/NF) Thomas P. Christie, William J. Barlow, et al, "Desert Storm Scud Campaign," Institute for Defense Analyses paper P-2661, Apr 1992, p 17; (S) "Mobile Short-Range Ballistic Missile Targeting in Operation Desert Storm," OGA 1040-23-91, Dec 1991, p 9; (S) : Iraq: Operations Before and During Desert Storm, 012343Z Dec 1992. There is still variance on the exact numbers of mobile launchers the Iraqis had before and after the Gulf War.

[132]Bill Getz, "Iraq Ignoring Sanctions on Nukes, Inspector Says," *Washington Times*, 17 Jun 1992, p A6.

[133]Robert M. Gates, "Weapons Proliferation: The Most Dangerous Challenge for American Intelligence," Proposed Remarks to the Comstock Club, Sacramento, CA, 15 Dec 1992, p 15.

operations. First, the preferred Iraqi employment mode would initially be from fixed or known launch sites, which would give Coalition air power a reasonable chance of eliminating the Scud threat–or most of it–in the opening hours of the war.[134] Second, if the Iraqis did shift to mobile operations under attack, the set-up and launch procedures would resemble those long utilized by Soviet Scud units in central Europe. More specifically, the TELs and MELs (mobile launchers) would not only require several hours to launch a missile but, in the process, provide distinctive signatures that Coalition forces could exploit to locate and attack them. And, third, the problem of dealing with Iraqi Scud units would not be greatly complicated by decoys or other "background noise." As we shall see, none of these assumptions proved accurate during the war.

Overall, then, the target arrays that comprised Iraqi nuclear, biological, and ballistic-missile capabilities were not well understood prior to the Gulf War; Iraq's chemical capabilities were better understood, but even in this area there were, as we shall see, uncertainties. In hindsight, it seems clear that the Iraqis had consciously structured these target systems to be as elusive and resistant to accurate air attack as possible, and it should not be surprising that Coalition efforts during Desert Storm to eliminate these capabilities with air strikes were not as effective as hoped.

Figure 37 shows the flow of Coalition air strikes against the Iraqi nuclear, biological, and chemical (NBC) targets that made up the Black Hole's C target category. In all, some 970 strikes were mounted against this target category. Nearly more than 40 percent of this total consisted of precision attacks, and about 80 percent of the precision strikes were carried by F-117s. Nonprecision attacks against NBC targets included strikes by B-52s, F-16s, F/A-18s, GR-1s, F-111Es, and A-6s. In addition, a few nonprecision attacks on these targets were made by F-111Fs and F-15Es.

The bulk of the strikes and sorties directed against the C or NBC target category focused on Iraqi chemical-warfare capabilities. Target facilities included the three redundant chemical precursor production facilities near Al Fallujah, research centers such as Salman Pak (which was also associated by Coalition intelligence with Iraqi work on biological toxins),

[134]Intvw, GWAPS with Gen Glosson, 9 Apr 1992. The GWAPS Missions database confirms that several hundred sorties were sent against Scud targets during the first four days of the air campaign.

and chemical-munition production facilities such as Samarra. Suspected storage bunkers for chemical weapons were scattered throughout Iraq, and some of these, notably the "S"-shaped bunkers seen primarily at airfields, had rather unique signatures. Further, by the time the war began Coalition intelligence indicated that chemical-warfare units might be operating from Kuwaiti airfields, which transformed virtually all the hardened shelters on those bases into potential storage facilities for chemical munitions. All in all, therefore, Iraqi chemical-warfare capabilities offered a fairly sizable number of potential aimpoints.

How effective were Coalition efforts against Iraqi chemical-warfare capabilities? On the one hand, the possibility that chemical munitions might be employed against Coalition forces was a recurring concern throughout the war. For example, toward the end of the second week (ATO Day 12), Badger medium bombers were struck at Al Taqaddum on

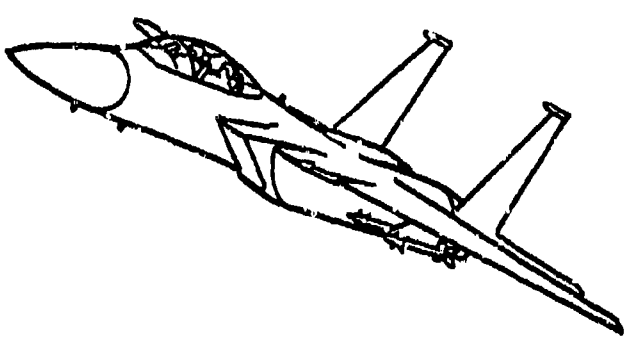
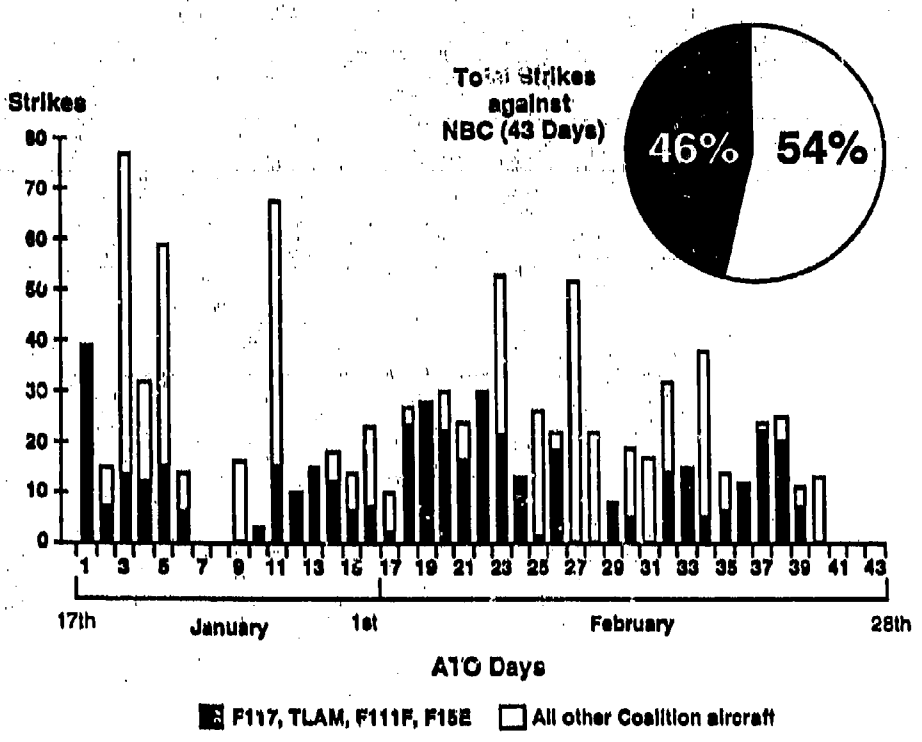


Figure 37
Coalition Strikes/Sorties against Nuclear, Biological, and Chemical (NBC) Targets



AIF strike counts, GWAPS Missions Database, 9 Dec 1992.

the belief that the Iraqis might attempt to employ them with chemical weapons.[135] Similarly, as late as mid-February 1991, General Schwarzkopf was still having "nightmare" visions of massive chemical use by the Iraqis making the planned Coalition ground campaign either "extremely costly" or possibly even enabling the Iraqis to achieve a stalemate on the

[135]GWAPS Missions Database, F-117 mission number 3323B on ATO Day 12.

ground.[136] On the other hand, the Iraqis did not employ chemical weapons during Desert Storm, even though postwar inspections by UN Special Commission teams eventually uncovered some 150,000 chemical munitions.[137] Why not?

It may be tempting to suppose that air attacks on chemical-munition facilities in Iraq, combined with efforts in the Kuwait theater to destroy up to 90 percent of the artillery in Iraqi frontline units and interdict lines of communication, prevented chemical use. However, the massive quantities of chemical weapons uncovered after the war suggest that air power almost certainly did not eliminate Iraq's capability to employ chemical weapons prior to G-Day, even though Iraq's known production facilities for chemical munitions were heavily damaged. Why then, contrary to the expectations and fears of many, did the Iraqis forego chemical weapons?

The most plausible hypothesis would be Iraqi fear of Coalition retaliation. True, the Iraqis had previously displayed no scruples about using chemical munitions against the Iranians and Kurdish elements of their own population. But neither the Iranians nor Iraq's Kurds had the capability to retaliate in kind, much less to escalate. In the Gulf War, by contrast, three of the Coalition powers–the United States, the United Kingdom, and France–were established nuclear powers. The Iraqis would also have had to assume that some of the Coalition nations, particularly those with historical involvement in the NATO alliance, would have possessed chemical-warfare capabilities as well. Last but not least, the American and British governments made concerted efforts before the war, both public and private, to impress upon Saddam Hussein that chemical use would have "severe consequences."[138] While it cannot be said for

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[136]Schwarzkopf, *It Doesn't Take a Hero*, p 439.

[137]Iraq's initial postwar declaration to the UN on 18 April 1991 acknowledged nearly 10,000 nerve-gas warheads, some 1,500 chemical-weapon bombs and shells, and 1,000 tons of nerve and mustard gas (Kay, "Arms Inspections in Iraq: Lessons for Arms Control," p 1). By the end of 1992 the Iraqi had admitted to 150,000 chemical munitions, and the head of the CIA believed that the Iraqis still possessed additional munitions that UN inspectors had not found (Gates, "Weapons Proliferation: The Most Dangerous Challenge for American Intelligence," 15 Dec 1992, p 12).

[138]DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, p 155. Intvw, GWAPS with Gen Glosson, 14 Apr 1992. From an Iraqi perspective, American and British warnings to eschew chemical employment could not have been easily dismissed after 17

certain, without access to decision-making information on the Iraqi side, that the Coalition's potential for retaliation, rather than the destruction of Iraqi chemical capabilities by air attack, succeeded in deterring Iraqi use of chemical weapons, this hypothesis is the most likely explanation for what happened.[139]

Does this conclusion mean that the Coalition's strategic bombing of Iraqi chemical-warfare capabilities was entirely ineffective? It does not, for two reasons. First, the portion of the effort aimed at destroying research, development, and production facilities for chemical munitions began the process of eliminating Iraq's ability to threaten its regional neighbors with weapons of mass destruction. Indeed, it took numerous inspections and much effort after the war by UN inspectors to begin even to approach eliminating the bulk of Iraq's chemical weapons. Concerted efforts to destroy the "cruciform" and "S"-shaped bunkers thought to contain chemical weapons were a sensible hedge against the possibility of the Iraqi Air Force trying to use chemical agents against Coalition forces. Second, there is an indirect sense in which Coalition air power in general probably contributed to deterrence. The Coalition's control of the air, together with the ability of aircraft like the F-117 to bomb pinpoint targets with consistent accuracy, surely must have reinforced Iraqi qualms about employing chemical weapons against Coalition forces. Further, the attrition of artillery in demoralized Iraqi front-line units must have eventually rendered any coordinated, systematic use of chemical munitions against the initial penetrations of Iraqi defenses difficult to execute. Even though air attacks against Iraq's chemical-warfare capabilities fell well short of destroying them completely, it by no means follows that these attacks were militarily futile or served no purpose.

January 1991.

[139]Asked during a 27 February 1991 press conference why the Iraqis had not used chemical weapons, Gen Schwarzkopf speculated that air attack, particularly of the artillery in front-line Iraqi units, had probably limited their capability to employ such weapons; he also raised Iraqi fears of nuclear retaliation as a possible explanation ("Excerpts from Schwarzkopf News Conference on Gulf War," *The New York Times*, 28 Feb 1991, p A8). However, Gen Schwarzkopf's bottom line was that, while he might never know the answer, he was thankful that chemical weapons had not been used. Much the same view was reiterated in the Defense Department's final report on the Gulf War (DOD, *Conduct of the Persian Gulf War: Final Report to Congress*, p 155).

How effective was Coalition bombing of Iraq's biological-warfare program? Two basic types of biological-warfare targets were attacked during the air campaign: infrastructure targets such as the Salman Pak and Taji research facilities and Iraq's suspected production plants for biological weapons (one at Al Latifiyah and two near Abu Ghurayb), and the specially designed, refrigerated bunkers scattered throughout Iraq that were suspected of containing biological or other special weapons.[140] As in the case of attacks on chemical weapons, strike sorties against known or suspected research and development facilities for biological weapons served the long-term goal of reducing Iraq's postwar threat to its neighbors. Such attacks, which were carefully planned to minimize the chances of biological contamination,[141] were also a prudent hedge against the possibility that some "weaponization" had occurred. Still, the fact that UN inspectors were unable to confirm after the war that the Iraqis had actually produced any biological weapons prior to 17 January 1991, together with the likelihood that anything of military value in structures suspected of containing biological weapons was quickly removed once the air campaign started, suggest that these efforts were, in retrospect, of questionable value militarily insofar as they sought to destroy nonexistent or absent biological weapons. Moreover, the high-order secondary explosions that occurred when some of these facilities were hit indicated that many have contained weapons of some sort.[142]

If anything, the gap between weapons impacting known aimpoints and the achievement of operational-strategic effectiveness against target *systems* was even larger in the case of the Iraqi nuclear program. As has already been suggested, we now know in retrospect that the Iraqis' program to amass enough enriched uranium to begin producing atomic bombs was more extensive, more redundant, further along, and considerably less vulnerable to air attack than was realized at the outset of Desert Storm. Moreover, Iraqi willingness, once the war began, to

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[140]Some eighteen of these bunkers were known prior to the war, and others were discovered during the course of the campaign. Not all of those eventually identified were hit before the ceasefire.

[141]Lt Col Deptula, GWAPS Intvw, 21 Dec 1992. In November 1990 the Black Hole planners learned that anthrax spores could not long withstand sunlight; attacks on bunkers suspected of containing biological agents were then "weaponeered" to take advantage of this fact (*ibid*).

[142]Lt Col Richard King, written comments on earlier draft of this report, Feb 1993.

take such unorthodox measures as removing nuclear fuel or critical machinery to fields or other areas adjacent to known nuclear installations like Al Tuwaitha quickly made Iraq's nuclear program even less vulnerable to bombing, no matter how accurate, than it had been during Desert Shield. In this sense, elements of the Iraqi nuclear program were transformed into targets that could be, and were, relocatable.

The extent to which Coalition intelligence analysts and planners were unable, right to the end of the Gulf conflict, to identify more than a portion of the target array that in fact made up the Iraqi nuclear program is indicated by the wartime history of the known targets. Once again, other than the uranium mine at Al Qaim, the only nuclear target on the Black Hole's 16 January 1991 target list was the large complex at Al Tuwaitha. By the end of the war, the number of nuclear targets had grown to eight, and bomb-damage assessment in Washington suggested that a fairly complete job had been done against them. As of 27/28 February 1991, the Defense Intelligence Agency was holding five of these targets destroyed, two damaged, and only one operational.[143] However, just two days after the war ended, the Black Hole was given a list of eight "nuclear" targets to hit in the event that bombing was resumed. While several in this list consisted of structures at known locations like Al Tuwaitha that had not been sufficiently damaged, others involved locations such as Ash Sharqat whose involvement in the Iraqi nuclear program had not previously emerged.[144] And, by the end of October 1991, UN inspection teams had uncovered a total of twenty-one different facilities that were involved in the Iraqi nuclear program (see Map 14).[145]

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[143] *J-2/JCS Daily BDA Assessment: Operation Desert Storm*, 27/28 Jan 1991; GWAPS NA 353.

[144] Memo, subj: S/N High Priority Contingency Targets as of 2 Mar 91, in BH, Box 2, Folder 50 ("Post Cease Fire Target List and Additional Targeting Info"). Ash Sharqat was struck by both Proven Force F-111Es and F-117s during the war, but it was attacked as a suspected ballistic missile facility. Its involvement in isotope separation does not appear to have been fully understood until very late in the campaign, if not until after the war.

[145] Security Council, report S/23215, seventh IAEA on-site inspection (11-22 Oct 1991), 14 Nov 1991, p 63.

Map 14
Iraqi Nuclear Facilities Uncovered by UN Inspection Teams

Bombing alone, therefore, failed to achieve the objective of *eliminating* the existing Iraqi nuclear weapons program. The Iraq nuclear program's redundancy, advanced status on the eve of the war, and elusiveness, in conjunction with the extraordinary measures the Iraqis took immediately after Desert Storm to conceal its extent by destroying certain facilities, all argue that the air campaign no more than "inconvenienced" Iraqi plans to field atomic weapons. When all was said and done, too many elements of the Iraqi nuclear program were unidentified during Desert

Storm, incompletely understood, or else moved out from under Coalition bombing soon after the air campaign began.

In hindsight, this conclusion is suggestive of an intelligence failure. Planners cannot target things whose existence is unknown to them, and it seems unlikely, given the lessons which we now know the Iraqis drew from the bombing of Osirik in 1981, that Coalition intelligence organizations could have been expected to produce a picture as comprehensive as that United Nations Special Commission inspectors were eventually able to piece together based on recurring and intrusive on-site inspections in the months following the war. On the other hand, the first-order questions about the extent to which active deception and concealment measures by the Iraqis might be able to complicate Coalition targeting, or to reduce substantially the effectiveness of even precision bombing, do not appear to have been asked, much less vigorously pursued. Thus, the intelligence "failure" in this particular area was also accompanied by a conceptual failure to think through the range of feasible countermeasures and responses that the Iraqis could take to minimize the effectiveness of bombing against the military programs and capabilities that their leaders valued most.

Efforts by Coalition air forces to suppress Iraqi launches of modified Scud missiles against Israel, Saudi Arabia, and other Gulf nations during Desert Storm ran into many of the same problems evident in the case of the Iraqi's nuclear-weapons program. Key portions of the target set–notably the presurveyed launch sites and hiding places used by the mobile launchers–were not identified prior to 17 January 1991, and, even in the face of intense efforts to find and destroy them, the mobile launchers, their hiding places, and launch sites all proved remarkably elusive. Although Iraq's average weekly launch rate of modified Scuds during Desert Storm (14.7 launches/week) was about 35 percent lower than it had been in the absence of concerted air attack during the 1988 "war of the cities," and while launch rates–particularly of coordinated salvos–generally declined over the course of the Gulf War, it remains impossible to confirm the actual destruction of any Iraqi mobile launchers by Coalition aircraft. During the war, aircrews reported destroying around eighty

mobile launchers,[146] and at least another nine to eleven were claimed by U.S. Special Operations Forces.[147] Most of these reports undoubtedly stemmed from attacks that did destroy things found in the Scud launch areas. But most of the objects involved–though not all–now appear to have been: (1) decoys, (2) vehicles such as tanker trucks that were impossible to distinguish on infrared or radar sensors from mobile launchers and their associated support vehicles, or (3) other objects that were unfortunate enough to provide "Scud-like" signatures.

Figure 38 shows the day-by-day distribution of the roughly 1,460 Coalition strikes mounted against Iraqi ballistic missile capabilities. This total includes missions that were reported as having dropped on mobile launchers (TELs and MELs), suspected hiding places for the mobile launchers (highway culverts, overpasses, etc.), fixed launch sites (such as those at the H-2 airfield in western Iraq), and Scud-related production and support facilities.[148] Nearly half of the 1,460 Scud strikes delivered ordnance against either fixed sites or structures like culverts and highway overpasses that were thought to be potential hiding places for mobile

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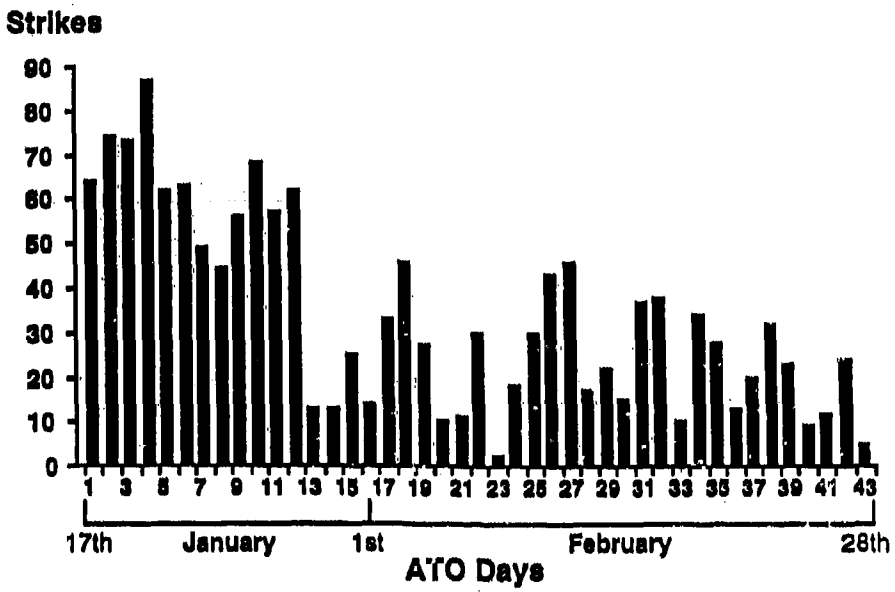
[146]Immediately after the war, the A-10s alone claimed to have destroyed 51 Scud launchers ["Operation Desert Storm: A-10 Combat Recap: 23 TFW(P) and 354 TFW(P), 17 Jan 91 to 28 Feb 91," slide entitled "A-10 Mission Results: Targets Destroyed–Confirmed," from Headquarters Tactical Air Command archives, provided 5 Apr 1991; GWAPS, NA 292]. F-15Es were reported by Gen Schwarzkopf to have destroyed 6-10 mobile launchers on the night of 29 January 1991 (DOD, "Special Central Command Briefing," Riyadh, Saudi Arabia, 30 Jan 1991, transcript #672561). Hence an estimated total of some 80 mobile launchers claimed to have been destroyed by Coalition aircrews is consistent with wartime claims, as well as information presented during a GWAPS visit to Nellis AFB, Nevada, in February 1992. (In fairness to the A-10 pilots, however, some of the "Scud kills" they reported may have been against short-range rockets like the Frog.

[147]GWAPS members visited the US Special Operations Command in March of 1992; (S/NF) Christie, Barlow, et al, "Desert Storm Scud Campaign," II-27 and II-28.

[148]The "AIF" total for Scud strikes/sorties in the GWAPS Missions database is substantially lower than the roughly 2,500 Scud sorties widely reported after the Gulf War [see, for example, Richard P. Hallion, *Storm Over Iraq: Air Power and the Gulf War* (Washington, DC: Smithsonian Institution Press, 1992), p 181]. The principal reason for this difference stems from "Scud patrol" missions that were *launched* to hunt mobile Scuds but, when unable to locate any, dropped on other targets of opportunity. Hallion's sortie totals also included combat support sorties by sensor platforms. This example illustrates the kinds of ambiguities that infected many of the figures concerning the Desert Storm air campaign that were circulated in the immediate aftermath of the war.

Figure 38
Sorties/Strikes against Scud Infrastructure, Fixed Launch Sites, and Mobile Launchers



AIF strike counts, GWAPS Missions Database, 9 Dec 1992.

launchers, some 30 percent struck ballistic-missile production and infrastructure, and only 15 percent–around 215 strikes–were reported to have involved attacks on mobile launchers.[149] The last percentage–particularly when placed alongside the roughly 1,000 "Scud patrol" sorties that dropped on other targets than Scuds–begins to give a quantitative sense of how elusive and survivable Iraq's mobile launchers proved to be.

While Coalition efforts against ballistic missile production and infrastructure served the postwar goal of eliminating Iraq's offensive threat to its regional neighbors, those directed against the fixed launchers do not appear to have been effective in suppressing Scud launches *during*

[149]GWAPS Missions Database, 14 Dec 1992. Again, Figure 38 excludes combat-support sorties from platforms like JSTARS that played a role in the Scud hunt.

the war. The reason for judging strikes against fixed launchers militarily ineffective in this sense–however prudent and necessary it may have been to strike them in order to preclude their use–stems from the fact that the Iraqis opted to rely exclusively on mobile launchers. Exactly when the mobile launchers were deployed to wartime hide sites remains somewhat murky because Iraqi deployments occurred incrementally and small changes involving the disappearance of various Scud-related vehicles from central support bases like Taji were, for the most part, reported as isolated, incremental changes.[150] In hindsight, it now appears that a good portion of the mobile Scud force–perhaps the bulk of it–dispersed from central bases by the end of August 1990, although some dispersal actions were still occurring right to the end of Desert Shield.[151] Hence, correctly interpreting the broader meaning of such piecemeal changes for likely Scud employment was difficult, and it may well be that the Iraqis themselves did not decide to abandon any use of fixed launch sites until right before the war.

In any event, the initial hope of the air planners in Riyadh that heavy attacks on the fixed Scud sites during the opening hours of the air campaign would largely eliminate Iraq's capability to launch ballistic missiles against Israel or regional members of the U.S.-led Coalition proved to be wishful thinking.[152] The fixed Scud launchers in western Iraq functioned, on the night of 16/17 January 1991, as "decoys" that diverted attention away from the mobile launchers that had already deployed to their wartime hide sites, and the first of Iraq's extended-range Scuds were fired at Israel the following night.[153]

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[150]Discussions with DIA analysts who followed Iraqi ballistic-missile capabilities during Desert Shield indicated that many signs of dispersal were observed in the sense of seeing vehicles and activity incrementally disappear from central support bases and other known locations. However, the inability to find the places to which vehicles and activities had been moved produced caveated reporting whose broader operational import was not readily understood by air planners in Riyadh as pointing to widespread dispersal.

[151]GWAPS discussions with DIA analysts 30 Sep 1992; also, (S) DIA, "Mobile Short-Range Ballistic Missile Targeting in Operation Desert Storm," OGA 1040-23-91, Dec 1991, p 1.

[152]Getting F-15Es and other strike aircraft cleanly through Iraq's air defense during the opening moments of the air campaign so that they could strike the fixed Scud launchers in western Iraq was a central feature of the master attack plan for ATO Day 1.

[153]Once again, ATO Day 1 had two nights. The first launches against Israel occurred around 0300 on the morning of 18 January 1991, Riyadh local time.

Once modified Scuds started falling on (initially) Israel and (two days later) Saudi Arabia, the next best military option would have been to locate and attack mobile launchers before they had time to fire. Soviet exercise patterns in central Europe with Scud-Bs, as well as Iraqi practice during the Iran-Iraq war, gave some hope that, if prior practices persisted, there might be enough prelaunch signatures and time to give patrolling aircraft some chance of being able to attack mobile launchers before they fired. But in the event, the Iraqis dramatically cut their prelaunch set-up times, mostly avoided prelaunch electromagnetic emissions that might give away their locations prior to launch,[154] and seeded the launch areas with decoys (some of which were very "high fidelity"[155]) and other vehicles. Thus, the long "dwell" times on launch positions and prelaunch emissions that might have made prelaunch attacks on mobile launchers by Coalition fighter-bombers possible were scrupulously avoided by the Iraqis. In sum, Iraq's operational approach and employment tactics meant that the probability of finding Iraq's mobile launchers and destroying them from the air before they fired was very close to nil at the outset of the conflict.

Nor did the chances of finding mobile Scuds before they fired improve appreciably as the campaign unfolded. Even with the use of platforms like JSTARS and special forces on the ground, Coalition forces had little success either detecting mobile launchers moving from their hide sites or catching them while they were setting up to fire from pre-surveyed launch points.

The next tactical option was to mount airborne Scud patrols in the hope that, once launches were detected, the strike aircraft would be able to reach the firing locations quickly enough to acquire the launchers with on-board senses and destroy them before they could leave the scene. The most difficult problem proved to be the ability of the sensors on strike aircraft to identify and acquire vehicles whose radar and infrared

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[154]Control of Scud units is now believed to have been done exclusively by landlines or couriers, which helps to explain why all the launches are thought to have occurred near major roads (DIA briefing to GWAPS, 30 Sep 1992). While occasional emissions from meteorological radars associated with Scud mobile launchers were sometimes picked up, they could not be correlated with launches.

[155]UN observers, who eventually oversaw the destruction of both mobile launchers and decoys, reported that the high-fidelity decoys were impossible to distinguish visually from the real thing outside of 25 yards–even on the ground. The Iraqis also made use of relatively low-fidelity decoys.

signatures were easily masked and extremely difficult to distinguish on any reliable basis from background clutter, trucks and similar vehicles, or countless other objects located within the areas in western and southeast Iraq from which the modified Scuds were launched. Prior to the war, an exploitation effort named "Touted Gleem" had been conducted using an actual Scud-B mobile launcher. Toward the end of 1990 this exploitation was expanded to include flying various strike aircraft against the MAZ-543 transporter erector launcher.[156] The results were not encouraging. They basically suggested that the MAZ-543 was hard for aircrews to find visually in the daytime and even harder to find at night with forward-looking infrared (FLIR).[157] To make matters worse, the Iraqis proved able to vacate a launch site within minutes of firing a modified Scud.

During Desert Storm over 80 percent of the modified Scud launches occurred at night, and the evident lack of success in locating the mobile launchers immediately after they fired simply reiterated the findings from Touted Gleem in late 1990. With a target the size of a MAZ-543 mobile launcher, even the F-15E had little chance of identifying and acquiring the launcher if its precise position relative to more readily discernible returns was not known to the aircrew prior to takeoff. In particular, telling an orbiting F-15E crew that a Scud had just been launched within an area as small as a single square mile generally proved insufficient to allow the launcher to be pinpointed with enough precision to enable acquisition. The clearest evidence of this limitation can be seen in the forty-two occasions on which Scud launches were visually observed by orbiting strike aircraft. In only eight of these cases did visual acquisition by aircrews of strike aircraft suffice to allow an attack to be prosecuted

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[156](S) JCS msg 302309Z Oct 1990, CHSH folder 115 (Iraq–Scuds), item 1115-5, "Subject: Project Touted Gleem."

[157](S/NF) Christie, Barlow, et al, "Desert Storm Scud Campaign," p I-15; also, (S/WN/NF/NC) "Quick Look of Project Touted Gleem," 57th Fighter Weapons Wing (FWW)/DT, Nellis AFB, 26 Nov 1990; discussions with Capt Jeff Hodgdon, who flew in Touted Gleem; (S) *Tactical Analysis Bulletin*, Vol. 91-2, Jul 1991, p 3-7. The cited 57 FWW document summarized flight trials by F-111F, F-15E, and LANTIRN-equipped (block 40) F-16 aircraft conducted at night against a Scud-B mobile launcher; Capt Hodgdon participated in these trials as an F-111F crew member. Although the Air Force aircraft that flew in these trials were given precise target coordinates, the mobile launcher proved "virtually impossible to find"–especially when the missile was not erected.

to the point of delivering ordnance.[158] Even allowing for the long distances at which a Scud launch could be seen at night, there appears to have been a fundamental sensor limitation to FLIR-equipped aircraft like the F-15E that rendered the probability of finding Iraqi mobile launchers extremely low–even when the launch point could be localized into a relatively small area in near real time by either aircrew eyeballs or off-board sensors providing coordinates.[159]

This "tactical" limitation appears to provide a basis for understanding what most likely happened during the "Scud hunt." Figure 39 shows the day-by-day launch totals for Iraq's modified Scuds during Desert Storm (using Riyadh local time to assign launches to calendar days). Notice, first, that the maximum number of launches on any single day does not exceed the total number of mobile launchers known to have survived the war.[160] So the observed launch data are quite consistent with the possibility that the Iraqis started the war with a total mobile-launcher inventory in the neighborhood of the high twenties to mid-thirties.

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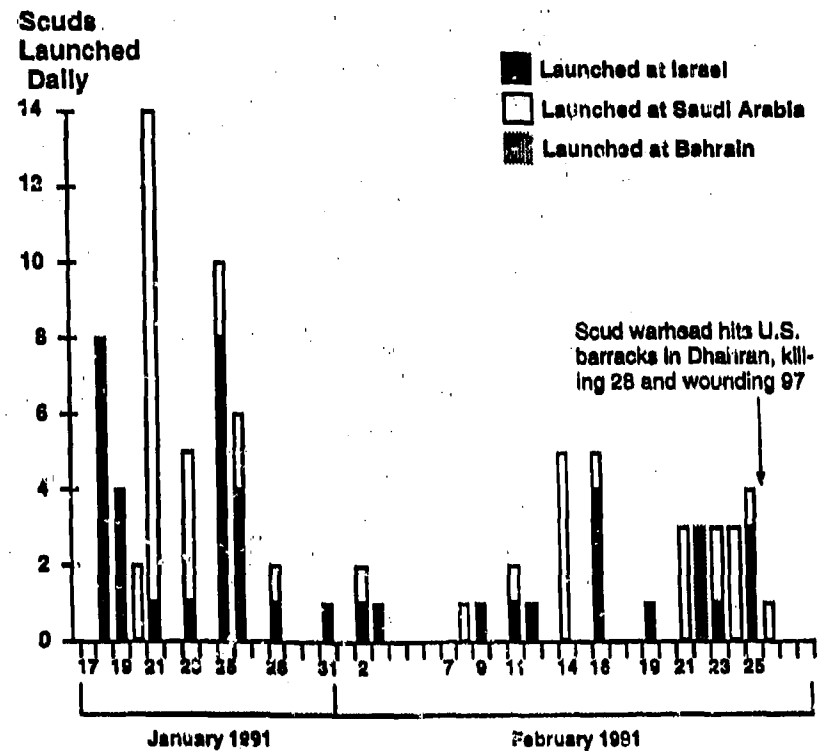
[158](S) Defense Science Board (DSB), *Lessons Learned during Desert Shield and Desert Storm*, (for comment draft), May 1992, p 72. It can be argued–and was, during the war, by the Israelis–that the tactics employed by Coalition aircraft flying airborne "Scud patrols" were less than aggressive. Strike aircraft typically operated above 15,000 feet and orbited near, rather than over, the known Scud launch areas.

[159](S) The DSB assessment of the Gulf War suggested that a veteran F-15E aircrew had a "pretty good chance" of finding a mobile launcher if its locational uncertainty was less than a kilometer or two [(S) DSB, "Lessons Learned during Desert Shield and Desert Storm," May 1992, p 69]. DIA's postwar assessment of the mobile Scud problem in Desert Storm recognized two problems: inadequate cuing of the strike aircraft and shortfalls in the ability of on-board aircraft sensors to acquire mobile launchers [(S) DIA, "Mobile Short-Range Ballistic Missile Targeting in Operation Desert Storm," Dec 1991, pp iii-iv]. Review of the empirical evidence by two GWAPS task forces led to the same conclusion reached by DIA analysts: namely, that Coalition aircrews had faced an insurmountable sensor limitation.

[160]The total number of mobile launchers known to have survived the war is nineteen. The number of launches per day, though, depends on whether Greenwich or Riyadh time is used to assign particular launches to specific days (see the footnote accompanying Figure 39 for examples). But even if the number of launches per day is calculated using Riyadh (rather than London) time, the maximum of fourteen on 21 January 1991 is less than the number of TELs and MELs. Alternatively, using London or Greenwich time, the maximum number is ten, as shown in Figure 39.

Figure 39
Daily Scud Launches During Desert Storm[161]

(Figure is UNCLASSIFIED)



Source: Thomas P. Christie, William J. Barlow, et al., "Desert Storm Scud Campaign (U)," IDA paper P-2661, Apr 1992, SECRET NF.

Next, thirty-three of the eighty-eight launches shown in Figure 39 occurred within the first seven days of Desert Storm. Hence the number

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[161]The first eight launches in Figure 39 against Israel all took place around 3 o'clock on the morning of 18 January 1991 Riyadh time (Schwarzkopf, *It Doesn't Take a Hero*, p 416). If Greenwich (or "Zulu") time is used to assign launches to calendar days, then one of these launches will fall on 17 January 1991. Similarly, the last two launches against Saudi Arabia both fell on 25 February using Greenwich (or London) time, rather than being split between the 25th and 26th as shown in Figure 39. Thus, some of the bars in Figure 39 are dependent on whether London or Riyadh time is used.

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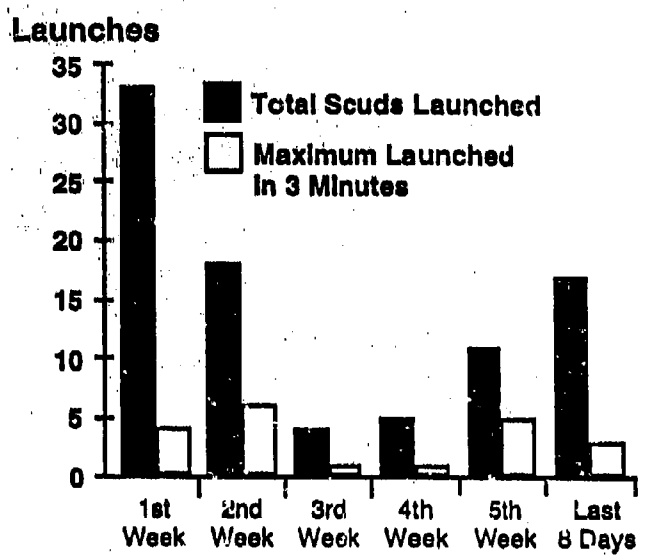
of launches over the remaining thirty-six days of the war–a total of fifty-five firings–reflected over a threefold lower average level of activity (1.5 launches/day versus an average of 4.7 launches/day during the first week), and it is not implausible to attribute this reduction in tempo to the Scud hunting efforts of Coalition aircraft.

On the other hand, the period of lowest activity spans the third and fourth weeks of the war, and there appears to have been some degree of recovery by Iraq's Scud units during the final week or two of the campaign. This pattern can be seen more easily in the week-by-week launch totals depicted as solid bars in Figure 40. Relative to the first week, the weekly launch totals reflect a substantial reduction of Scud launches through the fourth week. Yet the solid bars in Figure 40 also indicate that some degree of recovery occurred in the fifth week, and the last eight days of the war are comparable in the total numbers of Scuds launched to the second week.

A somewhat similar story emerged from considering the maximum salvo size in each week. The striped bars in Figure 40 depict the maximum salvo size, which was somewhat arbitrarily defined as the maximum number of missiles fired within a three-minute period during a given week. This measure tries to get at the Iraqis' potential to overwhelm Patriot defenses by putting a large number of missiles on Saudi Arabia or Israel within ninety seconds. Figure 40 suggests that the Iraqis recovered to a salvo size comparable to the second week in the fifth week but fell off during the final eight days–again presumably due to the pressure put on Iraqi Scud units by Coalition forces.

There were, of course, areas in which the Desert Storm air planners reached fairly accurate assessments of how the Iraqis might plan against or respond to air attack. The anticipated reactions of Iraqi surface-to-air missile defenses in the Baghdad area to decoys and HARM anti-radiation missiles on the opening night or the possibility that the Iraqi Air Force would not seriously contest air superiority in the opening days of the air campaign constitute instances of reasonably accurate forecasts of adversary behavior having been reached prior to 17 January 1991. In the case of the Iraqi Scud units, however, the evidence suggests that a series

Figure 40
By-Week Launch Totals and
Maximum Salvo Size for Iraqi Scuds



Source: Christie, Barlow, et al., "Desert Storm Scud Campaign (U)," IDA P-2661, Apr 1992, SECRET/NF.

of incorrect assumptions was made by intelligence analysts, air planners, and commanders alike. Further, the way the Scud hunt unfolded tended to mask these errors well into the air campaign. The first ten days saw substantial claims of Scud mobile launchers by aircrews, backed up in some cases by compelling video footage from airborne recording systems, and the lull in launches during the third and fourth weeks probably gave hope that some portion of the kill claims were legitimate. In such circumstances, it should not be surprising that a full picture of the history and extent of the Iraqis' Scud-decoy program was not developed until some months after the war ended. Like many elements of their nuclear program, most components of the Iraqis' mobile-Scud operations exploited "low signature" locations, and facilities did not draw attention to themselves in the way that "high secure" facilities like Al Tuwaitha obviously did.

In retrospect, there is nothing in the launch or other data bearing on the anti-Scud effort that is incompatible with an Iraqi Scud force that had, at most, thirty-some odd mobile launchers at the start of the war. Certainly Scud-hunting operations by Coalition aircraft and special forces harried and harassed the launch operations of these units. More importantly, in conjunction with the perceived effectiveness during the war of Patriots in defending against incoming Scuds, the Iraqi Scud campaign failed in its strategic purpose of trying to fracture the U.S.-led Coalition by dragging Israel into the fighting. Nevertheless, the fundamental sensor limitations of Coalition aircraft, coupled with the effectiveness of Iraqi employment tactics (including the use of decoys), suggest that relatively few mobile Scud launchers were actually destroyed by Coalition aircraft or special forces during Desert Storm. Given the level of effort, a handful may have been destroyed, but nowhere near the numbers reported during the war. Once again, there is no indisputable proof of any TELs or MELs–as opposed to high-fidelity decoys, trucks, or other objects with Scud-like signatures[162]–having been destroyed by aircraft operating independently. So beyond the disruption induced by the level of effort put into the hunt for mobile Scud launchers, Coalition air power does not appear to have been very effective against this target category.

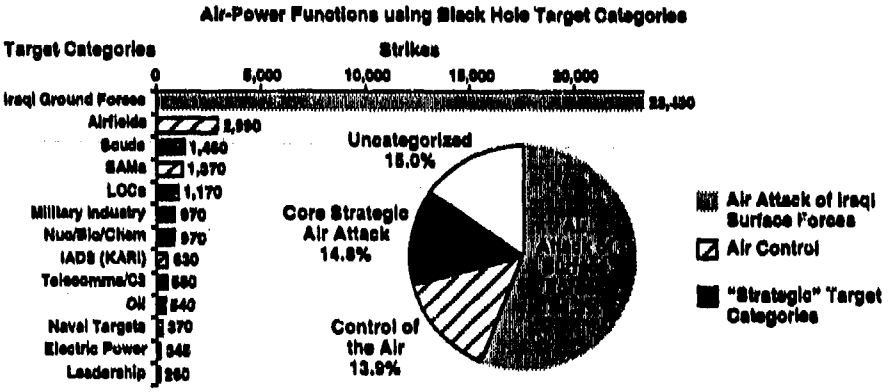
Conclusions

What broad conclusions can be drawn about the effectiveness of Coalition air efforts against the eight target sets–L, CCC, E, O, C, SC, RR, and MS–that have been identified as the core of Iraqi power? The answer depends heavily on the measures chosen.

To begin with, the portion of the total air-to-surface strikes and sorties devoted to the strategic core was in the vicinity of 15 percent. Hence the relative weight of effort against these targets was modest

[162]For example, on 30 January 1991 the videotape from an F-15E "Scud hunt" mission was shown at a US Central Command press conference as proof of Coalition success. While it was confidently asserted on this occasion that at least three–and possibly seven–of the vehicles in question were mobile launchers, it appears far more likely that the objects were in fact commercial fuel trucks (DOD, "Special Central Command Briefing," Riyadh, Saudi Arabia, 30 Jan 1991, transcript #672561; also discussions with DIA analysts and Air Force officers who were involved in bomb-damage assessment during the war and saw the tape when it was broadcast over CNN).

Figure 41
Coalition Air-to-Surface Strike/Sortie Totals by Functional Area



Source: GWAPS Missions Database, Dec. 1992. All strike totals have been rounded off to the nearest multiple of ten (e.g., 284 was rounded off to 280, and 539 to 540). Strike totals include a number still uncategorized. Most of these uncategorized strikes were A-10, F/A-18 or AV-8 sorties that, in all likelihood, were targeted against Iraqi ground forces. Strike totals do not include maritime strikes carried out by U.S. Navy aircraft as part of the fleet defense operations.

compared to that mounted by Coalition air forces in attacking land and naval forces. Granted, until the F-111Fs were drawn to the Kuwait theater for tank plinking in the fourth week of the war, attacks against the strategic core absorbed considerably more than a proportionate share of the Coalition's precision-capable platforms. Still, in light of the recurring tendency of advocates and critics alike to ask more of strategic air attack than it could deliver, it seems best to be cautious in deciding how much to expect from the 15 percent of air-to-surface strikes focused against the L, CCC, E, O, C, SC, RR, and MS targets during Desert Storm.

What sort of overall measures, then, might make sense? Regardless of the private hopes airmen such as Generals Horner and Glosson may have had during the Gulf War that air power might achieve the Coalition's military objectives without a ground campaign,[163] the modest fraction of the air-to-surface strikes and sorties focused against the strate-

[163]Asked if he had hoped that the Iraqis might quit before the ground offensive, Gen Horner replied, "Of course. I'm an airman." (GWAPS intvw, Shaw AFB, NC, 10 Mar 1992).

gic core had more pragmatic objectives. As the previous sections in this chapter have sought to explain, the principal ones were:

- disrupting and dislocating the functioning of the Iraqi government and its means of communications, command, and control;
- shutting down Iraq's primary sources of electric power;
- stopping production and reducing stores of refined petroleum products–especially fuels for tanks, other military vehicles, and combat aircraft that could be used by the Iraqi military;
- destroying Iraq's existing and potential capabilities for nuclear, chemical, or biological warfare, as well as Iraq's ballistic missile program;
- interdicting or destroying key elements in Iraq's transportation and military infrastructure–particularly those elements supporting the occupation of Kuwait or Iraq's nuclear, chemical, and biological weapons and ballistic missile programs; and
- keeping Israel from entering the conflict.[164]

The unifying theme in these objectives was basically to exert pressure from the outset directly against the heart of Iraqi power–an idea that has consistently underwritten strategic bombing campaigns.[165]

In some cases, the Coalition's immediate military objectives against the strategic core were achieved. Iraq's electric-power system, for example, was shut down fairly quickly under air attack, and both the Iraqi leadership and military were forced onto backup power systems for the duration of the conflict. True, in retrospect "turning the lights out in

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[164]This formulation of the concrete objectives of Coalition attacks on the eight core strategic target categories has been phrased so as to emphasize the uncertainties that Coalition commanders and air planners faced on the eve of battle. For the official objectives from which these more concrete ones evolved during the planning and execution of the air campaign, see Table 23 and Chapter 2.

[165]Noble Frankland argued in 1963 that the core idea behind the strategic air offensive against Nazi Germany during World War II–namely, to put pressure directly on the heart of the enemy nation–was, especially for Great Britain, a logical successor to a naval blockade [Noble Frankland, *The Bomber Offensive against Germany: Outlines and Perspectives* (London: Faber & Faber, 1965), pp 21 and 25].

Baghdad" may not have exerted as much psychological impact on the willingness of the Iraqi people in central Iraq to risk trying to overthrow Saddam Hussein as Coalition air planners had hoped. And the postwar persistence of United Nations economic sanctions in the face of ongoing Iraqi intransigence after the ceasefire prevented the rapid restoration of electric power in Iraq anticipated by Coalition air planners. Nevertheless, the principal military effect sought was achieved with some 280 strikes (including some sixty Tomahawk land-attack missiles) and remarkably little collateral damage.

In several other cases, the effectiveness of attacks on the core categories could not be clearly or precisely estimated based on the existing information. The bombing of L and CCC targets, for instance, undoubtedly imposed *some* disruption and dislocation on the Iraqi leadership. By severely limiting communications, these attacks probably took away Baghdad's options of orchestrating in real time any complex ground-force operations in the Kuwait theater. Nevertheless, the available evidence will not permit even a rough quantitative estimate as to *how much* Baghdad's national telecommunications and C^3 were disrupted by strategic air attack. Similarly, it is difficult to be completely certain as to what led Saddam Hussein and his Revolutionary Command Council to eschew using chemical weapons against Coalition forces, or against Israel–however plausible the hypothesis may be that the Iraqi dictator was deterred by the nuclear and chemical capabilities of his adversaries.

Finally, there were cases in which the strategic air attacks were far less effective than had been hoped or expected. We now know that Iraq's nuclear-weapons program was not, contrary to what was believed at the time, mostly destroyed by Coalition bombs. The program was far more extensive and dispersed than Coalition planners realized going into the conflict, elements of the program were moved out from under Coalition bombing after the conflict started, and significant pieces of it were either not identified or not understood by the time of the ceasefire. As a result, by mid-1992, inspection teams from Special Commission of the United Nations' Security Council had identified and destroyed more of the Iraqi nuclear and missile programs than had the air campaign.[166]

These sorts of summary judgments concerning operational-strategic effectiveness against the strategic core may not, however, be as useful as some of the broader patterns evident in Coalition air efforts against these

[166]Kay, "Arms Inspections in Iraq: Lessons for Arms Control," p 5.

target systems. One such pattern is the inverse relationship between both the elusiveness and adaptability under attack of various strategic target sets and the effectiveness of Coalition attacks against them. In the case of Iraqi electric power, Coalition air planners were confronted with an almost ideal target set. It consisted of a relatively small number of large, fixed facilities for which there were few "work-arounds" or spares. The electric generators, switches, and transformers that formed the functional heart of the Iraqi electric power system were not the sorts of things that could be readily removed or hidden. These targets exhibited little inherent capability either to elude Coalition air attacks or to adapt to even modest levels of physical damage and destruction. Moreover, the principal effect sought by Coalition air planners was not the long-term destruction of Iraq's electric power system but merely to shut it down for the duration of the conflict. Given the combination of a target system this vulnerable to precise attack and a Coalition military objective as modest as temporary shut down, it hardly seems surprising that attacks with precision-guided weapons were able to take down the majority of the system within a night or two.

The contrast between electric power and the Iraqi nuclear-weapon program is stark. To begin with, the Coalition's immediate objective in attacking Iraqi nuclear facilities was far more ambitious: namely, to push as far out into the future as possible the day when Iraq might be able to field an operational atomic or nuclear weapon. As previously suggested, we now know that by the eve of the war the Iraqis, with one exception, had everything necessary for the production of a fission weapon–workable detonators, high-explosive lenses, initiator technology, and valid bomb designs. All the Iraqis lacked was enough weapons-grade nuclear material. Nuclear material, specifically enriched uranium, was the long pole in the tent. But we also now know that the Iraqis were pursuing the production of nuclear materials along three redundant, parallel paths: electromagnetic isotope separation, chemical enrichment, and gaseous centrifuge enrichment.[167]

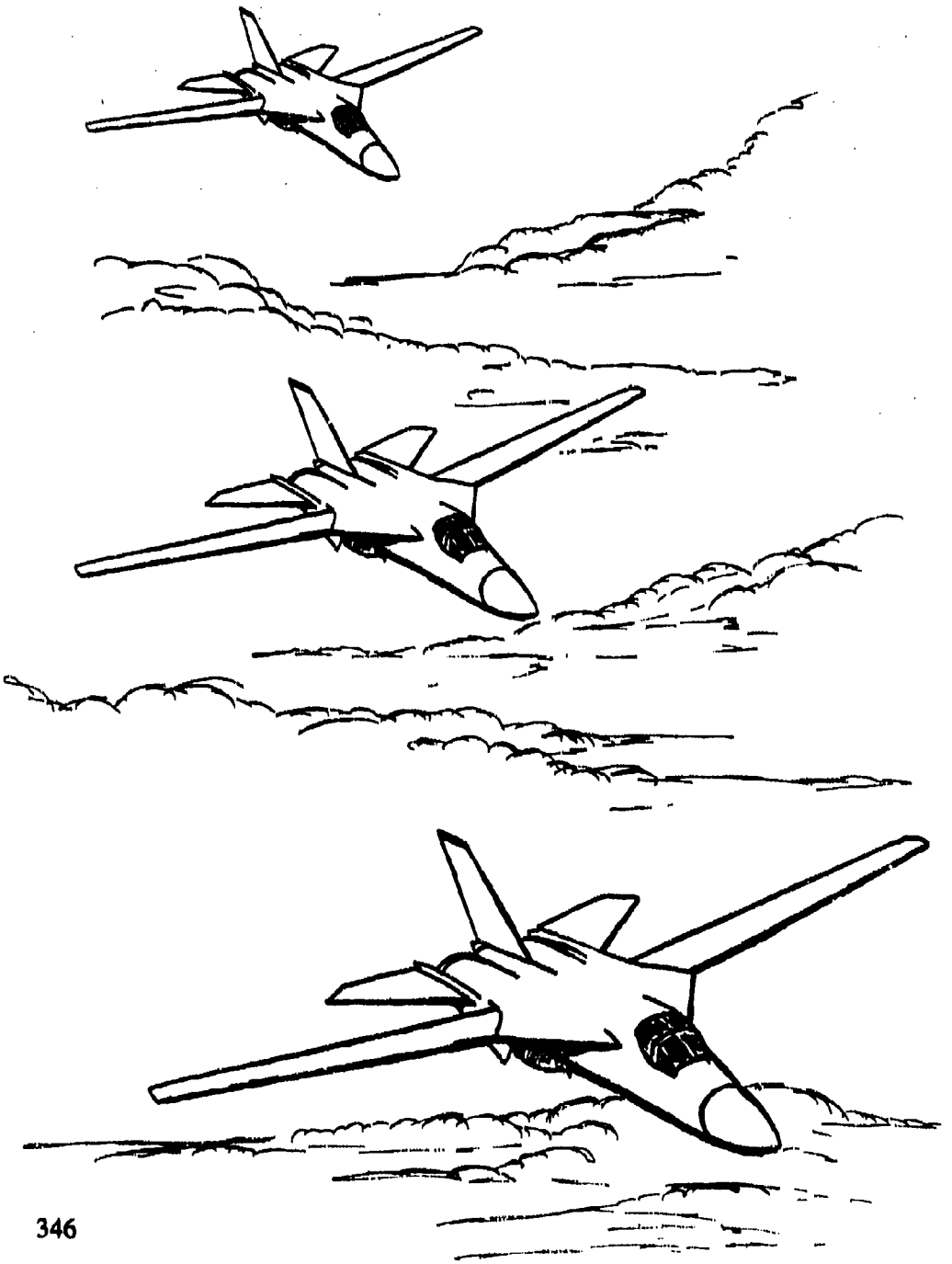
It is only with this after-the-fact picture of the Iraqi nuclear-weapons program that the true elusiveness, ambiguity, and adaptability under attack of the "target set" begins to manifest itself. Money does not appear to have been a constraint in any area of the Iraqi nuclear-weapons program. At the same time, the lessons of the 1981 Israeli raid on the Osirik reactor at Al Tuwaitha had precipitated a systematic program to

[167]Kay, "Arms Inspections in Iraq: Lessons for Arms Control," p 2.

make such capabilities as immune to accurate bombing as possible through redundancy, hardening, dispersal, concealment, and deception. In these circumstances, even identifying all the relevant facilities involved in what was, after all, an illegal[168] and covert weapons program was extremely difficult for Coalition air planners and intelligence specialists. Worse, nuclear materials, electromagnetic isotope separation devices (the so-called calutrons), supporting infrastructure, and the scientists and engineers involved could all be--and during the war were--removed from known facilities. As a result, many of the "successful" Coalition air strikes against Iraqi nuclear facilities during the Gulf War boiled down to precision bombing of more or less "empty" buildings. The nuclear target set was inherently much harder to identify than electric power, far more elusive or mobile, and certainly more capable of reconstituting itself after the war ended. Measured against the goal of destroying enough of the Iraqi nuclear-weapons program to push an Iraqi nuclear weapon out to the end of the decade or beyond, the bombing was not effective. At best it forced the Iraqis to disperse and hide the visible elements of the program, thereby temporarily suspending production of enriched uranium.

A further pattern suggested by the inverse relation of effectiveness to the elusiveness and adaptability of target sets is that success in strategic bombing tends either to come quickly or, short of widespread destruction of the enemy's country's entire industrial base and infrastructure, not at all. If the target system is not sufficiently small, unadaptable, understood by the attacking air force, and vulnerable to air attack so that it can be taken out quickly, then there is a good chance that additional attacks will soon yield increasingly diminishing returns due to enemy responses aimed at minimizing the damage. At the same time, the speed with which some target systems--notably electric power and the command and control for Iraq's strategic air defenses--were neutralized was impressive in comparison with most earlier combat experience. It is not easy to answer, though, how significant an advance in aerial warfare this ability to take down entire target systems in relatively short periods of time might be. This broader question is one of four overarching themes that will be addressed in the final chapter of this report.

[168]The Iraqi nuclear-weapon program was illegal in the sense that the country was still a signatory to the Nonproliferation Treaty.



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Implications and Conclusions

The introduction raised four overarching themes concerning the effectiveness of Coalition air power in the Gulf War that emerged during the preparation of this report. Formulated as questions, these four themes were:

- Do the sorts of technological capabilities embodied in advanced strike and sensor platforms like the F-117 and JSTARS, together with the operational concepts used to structure the Desert Storm air campaign, provide evidence that a **revolutionary advance** in late-twentieth-century warfare has occurred?

- What **limitations to strategic air attack** with modern, survivable delivery systems are reaffirmed by the Persian Gulf War?

- What **effects** did Coalition air power have **on the will and capability to fight of the Iraqi field army** in the Kuwait theater prior to the beginning of the ground campaign on 24 February 1991?

- What can be concluded from the Gulf War about the efficacy of **air power as a political instrument**?

This chapter will use these four themes as vehicles to draw out some of the overarching issues suggested by earlier chapters. For the most part, these themes were not explicitly discussed in Chapters 3 through 6 because they tended to cut across the boundaries inherent in the functional categories of air power used to structure this report, as well as the framework embedded in the various target categories used by air planners and commanders in Riyadh to organize the air campaign, particularly at the operational level of war. They can (and should) be viewed as "cross-cutting" issues that provide an alternative way of looking at the basic material presented to this point on the operational-strategic effectiveness of air power during Desert Storm.

Before tackling these four themes it may be useful to review, if very briefly, what has been suggested so far about the operational and strategic effectiveness of Coalition air power in the Gulf War. Once again, the intent of Chapters 3 through 6 was to survey the operational-strategic effectiveness of Coalition air power *within* the three functional areas of (1) air superiority, (2) air attack of surface forces, and (3) strategic air attack. At the risk of oversimplification due to brevity, Table 25 summarizes what the evidence available to the present bombing survey seemed to indicate about the operational-strategic effectiveness of Coalition air power during the forty-three-day Persian Gulf War by major target set or category. The basic implication of Table 25 is a simple one. While the Desert Storm air campaign accomplished much, in a number of target categories, there were gaps between what was desired or planned and what appears, on examination, to have been actually achieved. Without in any way trying to devalue what was accomplished by the combined efforts of the Coalition airmen who flew combat sorties during the war, these shortfalls will inevitably provide entering arguments for trying to come to grips with the four cross-cutting themes that will be the focus of this concluding chapter.

Evolutionary or Revolutionary Change?

In the heady atmosphere that followed the Coalition's swift and relatively bloodless liberation of Kuwait, American airmen were drawn to the judgment that they had witnessed a dramatic, if not revolutionary, change in warfare generally, and in aerial warfare in particular. Air Force Chief of Staff Gen. Merrill McPeak raised this theme publicly during his 15 March 1991 briefing of the air campaign to the media in Washington, D.C. Toward the end of his formal presentation, which was carried live on public television from the Pentagon, General McPeak specifically noted that stealth, in combination with precision-guided munitions, had certainly demonstrated "the potential to revolutionize warfare."[1]

While the details of precisely how the combination of low observability and precision-guided munitions had revolutionized warfare

[1] "Transcript of McPeak Briefing on Air Force Air Power in the Iraqi War," *Inside the Air Force*, 22 Mar 1991, p 16.

Table 25
Operational-Strategic Summary[2]

Target Sets*	Desired/Planned Effects	Actual Results
IADS (SAD) and Airfields (A)	Early air superiority • Suppress medium-high air defenses throughout Iraq • Contain/destroy Iraqi AF	IADS blinded/intimidated/suppressed • Low-altitude AAA, IR SAMs remained Iraqi AF bottled up on bases • 2 air-to-surface Iraqi shooter sorties? 375 of 594 HASs destroyed/damaged • Iraqi AF flees to Iran (starting 26 Jan 91)
Naval (N)	Attain sea control • Permit naval operations in northern Persian Gulf	All Iraqi naval combatants sunk/neutralized • Other vessels sunk Silkworms remained active throughout war
Leadership (L) and Telecomms/C³ (CCC)	Pressure/disrupt governmental functioning Isolate Saddam from Iraqi people, forces in KTO	Unknown degree of disruption • Neither decapitation nor Saddam's overthrow Telecomms substantially reduced • Links to KTO never completely cut
Electricity (E) and Oil (O)	Shut down national grid • Minimize long-term damage Cut flow of fuels/lubricants to Iraqi forces • No lasting damage to oil production	Rapid shutdown of grid • Down 55% by 17 Jan, 88% by 9 Feb • Lights out in Baghdad Some unintended damage to generators Refining capability down 93% (Day 34) Destroyed about 20% of the fuel/lubricants at refineries and major depots
NBC (C) and Scuds (SC)	Destroy chem/bio weapons • Prevent use against Coalition • Destroy production capability Destroy nuclear program • Long term Prevent/suppress use • Destroy production & infrastructure	Some chemical weapons destroyed • But most survived (UN Special Comm) • Chemical use deterred • No biological weapons found (UN) Nuclear program "inconvenienced" (UN) • Most program elements survived Firings somewhat suppressed, not salvos • Scud operations pressured • Aircraft destroyed few, if any, MELs/TELs
Railroads/ Bridges (RR)	Cut supply lines to KTO • Prevent retreat of Iraqi forces	All important bridges destroyed • Many Iraqi workarounds Short duration of war limited effects
Republican Guard (RG) and Other Ground Forces in the the KTO	Destroy the RG Reduce combat effectiveness 50% (armor, artillery) by G-Day	RG immobilized • Attrition by G-Day < 50% Some units (incl. RG) and 800+ tanks escape Front-line forces waiting to surrender or destroyed in place • Attrition by G-Day > 50% • Morale destroyed by air

* *Military support (MS), Breaching targets (BR), and KTO SAMs are subsumed in the target categories shown.*

[2]At the time this table was created, there had been much debate over the wisdom of creating this sort of summary of preceding chapters. Unavoidably, it was realized, the brevity required would invite misunderstanding and abuse. Nevertheless, the decision was made to provide an encapsulated summary of the operational and strategic results of the air campaign, by target category and correlated with the aims sought. To be emphasized is that the summary results are predominantly *qualitative*. Quantitative indices, where offered, represent only pieces of the story.

were not spelled out on this occasion, subsequent public comments and testimony before congressional committees by Air Force leaders articulated two main ideas. First, the F-117's low observability or stealth, while not rendering the aircraft invisible to radar, had enabled F-117 pilots, unsupported even by standoff jamming, to begin attacking targets within the most heavily defended areas of Iraq during the opening moments of the war, *before* Iraqi air defenses had been seriously degraded or damaged.[3] Second, when combined with imaging infrared sensors that allowed most targets to be readily acquired at night, and highly accurate laser-guided bombs that could penetrate hardened structures, the relation between strike aircraft and targets had changed dramatically. Both ideas were reiterated in the Defense Department's final report to Congress on the conduct of the Gulf War in April 1992.

> Technological breakthroughs revolutionized air warfare. Because of its precision delivery capability and low-observable, or stealth technology, planners assigned F-117As to attack the most heavily defended, high-value, and hardened targets. . . .This advanced technological capability allowed aircrews to strike more targets using fewer aircraft.[4]

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[3]Toward the end of 1991, controversy erupted in the press as to whether the Air Force, in trying to use the F-117's accomplishments in the Gulf War to bolster the case for the B-2 bomber, had exaggerated the degree to which F-117s had operated without defense suppression or jamming support (see Bruce B. Auster, "The Myth of the Lone Gunslinger," *U.S. News & World Report*, 18 Nov 1991, p 52; also David A. Fulghum, "F-117 Pilots, Generals Tell Congress about Stealth's Value in Gulf War," *Aviation Week & Space Technology*, 6 May 1991, pp 66-67). US Air Force officials, in responding to this charge, conceded that standoff jamming from EF-111s had been employed from time to time in conjunction with F-117 strikes. However, as one F-117 squadron commander later noted, "since EF-111 jamming was a precaution not a necessity," no F-117 strikes were aborted because EF-111s were not available, and, except for the Baghdad area, most F-117 sorties were flown without this "insurance" (Lt Col Ralph W. Getchell, "Stealth in the Storm: Separating the Facts from the Fiction," unpublished paper, p 2). Moreover, careful review of the information available to GWAPS indicated that the initial set of F-117 strikes against Baghdad targets on the opening night of the war required the aircraft to be well inside Iraqi airspace before the listening site on the Saudi-Iraqi border was attacked; also, the EF-111s that were planned to support the second set of F-117s into Baghdad went initially to H-3 and could NOT have been in position to offer effective standoff jamming support to F-117s in the Baghdad area. [CENTAF, CAFMS (Computer-assisted Force Management System) Database; (TS/LIMDIS) GWAPS, BH 1-2 and 1-3, 05 Jan/1030 [1991] Master Attack Plan: First 24 Hours and Evolution of 1st 24 HR Master Attack Plan, Part 2 of 2].

[4]DOD, *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, DC: Government Printing Office, Apr 1992), p 164.

Such claims for advanced nonnuclear weaponry are not without precedent. Going back to the early 1980s, Soviet military leaders such as chief of the Soviet General Staff Marshal Nikolai Ogarkov had argued that advances in nonnuclear (or conventional) weaponry, if combined with appropriate means of target detection and control, could "increase (by at least an order of magnitude) the destructive potential of conventional weapons, bringing them closer, so to speak, to weapons of mass destruction in terms of effectiveness."[5] In the wake of Desert Storm, the Soviet General Staff's interim report on the war suggested that Ogarkov's notion of integrated reconnaissance-strike complexes for conventional fires had been "realized for the first time."[6] Implicitly at least, this assessment could be construed as heralding the beginning of a revolution in military affairs potentially comparable to the advent of thermonuclear weapons and intercontinental ballistic missiles after World War II.

How valid are these claims of a revolutionary advance in warfare? The answer to this question has two parts. The first concerns the impact of weapon systems like the F-117/GBU-27 combination on the actual conduct of air operations during the Gulf War. The second part has to do with reaching some judgment as to what sort of criteria would have to be met in order to conclude that a change in warfare warranting the term "revolutionary" had taken place. The first issue, as we will see, is relatively straightforward. Especially from a campaign-planning standpoint, the changes brought about by precision-strike systems can be readily described, and they were fairly dramatic. The second question—whether those changes constituted a revolutionary break with the past—is more a matter of debate. For this reason, the present discussion will aim primarily at laying out the issues involved plainly enough for the reader to make up his or her own mind.

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[5]"The Defense of Socialism: Experience of History and the Present Day," intvw with MSU N. V. Ogarkov, *Krasnaya Zvezda [Red Star]*, 9 May 1984, english translation, Foreign Broadcast Information Service, *Daily Report: Soviet Union*, 9 May 1984, Vol. III, No. 091, Annex No. 054, p R 19.

[6]"Soviet Analysis of Operation Desert Storm and Operation Desert Shield," LN-006-92, Defense Intelligence Agency, Washington, DC, 28 Oct 1991, p 32. The Soviet conclusion that something approaching a reconnaissance-strike complex was realized for the first time in the Gulf War was not borne out by the evidence available to CWAPS. Although many of the pieces of such a complex were present, they were not integrated together and did not function as a whole during the campaign on any significant scale.

One way to get a sense of the change that precision-capable platforms like the F-111F and, especially, the Stealth F-117 had on the operational conduct of Desert Storm is to compare the target coverage they typically afforded when dropping precision munitions versus the target coverage represented by an equal number of similar aircraft delivering nonprecision ordnance. Table 26 compares twelve F-117 and F-111F sorties flown during the Gulf War with twelve flown by F-111Es. Just in terms of the number of distinct targets covered--twenty-six versus two--the contrast between the two cases is impressive.

There are, however, less obvious, qualitative differences that make the comparison between the two cases even more stark. For example, the eight F-111E sorties sent against the Kirkuk sector operations center (SOC) on Air Tasking Order (ATO) Day 8 did not succeed in putting the facility out of operation, and F-117s had to be sent against this target on ATO Day 10. True, the Iraqi SOCs proved to be hard enough that even individual GBU-27s could not penetrate them. But the accuracy of the F-117 at least offered a reasonable chance of putting a SOC temporarily out of action, whereas "dumb" bombs did not.

Bridges and individual tanks offer an even sharper contrast in effectiveness. While bridges in Iraq were attacked with nonprecision munitions, especially early in the war, Desert Storm ultimately reiterated the lesson of the Thanh Hoa bridge from Southeast Asia: namely, that 2-3,000-pound precision-guided bombs are needed to drop whole spans and effect genuine cuts.[7] As for individual pieces of dug-in armor, particularly main battle tanks, they were not even remotely vulnerable to attacks with unguided bombs given the medium-altitude bomb-release altitudes generally used during Desert Storm. So in both these cases,

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[7]The Thanh Hoa bridge had been heavily "overbuilt" by the North Vietnamese [Col Glenn Griffith, et al, "The Tale of Two Bridges," *The Tales of Two Bridges and the Battle for the Skies over North Vietnam*, ed. Maj A. J. C. Lavalle (Washington, DC: US Government Printing Office, 1976), p 38]. As a result, the more than 350 U.S. Air Force and Navy strike sorties flown against the bridge during 1965-68 failed to drop the structure, even though it was often rendered temporarily unusable due to bomb damage (*ibid*, pp 31, 38, 42-3, 46, 55-6, 59 and 62-3). USAF losses against the bridge over this period included F-105s, F-4s, and a C-130. During Linebacker I, two attacks involving a total of 26 F-4 sorties delivering laser-guided bombs finally succeeded in dropping the Thanh Hoa bridge without any aircraft losses (*ibid*, pp 84-6).

Table 26
Precision versus Nonprecision Target Coverage[8]

Number/Type Aircraft	Number/Type Ordnance	Target Category	Target: Name and Description
12 PRECISION SORTIES:			
1 F-117	1 GBU-27	SAD31	Baghdad "AT&T" building
	1 GBU-27	SAD10	Al Taqaddum IOC (Intercept Operations Center)
1 F-117	1 GBU-27	L01	Abu Ghurayb Presidential (sleeping) quarters
	1 GBU-27	L03	Al Taji NW command post/bunker
1 F-117	1 GBU-10	C1	Salman Pak CBW research production & storage
	1 GBU-27	MS13	Fallujah ammunition depot
1 F-117	1 GBU-27	MS38	Karbala ammunition depot
	1 GBU-27	SC53	Al Jumhuriya fiber-optic bridge, Baghdad)
1 F-117	2 GBU-27	CCC02	Baghdad TV transmitter
1 F-117	1 GBU-10	C11	Isis1 reactor, Al Tuwaitha
	1 GBU-10	SAD23	Iraqi "AWACS," Saddam International
1 F-117	2 GBU-10	L05	Iraqi Air Force headquarters, Baghdad
1 F-111F	4 GBU-12	RG	4 T-72s, Madinah Republican Guard division
1 F-111F	3 GBU-12	RG/GoB	3 tanks along N. Kuwait/Iraq border
	1 GBU-12	RG/GoB	GoB along N. Kuwait/Iraq border, 1 building
1 F-111F	2 GBU-24A/B	A19	Shelters #4 and #14, Al Asad airfield
1 F-117	1 GBU-10	RR24	An Nasiriyah highway bridge over Euphrates
	1 GBU-10	RR25	Hachama highway bridge over Nahr Desma
1 F-117	1 GBU-10	L11	Ba'ath Party headquarters, Baghdad
	1 GBU-27	SAD85	Possible alternate ADOC, Balad SE
12 NON-PRECISION SORTIES:			
4 F-111E	14 Mk-82	CCC14	Kirkuk AM radio transmitter
8 F-111E	14 Mk-82	SAD18	Kirkuk SOC (Sector Operations Center)

[8]CWAPS Missions Database. Each individual sortie shown was actually flown during Desert Storm, but most occurred on different days. Except for the two examples of F-111F "tank plinking," all the sorties included in Table 26 were drawn from the first two weeks of the air campaign.

precision-guided munitions were the only real option, and sorties with unguided bombs were mostly wasted sorties insofar as the attrition of items like Republican Guard T-72s was concerned.

Collateral damage suggests a further distinction between the two sets of attack sorties in Table 26. The F-117s were able to attack high-value targets in urban areas like Baghdad time and again because, for the most part, damage could be largely confined to the targeted buildings or structures and civilian casualties avoided, thus satisfying the constraint to minimize collateral damage. Particularly with bomb-release altitudes in the neighborhood of 15,000 feet, doing so would simply not have been possible with unguided weapons. With "dumb" bombs, Coalition air planners would have had to choose between foregoing many targets–if not the bulk of key target categories such as the leadership (or L) targets–and risking politically unacceptable collateral damage.

Finally, there is the issue of the F-117's low observability. Given the perceived imperatives of Coalition air commanders to minimize aircraft losses and collateral damage, the F-117, in conjunction with unmanned precision weapons like Tomahawk land-attack missile (TLAM), provided the weapons to begin systematically attacking a wide range of targets aimed at pressuring and isolating the Iraqi leadership without first beating down the air defenses. As the war progressed, the F-117 provided a platform that could safely return to targets in downtown Baghdad without appreciable risk of losses or the large support packages (F-4G Wild Weasels, EF-111 jammers, escort fighters, etc.) that other aircraft would have required to have similarly minimal risk of incurring losses.

These differences in breadth of target coverage, in comparative freedom from having to establish control of the air first, in the probabilities of hitting the desired aimpoints on the first or second try, in support requirements, and in the accompanying risks of friendly losses or collateral damage constitute, then, the operational substance behind the suggestion of U.S. airmen that the Desert Storm air campaign witnessed significant advances in aerial warfare. The question is: Do these changes warrant the term "revolutionary"? There are reasonable arguments on both sides of the issue.

Certainly the ability to cover some thirteen times as many aimpoints with the same number of sorties is impressive. From an air planner's

standpoint, this difference can be translated into a capability to inflict in days to weeks levels of destruction–at least against sets of known, fixed targets–that, with "dumb" bombs, typically required months to years to achieve in previous wars. Granted, the substantial impact of weather and other frictions on the operations of even F-117s during the Gulf War suggests that the era of "one bomb, one target" may not quite have arrived. But Table 26 does appear to confirm that the *ratio* between bombs on aimpoints and sorties was, for precision-capable platforms in Desert Storm, much different from what it had generally been in earlier conflicts. This point is not intended to ignore the fact that precision-guided, air-to-ground munitions have been in service for decades. For example, more than 4,000 of these munitions were dropped in North Vietnam in the period from April 1972 to January 1973.[9] But in 1972-73, laser-guided bombs were used primarily in the daytime against bridges. In Desert Storm, by contrast, not only was more than double the number of laser-guided bombs (more than 9,300) laid down in a shorter period of time (six weeks versus nine months) but most of the attacks were carried out at night across a far more comprehensive and operationally significant range of target sets. The deeper difference between precision bombing in the Linebacker operations and Desert Storm, therefore, lay in ways in which laser-guided bombs were used. In 1972-73, they were mainly used to solve a frustrating tactical problem against chokepoints in North Vietnam's transportation system. In January-February 1991, they were used to attack the "central nervous system" of Iraq and, in the case of things like "shelter busting" and "tank plinking," to go after classes of targets that were not previously even thought to be vulnerable to bombing. As a result, precision weapons that had heretofore primarily provided tactical advantage were used in the Gulf conflict to pursue operational-strategic effects throughout a theater of war.

A further advance in aerial warfare manifested in the Gulf War concerns the range of campaign options. In this case, the presence of just a small number of low-observable platforms in the force structure available to the Coalition offered up-front attack options that were not subject to the traditional requirement to focus everything initially on achieving control of the air. As a result, the array of options–or, if you will, the

[9]Headquarters Pacific Air Forces, *Summary, Air Operations Southeast Asia*, monthly reports for May 1972 to Jan 1973, especially the Jan 1973 report.

"conceptual maneuver space"–available to Coalition air planners for putting together an operational-level campaign was far larger than it would have been without the forty-two F-117s. Thus, it is certainly possible to argue that Desert Storm witnessed a significant, if not dramatic, advance in aerial warfare.

Yet, it remains possible to question whether these changes have revolutionized warfare as a whole. While the advances in aerial warfare embodied in Table 26 are significant, they mostly have to do with getting bombs on targets and in no way guarantee that the targets hit will be right ones–as the precise bombing of effectively empty nuclear targets at Al Tuwaitha or the inability to locate mobile Scud launchers both demonstrate. Hence, the more fundamental problem of getting from bomb damage and other direct, immediate physical effects to operational or strategic effectiveness against objectives such as driving the earliest date for an Iraqi nuclear weapon beyond the year 2000 does not appear to have been addressed, much less solved, by the dramatic change in target/sortie ratios evident in Desert Storm.

A further difficulty springs from the suspicion that most historical changes in military affairs deserving of the term *revolution*, while usually sparked by technological change, also required accompanying changes in doctrine, operational concepts, organizational arrangements, and institutional procedures in order to be fully realized. A classic case of inappropriate doctrine inhibiting effective employment would be Tunisia during the opening months of 1943: U.S. Army Air Forces aircraft were badly misused during this period because final decisions on target priorities had been given to local ground commanders, rather than being centralized under a single air commander who could weigh competing priorities across the entire front.[10] The highly successful *Blitzkrieg* that the Germans unleashed on the Western Allies in France on 10 May 1940 is an even more telling example; it was not so much the quality or numbers of German tanks that won the day[11] as their concentration of armor into

[10]Thomas J. Mayock, "Defeat and Reorganization," eds Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, Vol 2 (Washington, DC: Government Printing Office), pp 137, 139-140, 142-143, 160-161 and 164.

[11]The French, British, Dutch, and Belgian forces in France in May 1940 outnumbered the Germans in men, divisions, artillery, and tanks (Phillip A. Karber, Grant Whitley, Mark Herman, and Douglas Komer, "Assessing the Correlation of Forces: France 1940," BDM Corporation, BDM/W-79-560-TR, 18 Jun 1979, p 2-3).

Panzer units for penetration and rapid exploitation, incorporation of radios into armored units for the flexible command and control, operational concepts, and emphasis on leadership and lower-level initiative.[12] Combined with a campaign plan that, contrary to Allied expectations, concentrated the main effort (or *Schwerpunkt*) in the center through the "impassable" Ardennes forest, rather than in the north through Belgium, the Germans were able to shatter the Allied defense and overrun the low countries and most of France in just a few weeks.

The *Blitzkrieg* example can also be used to illustrate the importance of organization adaptation. The British had the requisite technology and military systems (tanks, radios, etc.); J. F. C. Fuller and Liddell Hart even articulated the necessary operational concepts. But only the Germans made the organizational adaptations–embodied in the Panzer division–required to fully realize the revolutionary potential of the tank for deep operations and maneuver warfare.

The problem that these doctrinal, conceptual, organizational, and procedural components of advances in military affairs raise for the view that Desert Storm represented a revolution in warfare is that, at the operational and strategic levels, no truly fundamental breaks with the past are obvious. Praiseworthy as the emphasis of Coalition air planners and commanders on centers of gravity, simultaneity in the initial attacks on Iraqi air defenses and other target categories, functional effects, and daily master attack plans were, none of these concepts, techniques, or procedures appear to lack historical antecedents. The leadership and telecommunications targets that the air planners saw as constituting the very core of Iraqi power had precursors in both Carl von Clausewitz's concept of

[12]The Germans' prewar doctrinal notions about the nature of war, the essential problems of combat, the kind of leadership and initiative required to overcome the problems of the battlefield, and human behavior under the stress of combat were embodied in their 1933 *Truppenführung* (literally troop-leading, but usually translated as field-service regulations). On these fundamental issues, the *Truppenführung*'s two-page introduction remains one of the most insightful two pages in twentieth-century military literature. For example, in talking to airmen who flew combat mission in the Gulf War about individual performance, it is apparent that the *Truppenführung*'s observation that "Many stand forth on the field of battle who in peace would remain unnoticed" was as valid over Iraq in 1991 as it was during World War II (*Truppenführung*, trans. US Army, Report No 14,507, 18 Mar 1936, p 1).

strategic centers of gravity as well as the Air Corps Tactical School's notion of vital (industrial) targets. Even within aerial warfare, the notion of functional effects has a long history. And the Air Tasking Order planning process that was appropriated (albeit with difficulty) for execution of the air campaign, though rationalized and driven by daily master attack plans, had extensive roots in the Air-Tasking-Order process and procedures developed over the years by NATO air forces for a conventional war in central Europe.

Admittedly, the reliance that the air planners in Riyadh chose to place on the F-117–literally depending on that platform to provide the backbone of the strategic portion of the air campaign–represented a significant step forward in aerial employment.[13] Likewise, their use of drones and HARMs (high-speed antiradiation missiles) to deal the Iraqi air defenses a stunning blow in the opening moments of the war was an innovative change from standard practices, since a more traditional, "roll-back" approach could have been employed instead.[14] These innovations, however, seem best characterized as taking maximum advantage of existing weaponry within the context of historical American thinking about strategic air attack, rather than as a fundamentally new way of conceptualizing the application of air power against the heart of an enemy country. The sort of first-order shift in thinking or fundamental paradigm that at least some observers of fields like physics have portrayed as the *sine qua non* of scientific revolutions is simply not manifest in the basic concepts, structure, and procedures underlying the Desert Storm air campaign (see Figure 42).[15]

At the time, of course, there was a strong subjective impression of breaking new ground among many of the participants, both in Wash-

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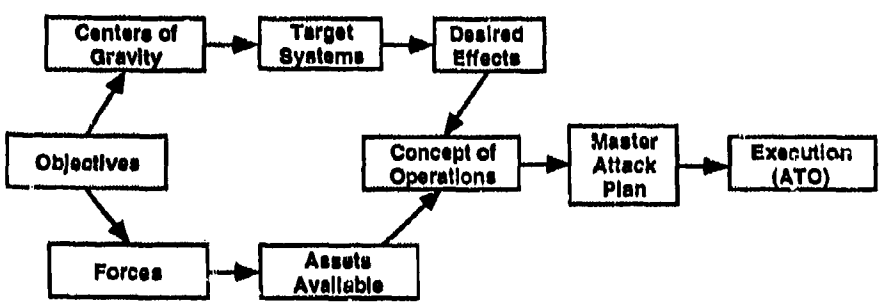
[13]A number of Air Force leaders senior to Glosson, starting with Gen Horner, were quite skeptical about leaning heavily on the F-117 (Intvw, GWAPS with Brig Gen Buster C. Glosson, 9 Apr 1992). Glosson, however, had personally experienced the difficulties of intercepting an F-117 at night when he was commander of the 1st Tactical Fighter Wing at Langley AFB. Based on this experience, he was persuaded that the Iraqis would not be effective against the F-117.

[14]Brfg slides, "Electronic Combat in Desert Shield/Desert Storm," CENTAF/EC GWAPS, NA 358; also, Intvw, GWAPS with Maj Gen Larry Henry,Pentagon, 28 Aug 1992.

[15]See Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, rev ed 1970), especially pp 92-135.

ington and Riyadh. But this impression appears to have arisen mainly from the fact that, between Linebacker II in 1972 and Desert Storm in 1991, Air Force operators and planners had given relatively little thought or attention to nonnuclear offensive air campaigns. In the case of planning against Soviet-led Warsaw Pact forces in central Europe, NATO air planners, believing themselves outnumbered and certain to be the defender rather than the attacker, had focused almost exclusively on defensive operations. The return to offensive planning precipitated by Iraq's invasion of Kuwait caused many notions to be dusted off and updated. Still, the fundamental concepts, approaches, and procedures were not new under the sun (see Figure 42). Indeed, one interpretation of the air campaign's overall success would be that the Gulf War happened to occur at a point in time when the equipment and training of Western air forces–especially the equipment and training of the American airmen--finally approached being able to do the sorts of things that visionary airmen had wanted to do since the 1930s, if not earlier. Hence, although the conceptual, organizational, and procedural aspects of the Desert Storm air campaign contained some steps forward, the overall approach in Figure 42 does not obviously represent revolutionary break with the past.

Figure 42
Air Campaign Planning Process Used for Desert Storm[16]



[16]This diagram of the air-campaign planning process is an amalgam of those made before and after the war by key members of the Black Hole (Special Planning Group) staff. For example, the Special Planning Group's 13 Sep 1990 briefing slides for a presentation of the air campaign plan to Gen Colin Powell contained a graphic almost identical to that shown in Figure 42 (GWAPS, BH 3-60, "General Glosson Briefs").

A more pragmatic concern about the temptation to attach the word "revolution" to the Desert Storm air campaign stems from the Coalition's lack of credible opposition in the air from the Iraqi Air Force. The dramatic change in the ratio between sorties and aimpoints illustrated in Table 26 was achieved against a technically inferior, ill-prepared air force that, in all likelihood, never planned to contest control of the air in the first place. Given these realities, it can surely be argued that declaring the Coalition's performance in the air to have been a revolution in warfare may be premature–at least until the heralded advances have succeeded against a more capable opponent.

Before leaving this subject, it should be noted that there is at least one alternative sense in which Desert Storm could be construed as foreshadowing a revolution in warfare. At his postwar briefing of the Desert Storm air campaign to the media, General McPeak was asked whether continuing the air war alone might have eventually defeated the Iraqis without a ground campaign. In response, he voiced the "private conviction" that Desert Storm was the "first time in history" that a field army had been "defeated by air power."[17] This thought raises the possibility that Desert Storm might be revolutionary in a very different sense than discussed so far: namely, that of foreshadowing a shift in the relative efficacy of air forces versus traditional, armor-heavy ground forces. Although a comprehensive investigation of this possibility would clearly range well beyond the venue of the present *air power* survey, it will inevitably resurface when we come to the theme about the effects of Coalition air power on the Iraqi field army prior to 24 February 1991. For now it should suffice to foreshadow a point that will be raised in the next section: that attacks by Coalition air forces on the Iraqi field army, like the air campaign in general, occurred in highly favorable circumstances. Consequently, without the additional confirmation of some sterner test–possibly in terrain or strategic circumstances far less conducive to air power than those encountered in Desert Storm–it would still appear premature to leap to judgment about a revolutionary change in the relation between air forces and armies.

[17]"Transcript of McPeak Briefing on Air Force Air Power in the Iraqi War," *Inside the Air Force*, 22 Mar 1991, p 18.

To summarize the issue concerning the kind of changes in air warfare that were demonstrated during the Gulf War, the proposition that stealth, precision, and the imaginative campaign plan employed by Coalition air forces in Desert Storm heralded a revolution in warfare seems, for now, to be one on which impartial observers can disagree. These and related technological advances in aerial warfare did become more manifest and important in 1991 than they had been heretofore. Yet, until these advances receive a more extended test in combat and are accompanied by equally dramatic changes in fundamental thinking about operational concepts, doctrine, and strategy, the case for revolutionary change will remain open to at least some doubt.

Limitations of Strategic Air Attack and Military Force

What limitations to strategic air attack with modern, survivable delivery systems are suggested by the Persian Gulf War? The first thing that needs to be said about this second theme is that the limitations at issue are not, by any means, endemic to air power alone. The principal limitations on the effective application of strategic air power that will be discussed in this section are two:

- the inherent uncertainties in the information on which action in war must inevitably be based; and

- the often unseen or unpredictable consequences of those actions.

Given the great importance of target and aimpoint selection in strategic air operations against the heart of an enemy nation, these two constraints have long been most commonly (and emotionally) discussed as special problems of air power. But, especially in light of the growing capabilities of both land and naval forces to strike over long distances through the air, it seems increasingly hard to escape the conclusion that these limitations apply across the board–as much to armies and navies in the late twentieth century as to air forces.

Chapter 1 began by highlighting the first-order judgment that Coalition air power truly dominated the course and outcome of Desert Storm. Air superiority, as we have seen, was established very rapidly. Effective control of the air, in turn, enabled Coalition aircraft to begin systematically attacking a wide range of strategic, operational, and tactical

target sets throughout Iraq and the Kuwait theater; it also enabled two Coalition corps to redeploy westward unobserved by the Iraqis.

With this in mind, the motivation for considering the limitations to strategic air attack manifested during the Gulf War springs precisely from the extent to which air power dominated the course and outcome of the conflict. After all, the Desert Storm air campaign occurred in almost ideal circumstances for the effective exercise of air power.

- To begin with, the Gulf War was the first major conflict of the post-Cold War era. As events unfolded, one of the two Cold War rivals, the Soviet Union, sided with a Coalition sanctioned by the United Nations and led by the USSR's former Cold War adversary, the United States. Thus, Iraq's political isolation not only left Baghdad without external sources of political or economic support for its annexation of Kuwait but without a superpower sponsor that could circumvent or mitigate a major military defeat on the battlefield.

- The military forces that seized Kuwait in August 1990 were traditional mechanized forces backed by a relatively modern industrial infrastructure in Iraq. Hence, Iraq and its military presented the kinds of targets that have traditionally been vulnerable to air attack, and, in marked contrast to the Korean and Vietnam wars, Iraq was largely isolated from external sources of armaments for its war effort.[18]

- The Gulf War took place in open, desert terrain well suited to the effective employment of air power.

- Once Desert Storm began, Iraqi air and air-defense forces proved unable to mount any serious opposition to Coalition control of the air.

- Systems like the F-117, F-111F, and TLAM were present in sufficient numbers to provide a capability to sustain precision attacks

[18]Thus, it was not unreasonable for Coalition air planners to suppose that "vital" target systems existed in Iraq and the KTO with the potential to affect the will and means of the enemy to sustain the annexation of Kuwait.

on a theater-wide scale at night over a period of forty-three days. In addition, Coalition air operations were supported by advanced space borne reconnaissance systems and specialized sensor platforms such as AWACS (Airborne Warning and Control System) and JSTARS (Joint Surveillance Target Attack Radar System). So Coalition air forces had significant equipment and technological advantages over the opposition–advantages that were further magnified by the far-superior aircrew training, operational concepts, and doctrine of Coalition forces.

- Until the Al Firdos bunker was struck by F-117s, Generals Horner and Glosson enjoyed, within the bounds set by the air campaign's political and military objectives and General Schwarzkopf's guidance, nearly complete leeway in the day-to-day conduct of operations and the selection of targets.

- The air campaign neither incurred significant losses of Coalition aircraft and crews nor inflicted widespread collateral damage or civilian casualties on Iraq.[19]

- Finally, in contrast to the strategic bombing of Nazi Germany, there was nothing comparable in Desert Storm to the massive contributions that Soviet armies on the Eastern Front made to final victory over Nazi Germany.

All in all, the circumstances of the Gulf War did not merely present a *conducive* environment for the successful application of Western-style air power; circumstances were so ideal as to approach being the best that could be reasonably hoped for in any future conflict. Consequently, **if limitations to strategic air attack with strong antecedents in prior conflicts also manifested themselves in the near-ideal circumstances of Desert Storm, those limits should probably be construed as inher-**

[19]In terms of friendly losses, the contrast between Desert Storm and the strategic bombing of Germany, which cost the American and British air forces more than 150,000 personnel and 38,000 aircraft lost in action, is stark [D'Olier, et al, *The United States Strategic Bombing Survey: Over-all Report (European War)*, p x]. Nor did Desert Storm witness anything remotely comparable to the incineration of enemy cities like Hamburg, Dresden, and Tokyo that occurred during World War II.

ent features of strategic campaigns, not as aberrations or shortcomings that improved weaponry or other technical advances will overcome.

Uncertainties and gaps in the information on which action in war is based limit the strategic application of air power first and foremost with respect to the selection of target systems. Given a specific set of political and strategic objectives, the fundamental questions concern the existence and vulnerability of target systems whose neutralization or destruction could plausibly be expected to achieve the specified objectives. Whether such target systems existed at all in the Korean and Vietnam wars was a subject of debate even before these conflicts ended. In the case of Korea, an effort was made during August-September 1950 to attack strategic military-industrial and economic targets in North Korea, even though U.S. Air Force commanders realized that the effort might not be decisive because so much of North Korea's logistics support was coming from production centers outside Korean borders.[20] The Service's internal postmortem, completed in March 1951, confirmed the suspicion that North Korea itself contained no industrial target systems capable of forcing an early end to the conflict.[21]

Much the same problem resurfaced in Rolling Thunder. While some U.S. airmen argued afterwards that air power could have been decisive if something like Linebacker II had been attempted earlier,[22] the rather specific and limited objectives of that eleven-day bombing campaign–forcing a negotiated settlement to permit American withdrawal–tend to undermine this view.[23] Even more compelling is Andrew Krepinevich's

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[20]Robert F. Futrell, *The United States Air Force in Korea 1950-1953* (Washington, DC: Office of Air Force History, rev ed 1983), pp 183 and 195.

[21]"Attacks against strategic targets," the postmortem concluded, "were technically successful, but did not appreciably affect North Korean military potential because the majority of the North Koreans' sustenance was received from outside its borders" ["An Evaluation of the Effectiveness of the United States Air Forces in the Korean Campaign," Vol 1, Command and Organization, 12 Mar 1951 (Maxwell AFB, AL: Air Force Historical Research Center, K168.041-1, microfilm roll No. 1255), p 69].

[22]Gen William W. Momyer, *Air Power in Three Wars (WW II, Korea, Vietnam)*, ed A. J. C. Lavalle and James C. Gaston (Washington, DC: US Government Printing Office, 1978), pp 33-34.

[23]Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York, The Free Press, 1989), p 208.

conclusion that, notwithstanding parallel claims from U.S. Army officers that an American ground invasion of North Vietnam could have been decisive, "there is no evidence to suggest that a U.S. occupation of North Vietnam would have produced results any different from those produced by the 1946 French reoccupation."[24] If Krepinevich is right, there is little possibility that decisive strategic target systems existed in North Vietnam during Rolling Thunder relative to the broad objective of putting an end to the North Vietnamese insurgency in South Vietnam. As Kenneth Werrell has noted, during the insurgency portions of the conflict, "the only targets within North Vietnam upon which the bombing might have had a decisive effect were the people themselves," but it is "difficult to see how a democracy could deliberately target people in a limited war."[25] Or, alternatively, no small set of precision aimpoints existed whose destruction would necessarily have persuaded the North Vietnamese leaders to abandon their long-term goal of conquering South Vietnam.

Did these, or similar, sorts of problems crop up in Desert Storm? Even a cursory review of the summary results in Table 25 confirms that they did. The Iraqi nuclear program, the national leadership and telecommunications/C^3 target systems, and Iraq's ballistic-missile capabilities all illustrate vulnerability problems, if not target-set existence problems as well. Postwar examination suggests that all of these target systems, while generically identifiable and of importance to Coalition objectives, were far less vulnerable than was assumed prior to 17 January 1991. In part, this lesser vulnerability stemmed from a lack of information on the parts of Coalition intelligence specialists, commanders, and planners. But, as the campaign unfolded there were also cases in which these initial uncertainties were expanded by Iraqi responses to air attack. For example, United Nations inspectors concluded on the sixth postwar visit to Iraq that "virtually the entire computer capacity of the Tuwaitha Nuclear Research Center had been evacuated," apparently after the war had begun.[26] Similarly, they discovered that fuel from the Tamuz-2 nuclear reactor at Al Tuwaitha had been moved to "emergency storage" in pits located in a farmland area a

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[24]Andrew F. Krepinevich, Jr, *The Army and Vietnam* (Baltimore, MD: Johns Hopkins University Press, 1986), p 261.

[25]Kenneth p Werrell, "Linebacker II: The Decisive Use of Air Power?" *Air University Review*, Jan-Mar 1987, p 39.

[26]David A. Kay, letter to Barry D. Watts, 20 Oct 1992; GWAPS, NA 375.

few miles away.[27] Given this sort of dispersal under attack, whose extent was not fully appreciated at the time, the Iraqi nuclear program became, arguably, less vulnerable to destruction by precision air attack as the campaign progressed. Indeed, to some extent the prewar target system literally dispersed over the course of the conflict to the point of more or less disappearing as a viable focus for precision bombing. In light of parallel measures taken by the Germans during World War II to render elements of their war industry "bombproof"–including widespread dispersal and the construction of underground armaments facilities–it would appear that informational uncertainties about the existence and vulnerability of strategic target systems was as much of a limitation for strategic air attack in Desert Storm as it was in the 1940s.

Limitations to air operations arising from the **unforeseen and unpredictable consequences** of particular operational actions have been equally persistent over time. A reasonably straightforward example from World War II is the wholly unexpected failure of German fighter production to decline in the months following the concerted bombing attacks on Germany's aircraft industry during the so-called "Big Week" of 20-25 February 1944. Granted, the mounting numbers of lost and seriously damaged aircraft sustained by the *Luftwaffe* over the ensuing three to four months left the German Air Force unable to increase the number of fighters in front-line squadrons despite increased production.[28] Coupled with mounting attrition of experienced pilots and the inability to provide replacements who could hold their own against increasingly better-trained American pilots, the German day-fighter force in Western Europe was broken prior to the Normandy landings of 6 June 1944. So the rising production of fighter aircraft through September 1944 did not prevent the Allies from achieving daylight air superiority over Western Europe. Nonetheless, the discovery by the U.S. Strategic Bombing Survey that German fighter production had not declined in the months following the Big Week came as something of a shock. At a minimum, this example

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[27]Security Council, first semi-annual report of IAEA implementation of the plan for the destruction, removal, or rendering harmless of Iraq's weapons of mass destruction under UN Resolution 687, 17 Dec 1991, p 4.

[28]Williamson Murray, "The Role of German Battle Damage Repair in the Luftwaffe's Conduct of the Second World War," Logistics Management Institute Report RE602P1, Feb 1988, p 22.

graphically illustrates that the detailed consequences of particular air actions can be very different from plans or expectations.

The bombing of the Al Firdos bunker offers a similar case of unforeseen and unpredictable consequences during Desert Storm. At the time the decision to strike this leadership target in downtown Baghdad was taken, it was perceived by the air planners in Riyadh who made it as wholly routine and noncontroversial. The bunker was a perfectly legitimate military target. It had not been previously struck because it had not previously been active, and, given the emphasis on functional effects, there was little motivation to hit a national-level command and control facility that was not actually being used. But once intelligence information finally came together within the theater suggesting that the facility had been activated, there was no obvious reason for Coalition air commanders or planners to worry that it might shelter Iraqi civilians.

When the Al Firdos district bunker was finally hit, however, the consequences quickly went well beyond the tragic loss of life claimed by Iraqi officials. Using the magnifying lens of the television (via satellite) to project around the globe the horror of women and children having been maimed or killed by Coalition bombs, the Iraqi leadership immediately exploited the situation to attempt to constrain the air campaign through political pressure.[29] The fact that targets in downtown Baghdad thereafter had to be personally reviewed by General Schwarzkopf suggests that this Iraqi stratagem met with some success. Among other things, the final two weeks of the war saw less pressure on certain leadership targets in downtown Baghdad, and the desire of some in the Black Hole to drop all the major bridges over the Tigris in the Iraqi capital, thereby splitting the city in half, was never realized.

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[29]The cynical nature of Iraqi official reactions to the bombing of the Al Firdos bunker is suggested by the fact that as soon as it became clear, in the war's immediate aftermath, that Western press reporters would no longer serve the interests of Saddam Hussein's regime by reporting to the world its ruthless suppression of Shia and Kurdish uprisings in the south and north of the country, the foreign press was abruptly expelled (Lee Hockstader, "Media Ouster Cuts Off West's View of Iraq; Insurgency May Have Convinced Baghdad It Was Time to Eject Correspondents," *The Washington Post*, 9 Mar 91, p A14).

Again, an essential element of this particular episode was the unpredictable role that Iraqi actions played in what occurred. Given the priority Coalition air planners attached to targeting leadership facilities throughout the conflict, *from the Coalition's perspective* it was highly improbable, if not almost inconceivable, that civilians would be knowingly sheltered in any locations that might be associated with the location of key elements of Saddam Hussein's regime. Whatever the real reasons behind Iraqi women and children evidently ending up in the Al Firdos bunker on the night of 12 February 1991, their presence was not readily predictable from the Coalition's standpoint, nor, consequently, was the disproportionate impact that the bombing of this facility would have on the air campaign. To demand such foresight from operational planners and commanders is to misunderstand fundamentally the degree to which uncertainty and unpredictability constitute the very atmosphere of war. As Clausewitz wrote more than a century and a half ago:

> War is the realm of uncertainty; three-quarters of the factors on which action in war is based are wrapped in a fog of greater or lesser uncertainty. . . .War is the realm of chance. No other human activity gives it greater scope: no other has such incessant and varied dealings with this intruder.[30]

There was little, if anything, in Desert Storm to suggest that Clausewitz's observations regarding the essential atmosphere of war stand in need of revision.

A related point that emerges from reflecting on the aftermath of the Al Firdos bunker being bombed is that there seems to be little, if anything, in technologies like stealth, infrared-imaging sensors, or laser-guided bombs that offers real promise of fundamentally reducing, much less eliminating, the inherent unpredictability of enemy actions and reactions in time of war. To the contrary, the role played by the magnifying lens of television in this particular episode suggests that technological "progress" in communications may be inexorably making the consequences of seemingly routine actions in war not only harder to predict but potentially more disproportionate in their political and strategic impact. Thus, it is not implausible to suggest that the limitation to strategic air attack inherent in the unforeseen and unpredictable consequences of

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[30]Carl von Clausewitz, *On War*, trans Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), p 101.

actions in war may become more of an impediment as time goes on, rather than diminishing or disappearing.

With remarkable foresight, the summary report of the United States Strategic Bombing Survey on the European theater observed that while strategic air power had been in its infancy during World War I, it had reached "full adolescence" in World War II.[31] However strongly one may be convinced that air power reached adulthood in the Gulf War, the recurrence in this conflict of obvious limitations to the operational-strategic efficacy of air power–notwithstanding the enormous advances in weaponry since 1918 and the near-ideal conditions in which the Desert Storm air campaign was waged–argues that these limitations are neither transitory nor due to technical shortfalls that will be soon overcome. In this regard, perhaps the best way to sum up the thrust of this section is to recount some comments made in early August 1991 by Dr. Jarrar Dhia Jaffar to David Kay, who had led several of the early United Nations teams that began inspecting the Iraqi nuclear program under UN resolution 687 after Desert Storm. Dr. Jaffar, who had been the chief Iraqi nuclear scientist prior to the war and had led the reconstruction of Iraq's "military industrial complex" afterwards,

> . . . volunteered that the Iraqis had just completed what he called "a strategic bombing survey in order to issue guidelines as to how Iraqi industry should be rebuilt so as to better survive aggression." I still recall the conversation vividly as I was struck that here we were still trying to overcome their deception and cheating in order to be able to scope out their nuclear program and they were already rebuilding their industries to survive the next war! I was also interested that he used the term "strategic bombing survey" which proved yet again to me that they did their homework.[32]

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[31]D'Olier, et al, *The United States Strategic Bombing Survey: Over-all Report (European War)*, p 1.

[32]David A. Kay, letter to Barry D. Watts, 20 Oct 1992; GWAPS, NA 375. Regarding Iraq's potential for weapons of mass destruction in the future, then head of the CIA offered the following assessment in December 1992: "Despite the damage to Iraq's weapons infrastructure, without sanctions and monitoring, Iraq could restart limited chemical and biological weapon production virtually overnight; a militarily significant amount of biological weapons could be produced in a matter of weeks, and new chemical weapons production could begin in less than one year. Iraq also retains ballistic missiles and missile launchers that it has not declared to the United Nations as required by UN Resolution 687. Baghdad probably still has more than 7,000 nuclear scientists and

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In short, the evidence of Desert Storm argues strongly that limits to strategic air attack encountered at least as far back as World War II manifested themselves again over Iraq in 1991. More importantly, the roots of these difficulties, whether attributed to faulty intelligence or to unpredictable enemy responses and countermeasures, do not appear to be amenable to technological solutions. Instead, they give every indication of being endemic to military power in general and strategic air attack in particular.

Air Power Effects on the Will and Capability of the Iraqi Army

What effects did Coalition air power have on the will and capability to fight of the Iraqi field army in the Kuwait theater prior to the beginning of the ground campaign on G-Day (24 February 1991)? Three of the Coalition's military objectives focused directly on the Iraqi Army. These were, once again: (1) to cut the Iraqi Army's supply lines, (2) to destroy the Republican Guard, and (3) to expel Iraqi ground forces from Kuwait. The first of these tasks belonged entirely to air power; the second and third were air power's until 24 February 1991, after which they were shared with Coalition ground forces.

Chapters 4 and 5 have argued that, by 24 February 1991, the Iraqi Army, if not cut off from supplies, was able to do little more than maintain itself in its positions. By that time also, Iraqi forces were able to offer only token resistance while being ejected from Kuwait. The Republican Guard forces, if not destroyed, were unable to perform their intended function as the strategic reserve of Iraqi forces. Instead, they were only able to retreat. Coalition air power demonstrated great resourcefulness, as well as some limitations, in bringing about these results.

Coalition interdiction operations to cut Iraqi supply lines to the Kuwait theater enjoyed the advantages of open terrain and an Iraqi transportation network whose many bridges offered potential chokepoints.

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technicians–more than enough to reconstitute a weapons program–and may have enough equipment and material to make enough fissile material for a nuclear weapon in five to seven years if UN inspections and sanctions were to cease"(Gates, "Weapons Proliferation: The Most Dangerous Challenge for American Intelligence," Proposed Remarks to the Comstock Club, Sacramento, CA, 15 Dec 1992, pp 14-15).

General Horner was correct, however, in his observation that attacking the Iraqi transportation system was more easily said than done, particularly given the tenacity shown by Iraqi engineers in rebuilding roads and by-passing chokepoints that had been cut.

Regarding the Iraqi Army's basic necessities of food, water, fuel, and ammunition, there were important constraints on the effectiveness that air power could be expected to achieve in the circumstances encountered during Desert Storm. Ammunition was only a critical item if it was being consumed, and, during the first 39 days of the Coalition offensive, the bulk of the ordnance expended by Iraqi forces in the Kuwait theater consisted of antiaircraft ammunition. Given the huge stocks of munitions the Iraqis were known to have prepositioned before the war, ammunition resupply could not have been a serious problem prior to the beginning of the ground campaign. Fuel, too, was a necessity for Iraqi ground forces, but cutting off the Kuwait theater from sources of petroleum was, of course, absurd given Kuwaiti oil fields. Finally, food and water could be restricted from entering the theater, but the theater was also home to more than a million Kuwaitis, who would undoubtedly feel the effects sooner than the occupying army.

The results Coalition air forces obtained from interdiction of Iraqi supply lines during Desert Storm appear to show that, as in past conflicts (World War II, Korea, and Vietnam), armies are hard to defeat through air interdiction alone. The debilitating effects of air interdiction intensify and are most effective when offensive action by friendly ground forces compel an opposing army to consume munitions and supplies at increased rates, deplete local stockpiles, and place high demands on constricted supply lines. By the time the ground war began, the Iraqi Army had been weakened but not "strangled" by air interdiction of its lines of communications. In the end, the one-hundred-hour ground campaign itself was too short for the potential synergism between air interdiction and offensive ground action to appear to any dramatic degree.

Under these circumstances, the success of the interdiction operations came not from cutting off the Kuwait theater from the rest of Iraq but from interdicting movement within the theater. Sorties against Iraqi lines of communications, which increasingly prevented Iraqi trucks from moving at all, destroyed them whenever they did move, and, with the help of JSTARS, wiped out concentrations of trucks and caused the internal

supply system to come apart. Units in the western part of the theater did, in fact, run out of fuel as well as many other things. This internal disruption was more a by-product of the attrition Coalition air forces inflicted on the Iraqi field army than a deliberate aim of that attrition.

In evaluating the overall success of the Coalition air effort to reduce the combat power of Iraqi ground forces in the Kuwait theater, one needs to recall the standard of success that was set: the attrition, by G-Day, of fifty percent of the armor and artillery possessed by the forty-two-plus Iraqi divisions deployed opposite Coalition ground forces. The air and army planners who set this goal were venturing into an area in which there was little theory or past experience to guide them. Coalition air forces had ample experience in planning against and attacking other air forces and air defense systems. They had both theory and experience, dating back to World War II, to guide attacks against the various strategic target sets. And Coalition air forces had extensive experience in attacking armies but predominantly in the context of air interdiction or close air support tied to the ground forces' attack or defense (scheme of maneuver). The possibility of substantially reducing the combat power of an entire opposing field army independent of any maneuver or engagement by friendly ground forces had little, if any, historical precedent on the scale envisaged for Desert Storm. New, too, was the capability of attacking the tactical, operational, and strategic echelons of an opposing army throughout the theater of operations more or less simultaneously. The historical experience of Coalition ground forces with air power had been mainly in using aircraft to attack the opposing ground forces in one or more of its parts at a time, not in trying to attack the entire depth of the opposing army at once.[33]

U.S. Central Command's decision was to settle on some specific numerical level of attrition, however arbitrary, since there was no accepted quantitative threshold for the level of attrition that would probably or certainly render an army ineffective. Military history contained too many

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[33]By the late 1970s, the Soviets were actively engaged in trying to think through the problems of attacking opposing armies to their operational depth from the outset. The notions of deep battle (*glubokaia boi*) and deep operations (*glubokaia operatsiia*) were at the core of this line of thought [David M. Glantz, *Soviet Military Operational Art: In Pursuit of Deep Battle* (London: Frank Cass, 1991), pp 24 and 35-38]. By the time of the Gulf War, some of these same ideas had been incorporated into the US Army's Air Land Battle.

examples of units with little attrition surrendering and units with extreme levels of attrition continuing to resist, or even winning, to permit the setting a standard independent of the circumstances of a particular war.[34] Modeling done in August and September of 1990 had consistently suggested that fifty percent attrition of Iraqi ground forces would bring success against most possible attacks by the Iraqi formations. This attrition level was not tied to any particular Coalition scheme of maneuver, or to any particular divisions or portions of the theater (see Chapter 2). The planners, in choosing it, were stepping beyond established theory and historical experience.

During the first thirty-nine days of Desert Storm, even though Coalition aircraft had freedom of action to operate above the Iraqi formations (particularly in the southern portion of the theater), several factors frustrated the attainment of measurable success: less accuracy and poorer weapons' effects from the higher bomb-release altitudes; fewer-than-planned sorties; and inadequate information on bomb damage in order to adjust tactics. By the third week in February 1991, enough reports had come in from Iraqi prisoners of war to suggest that the air attacks were destroying the Iraqi Army's infrastructure, as well as the willingness of its soldiers to resist. But these reports, while persuasive in a qualitative sense, were too anecdotal and spotty to depend upon precise measures of air power's effectiveness against the Iraqi field army–particularly while the campaign was still in progress.

The decision, midway through the war, to begin using 500-pound, laser-guided bombs against Iraqi armor provided an approach that offered much better prospects for attaining more measurable results, and this mid-war adaptation of air power, using tactics not previously developed or tested, proved a dramatic success. The aircraft most heavily employed in these armor attacks were F-111Fs. Figure 43 offers one measure of the increase in the F-111F's effectiveness achieved through the advent of what came to be known as "tank plinking." Once the F-111Fs became

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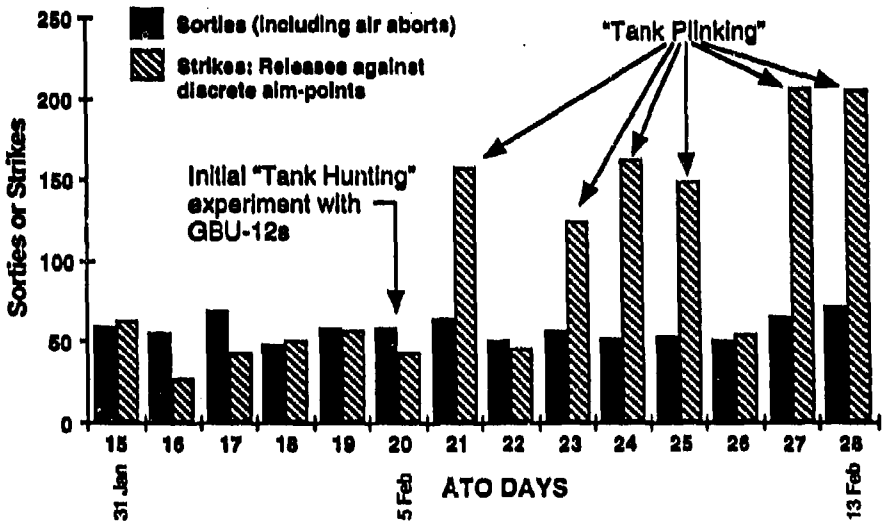
[34]See, for example, Robert McQuie, "Battle Outcomes: Casualty Rates As a Measure of Defeat," *Army*, Nov 1987, pp 30-34. While McQuie's review of the empirical data focused on personnel rather than equipment attrition, his basic conclusion was that from World War II down to the present battles had been "given up as when casualties ranged from insignificant to overwhelming" (*ibid*, p 33).

heavily engaged in attacking armor with 500-pound GBU-12 laser-guided bombs, the ratio of strikes to sorties produced by the Taif-based wing increased substantially.

Figure 43
Tank Plinking as a Wartime Innovation



Data for 48th TFW F-111Fs only; no Proven Force F-111E data included.

While the Republican Guard forces were routed as a part of the Iraqi Army in the Kuwait theater, the evidence does not support the view that these forces were "destroyed," as called for in the campaign's military objectives (although the precise intent of the term was never spelled out in detail). Relatively speaking, however, the importance of these units (a strategic center of gravity) to the Iraqi Army's strategy, and as a support for Saddam Hussein's regime, suggests that Coalition air forces should have sought to inflict higher attrition on these units compared to other Iraqi units. The evidence, while far from conclusive, indicates that the Guard took less attrition overall than those divisions closer to the front lines, and that the three heavy Republican Guard divisions (Tawakalna, Madinah, and Hammurabi) received far more emphasis in air attacks than the five Republican Guard infantry divisions (Adnan, Al Faw, Baghdad,

Special Forces, and Nebuchadnezzar), both during the air and ground phases of the Gulf War.

The difference between the attention given to the three Republican Guard heavy divisions and that given the five Guard infantry divisions was a matter of distinguishing between the heavy divisions as a center of gravity for the defeat of the Iraqi Army in the Kuwait theater and the entire eight divisions as a center of gravity for defense of the Iraqi regime. The heavy divisions were part of the strategic reserve whose armor had been destroyed or immobilized; the other five were much less dangerous to the Coalition during the war, though, arguably, they were just as important as the heavy divisions to the continuation of Saddam Hussein's regime afterwards. Heavey emphasis was placed on the Guard's armor and much less on its political importance, particularly as the date of the ground attack drew near and the focus of air attacks shifted to the front-line divisions.

In retrospect, the duration, intensity, and military effectiveness of the thirty-nine days of air operations that preceded the Coalition ground offensive on 24 February undoubtedly exceeded anything the Iraqi leaders were able to foresee based on the experience of the Iran-Iraq war. The Iraqi Army's one attempt, in late January 1991, to move out into the open and precipitate the kind of bloody, close combat on the ground that Iraqi strategists seem to have believed would ultimately decide the military, if not the political, outcome of the campaign, was swiftly decimated by Coalition air power, with much of the destruction being inflicted at night. Unable to attack or retreat in the face of Coalition air power, the Iraqi Army in the Kuwait theater could thereafter only dig in deeper and continue to suffer mounting punishment, both physical and psychological, from the air. As a result, when the Coalition's ground attack finally came, the ground forces of the U.S.-led alliance were able to destroy or expel from Kuwait the Iraqi divisions there in a scant one-hundred hours of operations. All in all, the Coalition's military performance was as overwhelming as any in modern military history, and, despite any short-falls in execution documented throughout this and other GWAPS reports,

Coalition air power was unquestionably *the* deciding (or "decisive") element in this overall outcome.[35]

Whether this outcome presages a new relationship between air forces and ground forces had become, by the time this report was being finished, a subject of lively debate between American airmen and their ground-force colleagues. As suggested earlier in this chapter, though, it appears to be an issue on which all the returns may not yet be in. In this regard, it seems useful to observe that the debate probably ought to focus more on the *relationship* between air and ground forces than on whether air forces alone can defeat armies. Again, Desert Storm presented a situation in which Coalition ground forces, even if they had not been employed at all, would still have shaped the options available to the Iraqi Army in Kuwait, and, military possibilities aside, it was politically important for the Coalition to engage and rout the Iraqis on the ground. Finally, before reaching any judgments on future relationships between air forces and armies, one must move beyond the mitigating effects of a host of factors–including political circumstances, training, technology, geography, and force ratios–that heavily favored the Coalition.

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[35]Strictly speaking, the relevant dictionary definition of "decisive" entails nothing more than the claim that Coalition air power manifested the "power or quality of deciding" the outcome of Desert Storm [*Webster's Third International Dictionary of the English Language: Unabridged*, ed. Philip B. Grove (Springfield, MA: G. & C. Merriam, 1976), p 585]. Notice some of the tempting implications that this sense of the word "decisive" need not embrace. It does not necessarily imply, for example, that there were no viable military alternatives to the Coalition's extended and near-exclusive reliance on air power during the first 39 days of the campaign. True, the histories, doctrinal predilections, and force structures of the US, British, and other Coalition air forces reflected strong preferences for the sort of approach that was taken. Nevertheless, there were military alternatives, including an early amphibious assault on Kuwait. Nor does the proposition that Coalition air power as a whole was decisive in the Gulf War necessarily imply that air forces *alone* could have prevailed as swiftly and bloodlessly as did the combination of land, sea, and air forces actually employed. In the event, heavy vehicles of the XVIII Airborne and VII Corps began redeploying westward on the first day of the war, and, by the evening of 17 January 1991, the convoys stretched out some 120 miles (Schwarzkopf, *It Doesn't Take a Hero*, p 416). So even if the Iraqis had chosen to abandon Kuwait prior to 24 February 1991, the victory still would not have been achieved *entirely* by air power alone due to the presence and deployment for combat of large Coalition ground forces in the theater. Moreover, the decision to attack on the ground, rather than trying to force Iraq out of Kuwait with air power alone, would appear to have been a wise one given Saddam Hussein's postwar refusal to acknowledge defeat.

In this context, there were at least three advanced capabilities used by Coalition air forces during Desert Storm that unquestionably demonstrated an enhanced ability to attack ground forces from the air. These advanced capabilities were the ability to suppress enemy air defenses with air-defense-suppression assets and other electronic-warfare capabilities enough to command the air over Iraqi ground forces; the ability to track the positions and movements of the enemy army with satellites, JSTARS, and other airborne platforms; and the ability to deliver weapons with precision by employing guided munitions from both fixed- and rotary-wing aircraft. These three capabilities are, to a great extent, mutually dependent, and, while many circumstances in Desert Storm aided their effective employment, their full potential was not realized during the conflict. If, in a future conflict, one side possessed command of the air above opposing armies, all-weather precision-guided weapons, and an integrated system of reconnaissance and airborne command and control, it could conceivably dominate an enemy ground force far superior to the Iraqi Army in 1991. It is in these technologies and under such conditions that a revolution in the relationship of air to ground forces could be underway.

Air Power as a Political Instrument

What can be concluded from the Gulf War about the efficacy of military power in general and air power in particular as a political instrument? There are two fundamental problems underlying the answer to this question. The first, which was raised in the context of discussing the limitations of strategic air attack, stems from the unpredictability of results in war, whether military or political; attacking existing target sets, however vulnerable, may or may not lead to the desired political ends. The second limitation arises from the fact that results in war are never final; political outcomes are always open to modification or redress at some later time.

Did these sorts of limitations crop up during or after Desert Storm? Coalition attacks on the leadership target category (the Black Hole's "L" targets) illustrate both limitations. Short of having been lucky enough to put a bomb in Saddam Hussein's lap, it remains unclear to this day whether there was any set of targets that the U.S.-led Coalition would have been willing to attack whose neutralization or destruction would have been likely to force Saddam Hussein's Ba'thist regime to abandon

Kuwait in late January or early February 1991, or to bring about the removal from power of Saddam Hussein himself. Thus, as successful as the Desert Storm air campaign was, there remains, even well after the fact, uncertainty as to whether this unofficial political goal, against which some sorties were mounted, was achievable.[36]

True, after the bombing of the Al Firdos bunker, constraints on attacking leadership targets in downtown Baghdad increased. But the evidence in Chapter 6 tends to suggest that the ultimate effects of these additional constraints were probably minimal when viewed in terms of the way in which combat operations in the Gulf War actually played out. Certainly insofar as the outcome of the one-hundred-hour ground campaign was concerned, it is difficult to argue that the inability of Coalition airmen to "finish off" some of the leadership and other strategic targets in downtown Baghdad would have perceptibly affected the fighting power of Iraqi ground forces in the Kuwait theater either way. Yet, it remains possible that some amount of additional pressure on leadership targets might have been enough to cause Saddam Hussein to flee Iraq or to be successfully overthrown. Indeed, aspects of the air efforts in the Kuwait theater appear to have somewhat undermined the prospects for successful popular uprising against Saddam Hussein's rule. Coalition air attacks on physical and electronic lines of communication throughout the country produced a situation in which the flow of information to disaffected groups during the critical early days of the popular uprisings in March 1992 was severely limited; similarly, the thrust of Coalition operations against Iraqi forces in the Kuwait theater ultimately relieved Saddam Hussein of the most troublesome parts of his army while preserving some of his most loyal units.[37] Nonetheless, it is impossible to rule out completely, on the available evidence, the possibility that the modest con-

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[36]For the most part, the issue of the *existence* of vital strategic targets *in particular political and strategic circumstances* has generally been neglected by American airmen. For one of the rare exceptions, see Thomas A. Fabyanic, *Strategic Air Attack in the United States Air Force: A Case Study* (Manhattan, KS: Military Affairs/Aerospace Historian, 1976; originally Air War College Professional Study No. 5899), especially pp 175-176.

[37]Faleh Adb al-Jabbar, "Why the Uprisings Failed," *Middle East Report*, May/Jun 1992, pp 9-10. Jabbar also argued that Iraq's security precautions to deal with potential internal enemies in the weeks preceding Desert Storm were in many respects as extensive as those directed against the external threat posed by the Coalition (*ibid*, p 10).

straints imposed on air operations following the bombing of the Al Firdos bunker provided the narrow margin that Saddam Hussein needed to remain in power after the war.

The deepest limitation to air power's efficacy as a political instrument, however, stems from the lack of finality to results in war: the defeated side, especially, may regard the military outcome as a transitory evil to be redressed at a later time by political or other means.[38] Germany's reaction to military defeat in World War I has long been cited as a classic illustration of this phenomenon. The reactions of Egypt and Syria to the calamity of their June 1967 defeat by Israel offers another. And North Vietnam's military conquest of South Vietnam in 1975, notwithstanding the success of American military power in 1972 in forcing a negotiated end to U.S. involvement in Southeast Asia in early 1973, is simply a more recent example of the inherent limits to the political efficacy of military power alone.

The inability of bombing to destroy more than a portion of the Iraqi nuclear program provides a further illustration of unpredictable lack of finality to results in war. Destroying Iraq's clandestine nuclear program was rightly seen as essential to the goal of curbing Iraq's offensive threat to its regional neighbors for a nominal period of five to ten years. But all that military force could directly accomplish was to cause the temporary cessation and dispersal of the program, not destroy it. Arguably, this lack of success from military action alone was redeemable in a broader sense because the magnitude of the Coalition's military victory enabled the United Nations and the U.S.-led Coalition to impose an intrusive arms-control regime on Iraq. Whether the pursuit of Iraq's nuclear program by the UN Special Commission has (or will) successfully finish the job Coalition bombing began on 17 January 1991 remains, at this writing, unknown. On 17 January 1993, two years to the day after Desert Storm began, Coalition forces elected to strike a nuclear facility just south of downtown Baghdad in order to regain Iraqi compliance with the United Nations' inspection regime.[39] All that can be said for certain at this

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[38]Clausewitz, *On War*, trans Paret and Howard, p 80.

[39]The target on this occasion was identified by the Pentagon as an industrial complex at Zaafaraniya that was believed to have had computer-controlled machine tools that were used to make components for the calutrons Iraq had used to enrich uranium for nuclear weapons (Michael R. Gordon, "Bush Launches Missile Attack on Weapons Site Near

time, therefore, is that the lopsidedness of the Coalition's victory created a postwar situation in which it appeared possible to pursue the goal of eliminating the Iraqi nuclear program by largely *political* means (albeit punctuated by intermittent use of force). Whatever judgment historians may eventually reach on the success or failure of this extension of force-application by political means, it certainly underscores the lack of finality as to what can be achieved directly by military means alone.

The more sobering manifestation of the limitations to military force as a political instrument evident in the Gulf War, though, may lie in the lack of acceptance by Saddam Hussein's Ba'th regime that it was militarily defeated in 1991. The fawning celebrations of Saddam Hussein's fifty-fifth birthday staged in April 1992 appear to have been designed, among other things, to make a mockery of Coalition claims to have won a crushing victory in the Gulf War. For instance, the Iraqi newspaper *al-Thawra* seized the occasion to crow that "Iraq's enemies [had] fled like rats in the face of the swords of right and principled men."[40] By the fall of 1992, a thirty-part Iraqi television program was hammering home nightly the "revived claim that Kuwait was, is, and always will be, part of Iraq,"[41] and such rhetoric was still emanating from Baghdad in January 1993. Where this sort of thing may ultimately lead is impossible to predict. While the potential parallel to Erich von Ludendorff's 1918 claim that the German army had been "stabbed in the back" at home rather than defeated in battle is disturbing, the Coalition that defeated Iraq has continued to sustain economic sanctions on its, so far, unrepentant enemy, and, to date, the Cold War pattern of immediately rearming defeated Arab client states has not been repeated in the case of

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Baghdad as Washington Greets Clinton," *New York Times*, 18 Jan 1993, p A8). The attack was carried out by more than 40 TLAMs launched from US warships in the Persian Gulf. The rising pattern of Iraqi noncompliance with UN resolutions during 1992 had been well documented in UN Special Commission reports (see, for example, S/24108, 16 Jun 1992, pp 11-18; also S/24984, 17 Dec 1992, pp 3 and 5-10). By February 1992, the UN Security Council had declared Iraq to be in "continuing material breach" of the relevant provisions of resolution 687 (1991) regarding its programs for weapons of mass destruction and ballistic missiles with ranges greater than 150 kilometers, and Iraqi resistance to the inspection regime had generally stiffened as the year unfolded.

[40]Jack Kelley, "Saddam Still Keeps His Grip on the Iraqi People," *USA TODAY/ International Edition*, 29 Apr 1992, p 8A.

[41]"Life in Saddamland," *The Economist*, 5 Sep 1992, p 45.

Iraq. Nevertheless, the very existence of such uncertainties about the future simply reiterates the limits of military force in general.

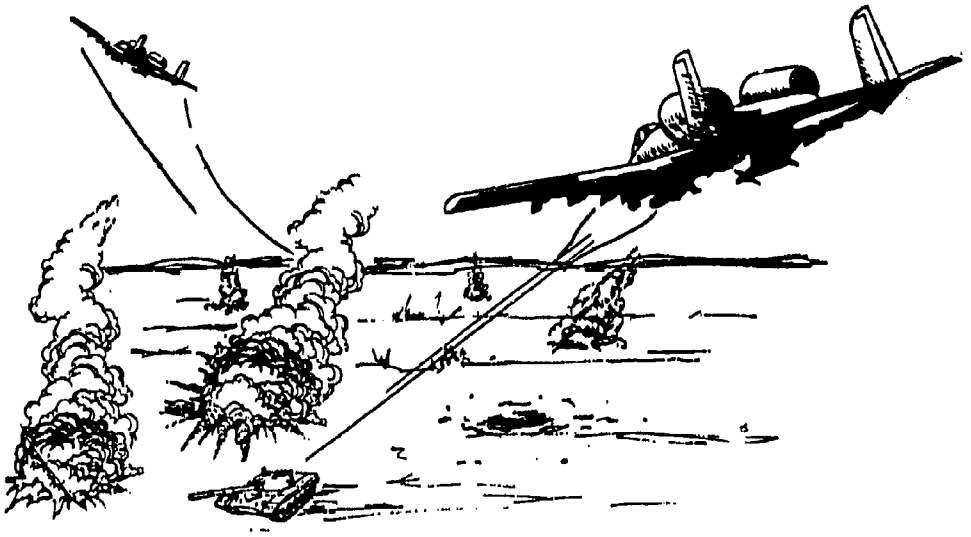
Results in war–especially political results–are neither wholly predictable nor final. This limitation of military power in general and air power in particular gives every indication of being a permanent limitation to the application of military force in pursuit of political objectives. It is also a limitation that military professionals cannot afford to overlook in either the planning or execution of military operations.

Afterword

This concluding chapter has sought to use four cross-cutting themes to provide some perspective on both the achievements and limitations that Coalition air power manifested in the Persian Gulf War. These four themes emerged, once again, from trying to evaluate, as impartially as possible, what air power achieved during Desert Storm. Two of them, as we have seen, dealt explicitly with limitations of air power–even though both turned out to be as much limitations of military power in general as of air power per se. Airmen who participated in the 1991 conflict may be inclined to interpret such discussion as downplaying their achievements in the interests of some abstract notion of objectivity. The present report, with its conscious emphasis on the assessment (and, where possible, the measurement) of both effects and effectiveness, seems especially vulnerable to this criticism, however unintended any devaluation of what was achieved may have been. In closing, therefore, it seems appropriate to reiterate that this report was part of a *survey* that never pretended to offer a definitive history of the Gulf War; the definitive history of the war remains to be written. Equally important, the decision to try to address not just air power effects, but *effectiveness*, was taken in full knowledge of the immense difficulties of doing so. How well or poorly the present report fared in this admittedly ambitious aim must be left for others to judge in the fullness of time.

That said, it appears best to close by returning to what was achieved by Coalition air power in the Gulf War. **Air power dominated the military outcome of Operation Desert Storm.** Will air power, broadly understood, dominate war even more in the future than it did in 1991? In this concluding chapter we have sought, more than anything else, to provide a framework within which such questions might be debated and

one day answered. But as to the answers themselves, we are undoubtedly still too close to the events themselves to reach definitive judgments. Nevertheless, former U.S. Air Force Chief of Staff Michael Dugan may have hit closer to the mark than anyone else in an article he published in the summer of 1992. When the next military test for the U.S. and its allies comes, he wrote, airmen "may or may not be decisive; they will surely be indispensable."[42] As modest a step forward as this encapsulation of the achievement of Coalition air power during the forty-three days of Desert Storm may be, it does appear well-established, in our judgment, by the results of Persian Gulf War.



[42]Michael J. Dugan, "Operational Experience and Future Applications of Air Power," *RUSI Journal*, Aug 1992, p 38. In a NOVA television presentation that aired in January 1993, both Gen McPeak, then Air Force Chief of Staff, and Gen Horner, the Coalition's Joint Forces Air Component Commander during Desert Storm, offered remarks on air power's demonstrated and future decisiveness virtually identical in spirit to Dugan's. As Gen McPeak stated in the NOVA broadcast: "I think it's easy to assess that air power was decisive in the Persian Gulf War, and may not be quite so decisive next time 'round, because conditions will be different, including the place where we fight the war." ("Can Bombing Win a War?," Journal Graphic transcript of NOVA show #2002, Air Date 19 Jan 1993, p 7).

Appendix 1

F-117 and F-111 Daily Strike Data

This appendix contains day-by-day data on F-117 and F-111 strikes during Operation Desert Storm. The two sets of tables that constitute the core of this appendix break out daily strikes for each aircraft using the target categories employed by Black Hole air planners during the war. While some of these categories are fairly close to those found in the Defense Intelligence Agency's Automated Intelligence Installations File (AIF), others are not. For example, the Black Hole's oil (O) and electric-power (E) categories contain, almost exclusively, targets that appear under similar labels in the AIF. By contrast, the AIF's offensive counterair (OCA) category encompasses target sets–notably airfields (A) and the KARI air-defense command-and-control system (SAD)–that the Black Hole planners chose to break out as distinct categories. The reader is also reminded that the Black Hole's target categories were not, as a general rule, homogeneous. For instance, two of the major telecommunications exchanges in downtown Baghdad were placed in separate target categories–CCC and SAD–by the Black Hole air planners.

The F-117 tables break out each day's **strikes** (occasions on which ordnance was actually released against a distinct target or aim point) into fifteen categories:

Strategic Air Defenses (SAD),
Surface-to-Air Missiles(SAM),
Telecommunications/C^3 (CCC),
Leadership (L),
Nuclear/Biological/Chemical Warfare (C),
Airfields (A),
Military Research, Production, and Support (MS),
Railroads and Bridges (RR),
Scuds (SC),
Electric Power (E),
Oil (O),
Republican Guard (RG),
Naval (N),

Breaching (BR), and,
Unknown (?).

The F-111E/F tables use these same target categories with two exceptions. The RG category has been expanded to include strikes against non-Republican Guard ground order of battle carried out by F-111Fs in the Kuwait theater (and, hence, labeled *RG/GOB*). In addition, the breaching and naval categories were dropped from the F-111 tables because neither F-111Fs nor Proven Force F-111Es apparently conducted any strikes against naval targets.

One reason for including the daily F-117 and F-111 strike data in this report stems from the central role that the F-117 and F-111F played in the air campaign. While a number of other Coalition aircraft delivered laser-guided munitions during Desert Storm (including U.S. Air Force F-15Es, U.S. Navy A-6s, Royal Air Force Tornados, and Royal Saudi Air Force F-5s), the precision-bombing attacks that appear to have had the greatest affect on the air campaign were mostly carried out by F-117s and F-111Fs. These were the only two platforms in the theater that delivered the 2,000-pound class hard-target-penetrating, laser-guided bombs (the GBU-24A/B and GBU-27 with the I-2000 or BLU-109 bomb body) so important to attacking a number of leadership, strategic air defense, and other targets that required both accuracy and penetration. Moreover, the vast majority of the weapons dropped by the F-117s and F-111Fs were laser-guided bombs.

The reasons why various other aircraft did not drop more laser-guided bombs varied widely. Obviously, supplies of these weapons, especially those with I-2000 warheads, were not unlimited. It was also harder for most other aircraft to employ laser-guided bombs at night, or on the scale achieved by the F-117 and F-111F. For instance, the F-15E wing, which could and did operate at night, usually had no more than six laser targeting pods available at any one time. So even though this aircraft dropped more than 1,300 laser-guided bombs by the war's end (mainly GBU-12s used for tank plinking), the bulk of the ordnance delivered F-15Es consisted of CBUs, Rockeye, or unguided bombs. As for other limitations, aircraft like the Tornado could only employ laser-guided bombs, while some other aircraft provided laser designation of the target, and such "buddy lasing" tactics were cumbersome and limited to daytime hours. Finally, the U.S. Navy, with aircraft capable of employing laser-guided

weapons autonomously and at night, simply appears to have held back laser-guided bombs for the ground campaign.

The strike data for the F-117 and F-111 were generated in the same way. The relevant portions of the GWAPS Missions Database were off-loaded into a spreadsheet (Microsoft Excel) and printed out. Initially, counts of daily strikes by target category were made by hand. Subsequently Excel was used to do the addition.

The original motivation for "hand-counting" the F-117 data was to provide a way of verifying the aggregate strike data that, starting in the spring of 1992, began to become available to GWAPS researchers from the application of software routines designed to provide tabular data for the GWAPS Statistics report. By December 1992, a fairly tight correlation had been achieved between F-117 strike data aggregated using Oracle database routines and the data appearing in the tables reproduced below. A final cross-check in early 1993 found a net difference for the entire war of only eleven F-117 strikes, with the largest discrepancy (eight strikes) occurring on ATO Day 13.

Cross-checks in the late summer of 1992 between Oracle-generated F-111 strike data and that produced manually by members preparing this report, however, revealed major discrepancies, and, unfortunately, these differences were not eliminated in the final F-111F and F-111E strike counts published in the Statistics report. One major source of discrepancies between the manual and Oracle counts stemmed from the use of F-111Fs to attack hardened aircraft shelters and bunkers on Iraqi airfields. Initially, the F-111F crews tended to drop both of their laser-guided bombs on a single shelter. With the passage of time and growing confidence in the weapon system, employment shifted to dropping one bomb a shelter, which meant that each F-111F could attack two or more separate shelters on a given sortie. Since each shelter attacked counted as a separate strike, this area proved to be one in which the manual counts were more accurate. The shift from double to single drops was reflected in the aircrew remarks columns of the Missions Database. A person reading through could make the appropriate adjustments, but, as it turned out, no way was ever found to get Oracle routines to make them. For the second week of the air campaign, these "strike-counting" problems produced, based on a final check in early 1993, a net discrepancy of over 80 strikes, and on only one day did the total of F-111 strikes in the Statistics report's AIF counts match the manual totals.

Even greater discrepancies cropped up during the first week or so of tank plinking by the F-111Fs, which began in earnest on 21 February 1991. When the manual counts from the Excel printouts were cross-checked with aircrew sign-in/sign-out logs from the F-111F wing for this period of the war, it was discovered that large numbers of sorties did not appear at all. Subsequent investigation revealed that these sorties were in fact present in the Missions Database but had been inadvertently masked. To give a sense of the magnitude of these discrepancies, for the period 7-13 February 1991 they totaled just over 400 strikes. The majority of the omissions appeared in F-111F attacks against Iraqi ground order of battle.

When the manual strike counts reproduced below were rechecked in early 1993 against the final AIF counts published in the Statistics report, it was discovered that the two sources of systemic error described above had not been eliminated. As a result, the manually counted F-111 data in this appendix contain just over 1,000 additional strikes. The "final" strike totals by AIF categories for the F-111F and F-111E are, respectively, 2,802 and 423 strikes, which total 3,228. The total F-111F and F-111E strikes from the manual counts in this appendix come to 4,242–a net discrepancy of 1,014 strikes.

In retrospect, the larger total from the manual counts is clearly the more accurate figure. Further, since the manually produced F-111 data were used in writing both the Operations and Effectiveness reports, it seemed obligatory to include them in this appendix along with the F-117 data. While the computer-generated AIF strike counts for the F-111E and F-111F are satisfactory for many broad generalizations about the Desert Storm air campaign, their systemic discrepancies with manual data illustrate the potential dangers future researchers may encounter if they rely too heavily on computer-generated statistics–especially for fine-grained analyses of particular aircraft or weapons.

As of	Strikes against Targets by Block Hole Categories																	Total	NO (No	Total	Bombs		HR	WxNO	WxNO	%WxNO
22-Apr-93	SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG	N	BR	?			Strikes	Drop)	Bombs	Hit	Miss	%	/Cnx	/Miss	or Miss
Day 1 (17 Jan)	24		8	16	4		9											61	19	64	41	23	64%	7	21	25.3%
Day 2 (-4)	15		6	5	3		3	3	5									40	28	44	20	24	45%	27	49	68.1%
Day 3	6		5	7	4		1	2	1									26	21	29	21	8	72%	18	25	50.0%
Day 4	6	4	2	1	5		7		3									28	15	38	17	21	45%	6	13	24.5%
Day 5	9		4	9	11	1												34	4	52	47	5	90%	0	0	0.0%
Day 6				4		24	5	7		1								41	6	45	39	6	87%	1	1	2.0%
Day 7			10					6	1									17	38	22	14	8	64%	34	40	66.7%
Days 1-7	60	4	35	42	27	25	25	18	10	1	0	0	0	0	0	0		247	131	294	199	95	68%	93	149	35.1%
1st Week %s:	24%		14%	17%	11%	10%	10%																			
Day 8 (24 Jan)	1			1		18		14	8									42	26	46	34	12	74%	23	26	36.1%
Day 9	1		1			7		7	15									31	15	31	21	10	68%	12	18	36.1%
Day 10 (+6)	3				4	26	1		14						1			49	25	51	42	9	82%	17	17	22.4%
Day 11	2		2	3	10	28	9	5	4									63	6	65	54	11	83%	0	0	0.0%
Day 12			4	4	14	3	13	5	2			3						48	6	57	47	10	82%	1	1	1.8%
Day 13 (+8)			3	2	3		10	9	2			1						30	19	42	24	18	57%	18	20	32.8%
Day 14	4		4		6		9	22	1		2	1						49	15	55	37	18	67%	8	8	11.4%
Day 8-14	11	0	14	10	37	82	42	62	46	0	2	5	0	0	1			312	112	347	259	88	75%	79	90	19.8%
2nd Week:					12%	26%	13%	20%	15%																	
Day 15 (31 Jan)			7		1	2	6	15	1			2						34	6	51	36	15	71%	0	0	0.0%
Day 16 (1 Feb)			7		3		5	15	11			4						45	9	50	44	6	88%	1	1	1.7%
Day 17						12	2											14	13	13	12	1	92%	11	11	42.3%
Day 18			3	1	25	3		2	1									35	31	38	25	13	66%	26	33	47.8%
Day 19			8	11	28			1	3									51	4	52	49	13	79%	0	0	0.0%
Day 20		2	2	2	21	10	10		7			1						55	10	58	51	7	88%	0	0	0.0%
Day 21	2		5	6	16	26	2						2					59	7	58	51	7	88%	7	7	10.8%
Days 15-21	2	2	32	20	94	53	25	33	23	0	0	7	2	0	0			293	80	330	268	62	81%	45	52	12.7%
3rd Week:			11%		32%	18%	9%	11%	8%																	
Day 22 (7 Feb)	8		10	3	31				1									53	10	60	55	5	92%	2	2	2.9%
Day 23					26	6	6	1	23									62	5	63	54	9	86%	1	1	1.5%
Day 24	4	6	3	3	2		13	5	9									45	4	51	41	10	80%	2	3	5.5%
Day 25 (+2)	10	14	14	3	3		12		2									58	6	65	56	9	86%	1	1	1.4%
Day 26	5		6	13	25		8		8	1								66	4	66	57	9	86%	0	0	0.0%
Day 27	6	1	14	32				3										56	6	59	53	6	90%	0	0	0.0%
Day 28	8	1	33	2		4			2				2					52	13	59	47	12	80%	1	1	1.4%
Days 22-28	41	22	80	58	87	10	39	9	46	1	0	0	2	0	0			392	50	423	363	60	86%	7	8	1.7%
4th Week:	10%		20%	14%	22%		10%		11%																	

Table 27
F-117 Summary
Data

As of	Strikes against Targets by Black Hole Categories															Total	ND (No	Total	Bombs		Hit	WxND	WxND	%WxND
22-Apr-93	SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG	N	BR	?	Strikes	Drop)	Bombs	Hit	Miss	%	/Cnx	/Miss	or Miss
Day 1 (17 Jan)	24		8	16	4		9									61	19	64	41	23	64%	7	21	25.3%
Day 2 (-4)	15		6	5	3		3	3	5							40	28	44	20	24	45%	27	49	68.1%
Day 3	6		5	7	4		1	2	1							26	21	29	21	8	72%	18	25	50.0%
Day 4	6	4	2	1	5		7		3							28	15	38	17	21	45%	6	13	24.5%
Day 5	9		4	9	11	1										34	4	52	47	5	90%	0	0	0.0%
Day 6				4		24	5	7		1						41	6	45	39	6	87%	1	1	2.0%
Day 7			10					6	1							17	38	22	14	8	64%	34	40	66.7%
Days 1-7	60	4	35	42	27	25	25	18	10	1	0	0	0	0	0	247	131	294	199	95	68%	93	149	35.1%
1st Week %s:	24%		14%	17%	11%	10%	10%																	
Day 8 (24 Jan)	1			1		18		14	8							42	26	46	34	12	74%	23	26	36.1%
Day 9	1		1			7		7	15							31	15	31	21	10	68%	12	18	36.1%
Day 10 (+6)	3				4	26	1		14						1	49	25	51	42	9	82%	17	17	22.4%
Day 11	2		2	3	10	28	9	5	4							63	6	65	54	11	83%	0	0	0.0%
Day 12			4	4	14	3	13	5	2			3				48	6	57	47	10	82%	1	1	1.6%
Day 13 (+8)			3	2	3		10	9	2			1				30	19	42	24	18	57%	18	20	32.8%
Day 14	4		4		6		9	22	1		2	1				49	15	55	37	18	67%	8	8	11.4%
Day 8-14	11	0	14	10	37	82	42	62	46	0	2	5	0	0	1	312	112	347	259	88	75%	79	90	18.6%
2nd Week:					12%	26%	13%	20%	15%															
Day 15 (31 Jan)			7		1	2	6	15	1			2				34	6	51	36	15	71%	0	0	0.0%
Day 16 (1 Feb)			7		3		5	15	11			4				46	9	50	44	6	88%	1	1	1.7%
Day 17						12	2									14	13	13	12	1	92%	11	11	42.3%
Day 18			3	1	25	3		2	1							35	31	36	25	13	69%	26	33	47.8%
Day 19			8	11	28			1	3							51	4	62	49	13	79%	0	0	0.0%
Day 20		2	2	2	21	10	10		7			1				56	10	58	51	7	88%	0	0	0.0%
Day 21	2		5	6	16	26	2						2			59	7	58	51	7	88%	7	7	10.8%
Days 15-21	2	2	32	20	94	53	25	33	23	0	0	7	2	0	0	293	80	330	268	62	81%	45	52	12.7%
3rd Week:			11%		32%	18%	9%	11%	8%															
Day 22 (7 Feb)	8		10	3	31				1							53	10	60	55	5	92%	2	2	2.9%
Day 23					26	6	6	1	23							62	5	63	54	9	86%	1	1	1.5%
Day 24	4	6	3	3	2		13	5	9							45	4	51	41	10	80%	2	3	5.5%
Day 25 (+2)	10	14	14	3	3		12		2							58	6	65	56	9	86%	1	1	1.4%
Day 26	5		6	13	25		8		8	1						66	4	66	57	9	86%	0	0	0.0%
Day 27	6	1	14	32				3								56	8	59	53	6	90%	0	0	0.0%
Day 28	8	1	33	2		4			2				2			52	13	59	47	12	80%	1	1	1.4%
Days 22-28	41	22	80	56	87	10	39	9	45	1	0	0	2	0	0	392	50	423	363	60	86%	7	8	1.7%
4th Week:	10%		20%	14%	22%		10%		11%															

Table 27 (cont'd)
F-117 Summary Data

Table 27 (cont'd) F-117 Summary Data

As of 22-Apr-93	Strikes against Targets by Black Hole Categories: SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG	N	BR	?	Total Strikes	ND (no Drop)	Total Bombs	Bombs Hit	Bombs Miss	Hit %	WxND or Cnx	WxND or Miss	%WxND or Miss
Day 29	1	3	19			16	8		4			2				53	8	60	52	8	87%	0	0	0.0%
Day 30 (15 Feb)		6			6		18	2	5					23		60	8	64	54	10	84%	3	3	4.2%
Day 31			8		13	4		6	10							41	5	52	48	6	88%	2	2	3.5%
Day 32		3			15	5	17		13							53	14	60	42	18	70%	8	11	14.9%
Day 33				6	4	37	4	2	3							56	7	66	48	18	73%	5	5	6.8%
Day 34					6		2	1	7							16	23	32	30	2	94%	19	19	34.5%
Day 35			2		8		19	2								31	1	45	41	4	91%	1	1	2.2%
Days 29-35	1	12	29	6	52	62	68	13	42	0	0	2	0	23	0	310	66	379	313	66	83%	38	41	9.2%
5th Week:			9%		17%	20%	22%		14%															
Day 36 (21 Feb)			11	4	27			6	7			1				55	3	64	52	12	81%	0	0	0.0%
Day 37				8	22		5									35	8	57	51	6	89%	0	0	0.0%
Day 38			4	9	18		12									43	14	57	44	13	77%	12	18	22.5%
Day 39				16	4		11	11								42	14	53	48	5	91%	5	5	7.5%
Day 40	*All F117 sorties cancelled by CENTAF due to weather.*															0		0	0	0		0	0	100.0%
Day 41				2			4									6	78	10	8	2	80%	78	78	88.6%
Day 42 (-1)				14	8	2	7	11								42	7	51	47	4	92%	3	3	5.2%
Day 43	*No F117 sorties night of ATO Day 43 due to the war ending on the morning of 28 Feb.*															0		0	0	0		0	0	
Days 35-43	0	0	15	53	79	2	38	27	7		0	1	0	0	0	223	124	292	250	42	86%	98	102	24.5%
6th Week			7%	24%	35%		17%	12%															*Excluding Day 40*	

WX No Drop/ Miss	% of Bombs
442	18.9%

SUMMARY DATA:

SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG	N	BR	?	Total Strikes	No Drops
115	40	205	187	378	234	238	162	173	2	2	15	4	23	1	1777	563
6.5%	2%	12%	11%	21%	13%	13%	9%	10%	.1%	.1%	1%	.2%	1%	.1%	100%	

Bombs Hit	Bombs Miss
1652	413
Hit%	80%

TARGET CATEGORIES: SAD = Strategic Air Defenses, SAM = Surface-to-Air Missiles, CCC = C3/Telecommunications, L = Leadership, C = Nuclear/Biological/Chemical, A = Airfield, MS = Military Support, RR = Railroads/Bridges, SC = SCUD, E = Electricity, O = Oil, RG = Republican Guard, N = Naval, BR = Breaching, and? = Unknown.

NOTES:
- Discrepancies with GWAPS AIF counts: The "(-4)" annotation for Day 2 indicates that 4 strikes must be subtracted to get the AIF strike count for that ATO day. Such unresolved discrepancies exist on a total of five days as annotated. The final AIF strike total was 1788 (versus 1777 in this table).
- ATO Day 1 had two nights worth of F-117 strikes: the nights of 16/17 and 17/18 January 1991.
- Except for 4 Mk-84s on Day 37, all F-117 drops were precision-guided munitions (laser-guided, 2000-pound GBU-10s or GBU-27s).

COMMENT on the IMPACT of WEATHER: The high percentages of no drops or misses due to weather during the first ten days shows the dependence of laser-guided bombs on clear air. By the second week of the war, the Black Hole planners had begun working around this limitation. In the last few days, with a 72-hour target list to be hit and war termination looming, working around the weather ceased to be possible and it again became a major constraint (Days 40 and 41).

SOURCE: GWAPS Missions Database supplemented by the 37th Wing's unit history.

As of 24-Apr-93		Target Categories: SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG/GOB	?	Total Strikes	Aborts Air	Grnd	Notes
Day 1	PGM				2	4	24			8					38	8	3	Day 1: 48th TFW only; hit suspected
(17 Jan)	NonPGM					8	9	8		4					29	3		Scud/BW bnkrs on 10 airflds
Day 2	PGM					4	14			1					19	35	5	Day 2: 12 Proven Force (20th TFW)
(18 Jan)	NonPGM	12				3									15	5	1	Scud/BW bnkrs on 4 airflds
Day 3	PGM	3				1	5	1		2					12	15	3	Day 3: 8 no-tanker air aborts; bnkrs
(19 Jan)	NonPGM	4					1	2		4	4	4			19	5		Tikrit, Balad, Qalat Salih aflds
Day 4	PGM						4								4	2	2	Day 4: Mostly CBU87 on Balad;
(20 Jan)	NonPGM	4				6	15	6							31	5		PF Mk82 on Mosul
Day 5	PGM	1					3	8		4					16	18	1	Day 5: 16 no-tanker air aborts; H2 &
(21 Jan)	NonPGM	18		6			7								31	7		H3, Scud bnkrs
Day 6	PGM	1		3			20								24	3	0	Day 6: Mostly 2 bunkers/111F at Al
(22 Jan)	NonPGM			2	1		5	8							16	8	2	Asad; 14 HHQ Cnx
Day 7	PGM						19								19	43	5	Day 7: 30+ air aborts WX! Counted 2
(23 Jan)	NonPGM						12								12	1		DMPIs/111F in some cases on aflds
Days 1-7		43	0	11	3	26	138	33	0	23	4	4		0	285	158	22	132 Precision Strikes
		15%				9%	48%	12%		8%								153 NonPrecision

		Target Categories: SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG/GOB	?	Total Strikes	Aborts Air	Grnd	Notes
Day 8	PGM						31		4						35	19	1	Day 8: Tallil, Taqaddum, Al Jarrah
(24 Jan)	NonPGM	13		4			5								22	1		Proven Force never reports aborts!
Day 9	PGM						14								14	37	2	Day 9: 30 Wx aborts! Excl 7 HHQ cnx
(25 Jan)	NonPGM								8					4	12			for retgting. A few double DMPIs
Day 10	PGM						18			4		2	2		26	18	1	Day 10: oil manifolds (in MS).
(26 Jan)	NonPGM						8								8	1		Excludes 3 Opns cnx.
Day 11	PGM						44			3					47	11	3	Day 11: some double DMPIs; mostly
(27 Jan)	NonPGM	4		6			11								21	2		busting shelters on airflds
Day 12	PGM			5			20	4	7	2					38	13	3	Day 12: Excludes 1 Opns cnx
(28 Jan)	NonPGM						3	3	2				1		9	4		
Day 13	PGM					4	7		14	4					29	23	1	Day 13: Excludes 1 Opns cnx
(29 Jan)	NonPGM					1	12	4							17	2		Al Jarrah afld, Basrah SCUD
Day 14	PGM			1	7	5	56				1		2		72	6	1	Day 14: Excludes 1 Opns cnx. 20
(30 Jan)	NonPGM							4			8				12	0		double-DMPIs/111F on airfields
Days 8-14		17	0	16	7	10	229	15	35	13	9	2	5	4	362	137	12	261 Precision Strikes
							63%		10%	4%								101 NonPrecision

Table 28
F-111 Summary Data

Table 28 (cont'd) F-111 Summary Data

		Target Categories													Total Strikes	Aborts Air	Aborts Grnd	Notes
		SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG/GOB	?				
Day15	PGM					2	54								56	10	1	Day 15: Some 2/4 DMPIs/111F on
(31 Jan)	NonPGM						7	8	4						19	3		airfields; excludes 2 Opns cnx
Day 16	PGM						19								19	33	1	Day 16: air aborts for no tnkrs &
(1 Feb)	NonPGM						12	8							20			wx; excl 1 HHQ cnx
Day 17	PGM					3	18	8	10						39	33		Day 17: Latifyah SSM (in MS),
(2 Feb)	NonPGM	4				8		8		8					28	1		Shelter busting at H3
Day 18	PGM			2		1	29		12						44	3		Day 18: Tallil, Taqaddum, Shayka
(3 Feb)	NonPGM						7				8	8			23	1		Mazhar airflds
Day 19	PGM					8	31	3	3	8					53	10	3	Day 19: C11 (Tuwaitha); excludes
(4 Feb)	NonPGM						4	8			4				16		1	1 Opns cnx
Day 20	PGM			4			28	1	1					2	36	18	4	Day 20: Ist GBU-12 tank/arty hunt
(5 Feb)	NonPGM						7				4	8			19	1		(1 sortie); logged as 2 RG strikes
Day 21	PGM		1	1			3	2	7					143	157	8	3	Day 21: No Proven Force; Ist day of
(6 Feb)	NonPGM														0			tank plinking (all strikes "masked")
Days 15-21		4	1	7	0	22	219	46	37	16	16	16	145	0	529	121	13	404 Precision Strikes
							41%	9%	7%				27%					125 NonPrecision

		Target Categories													Total Strikes	Aborts Air	Aborts Grnd	Notes
		SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG/GOB	?				
Day 22	PGM	3	1				13	20		6					43	10	2	Day 22: SCUD related H2; H3;
(7 Feb)	NonPGM						8	1				25			34	1		2 Centcom Taskings
Day 23	PGM					5	23			2			94		124	5	1	Day 23: Tallil & H3—mostly double
(8 Feb)	NonPGM						4				4	8			16			DMPIs; tank plnkng (94 masked strks)
Day 24	PGM						10		4				149		163	3	6	Day 24: Al Shabah afld; tank plinking
(9 Feb)	NonPGM											12			12			(149 strikes "masked")
Day 25	PGM					6	1		9	3			130		149	3	3	Day 25: excl 4 Opns cnx; PF on oil
(10 Feb)	NonPGM											12			12			Tgts; plinking mostly masked
Day 26	PGM			1				14	1				38		54	21	4	Day 26: tank plinking mostly AF7;
(11 Feb)	NonPGM					4		8							12			Latfiyah SSM; Shayka Mazhar afld
Day 27	PGM						2	9	9	4			183		207	2	3	Day 27: plinking Medina, Hammurabi
(12 Feb)	NonPGM	4				4						4			12			RG; Centcom taskings logged MS
Day 28	PGM					3	8		18				176		205	5	3	Day 28: Medina & Hammurabi Rep Gd
(13 Feb)	NonPGM			4		4		4							12			divs
Days 22-28		7	1	5	0	26	69	56	41	15	4	61	770	0	1055	50	22	945 Precision Strikes
							7%	5%				6%	73%					110 NonPrecision

		Target Categories													Total	Aborts		
		SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG/GOB	?	Strikes	Air	Grnd	Notes
Day 29	PGM	3						2	13				178		196	5	3	Day 29: Medina & Hamuarabi
(14 Feb)	NonPGM					4		4		4					12			
Day 30	PGM						38		10				181		229	4	3	Day 30: Medina, 17 AD, kill box AE6;
(15 Feb)	NonPGM						8			4					12			As Salman N, 4 GBU24s=4DMPIs.
Day 31	PGM								12				91		103	13	6	Day 31: Medina & Hammurabi; kill
(16 Feb)	NonPGM														0			boxes AF7, AG7; PF cnx.
Day 32	PGM					7	5	7	1	1			32		53	30	2	Day 32: Excl 3 HHQ CNX; Medina
(17 Feb)	NonPGM					4		8							12			& Hammurabi; AF7
Day 33	PGM			3		11			13				104		131	7	2	Day 33: Medina, Hammurabi,AF7
(18 Feb)	NonPGM							12							12			
Day 34	PGM							19					121		140	14	6	Day 34: Medina & Hammu; AF7SE,
(19 Feb)	NonPGM					8			4						12			AF7SW, AG7SW, AF6NW; tank hunt
Day 35	PGM					2		14					4	5	25	16	3	Day 35: Many Mk84s rdr del thru wx
(20 Feb)	NonPGM				4			4	4				13		25	5		(vice laser GBU12s); AF7
Days 29-35		3	0	3	4	36	51	70	57	9	0	0	724	5	962	94	25	877 Precision Strikes
							5%	7%	6%				75%					85 NonPrecision

		Target Categories													Total	Aborts		
		SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG/GOB	?	Strikes	Air	Grnd	Notes
Day 36	PGM				4			3	5				141		153	5	4	Day 36: Medina, Hammurabi; AG7,
(21 Feb)	NonPGM							12							12			AF7; VIP bunkers & Winnebago
Day 37	PGM						3		9				228		240	4	3	Day 37: Tawakalna, IZ/KU border, &
(22 Feb)	NonPGM					12									12			west of KU
Day 38	PGM			10					11				118		139	12	5	Day 38: PF Taji tnk repair
(23 Feb)	NonPGM							12							12			
Day 39	PGM								8				163		171	1	2	Day 39: Tawakalna; excludes no drops
(24 Feb)	NonPGM							14							14			
Day 40	PGM						32		4				74		110	13		Day 40: Bad wx led to GBU-12s
(25 Feb)	NonPGM					4	8						53		65			dropped by rdr; GBU-12 on arflds
Day 41	PGM						1		3				5		9	2		Day 41: Some "plinking," but mostly
(269 Feb)	NonPGM		5			4		8	43				2		62	2	4	CBU-87s on GOB
Day 42	PGM			6					7						13	18	3	Day 42: 18 air aborts WX; GBU28s on
(27 Feb)	NonPGM							18	7				12		37	4	1	Taji; lots of CBU-87s on GOB
Day 43	PGM	*The war ended on the morning of 28 February. Hence no F-111*													0			
(28 Feb)	NonPGM	*sorties on the night of ATO Day 43.*													0			
Days 36-43		0	5	16	4	20	44	67	97	0	0	0	796	0	1049	61	22	725 Precision Strikes
							4%	6%	9%				76%					149 NonPrecision

Table 28 (cont'd)
F-111 Summary Data

Table 28 (cont'd)
F-111 Summary Data

F-111E/F Summary Data by Target Category:

Target Categories													Total	Aborts	
SAD	SAM	CCC	L	C	A	MS	RR	SC	E	O	RG/GOB	?	Strikes	Air	Grnd
74	7	58	18	140	750	287	267	76	33	83	2,440	9	4,242	621	106
1.7%	.2%	1.4%	.4%	3.3%	17.7%	6.8%	6.3%	1.8%	0.8%	2%	57.5%	.2%	100%		

SAD	Strategic Air Defenses
SAM	Surface-to-Air Missiles
CCC	Telecummunications/C3
L	Leadership
C	Nuclear/Biological/Chemical Warfare
A	Airfields
MS	Military Research, Production, and Support
RR	Railroads and Bridges
SC	Scuds
E	Electric Power
O	Oil
RG/GOB	Republican Guard
?	Unknown

Figure 44
F-117 Strikes: Days 1-21

This diagram was generated from the GWAPS Missions Database. It shows the geographic pattern of F-117 strikes during the first half of Desert Storm. The bulk of the strikes during this period tended to fall along the Tigris and Euphrates rivers in central Iraq. The focus on the Baghdad area is also evident.

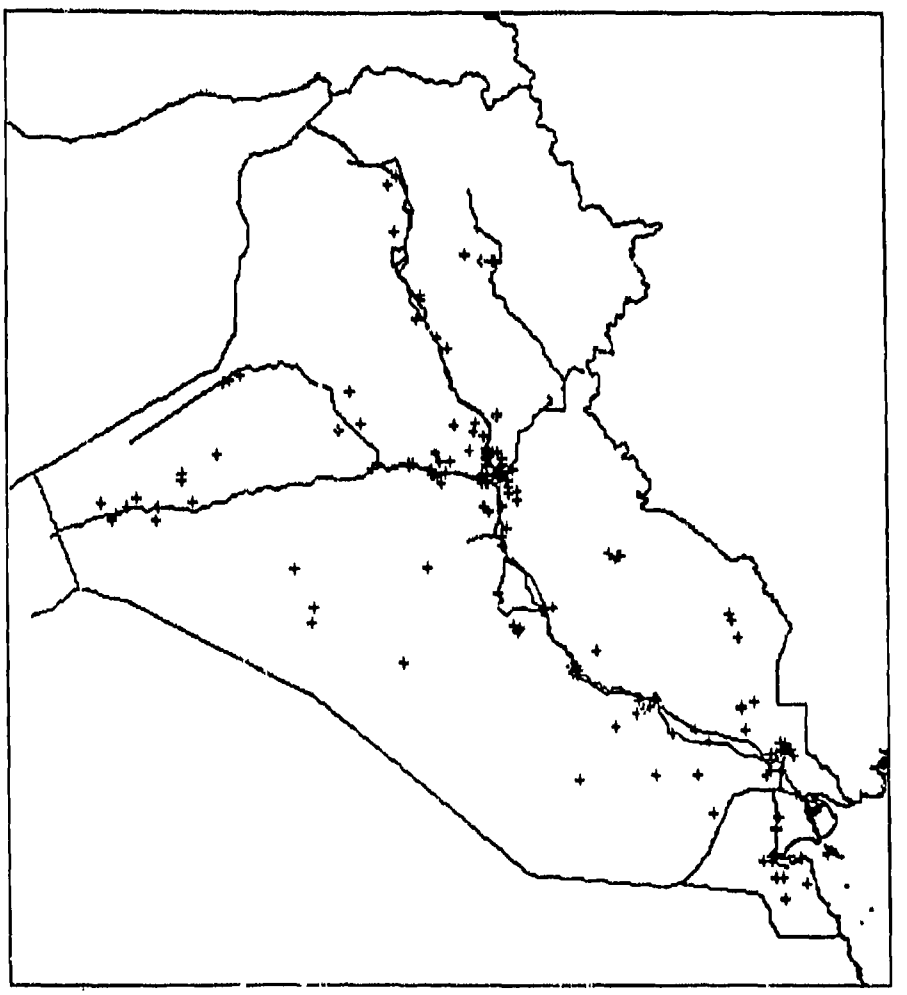


Figure 45
F-117 Strikes: Days 22-43

The geographic distribution of F-117 strikes during the second half of Desert Storm did not change appreciably from what it had been during Days 1-21.

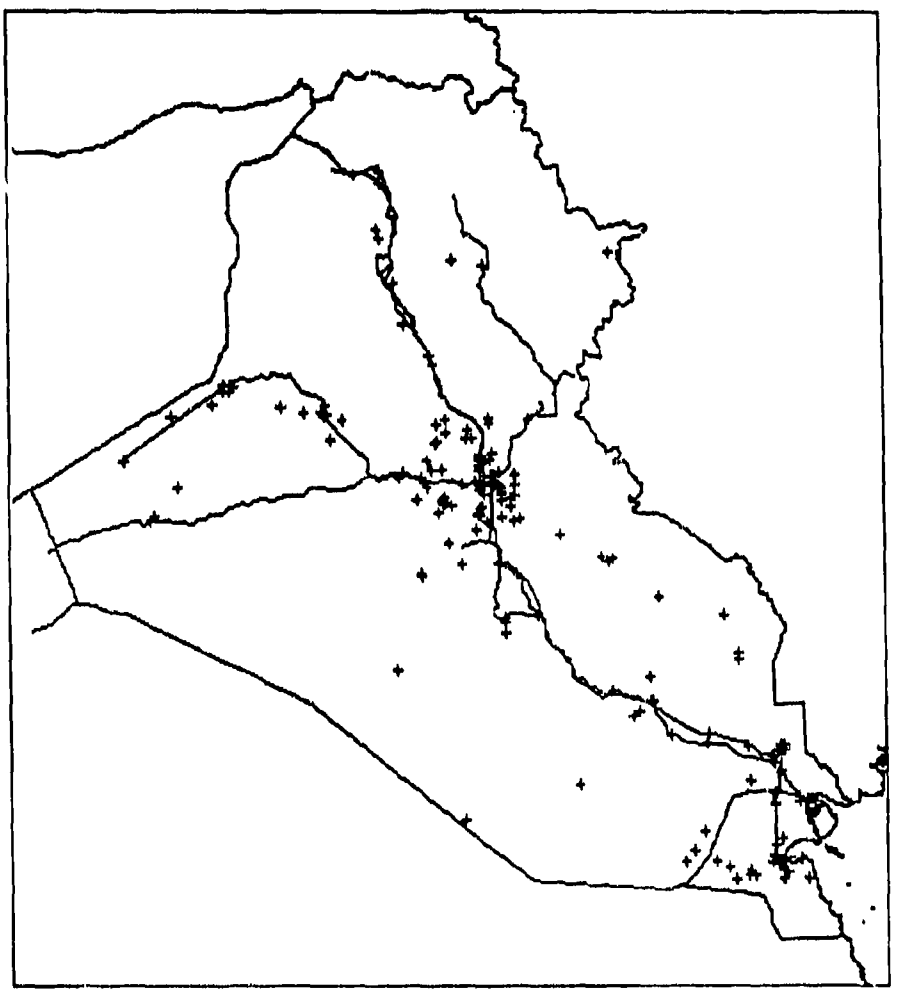


Figure 46
F-111F Strikes: Days 1-21

The pattern of F-111F strikes during the first half of Desert Storm is not that dissimilar from that evident in the case of the F-117. The clustering of strikes in Baghdad is absent. A concentration on airfields is also evident. Indeed, repeated visits to airfields with the same location explains why there appear to be so few F-111F sorties during this period.

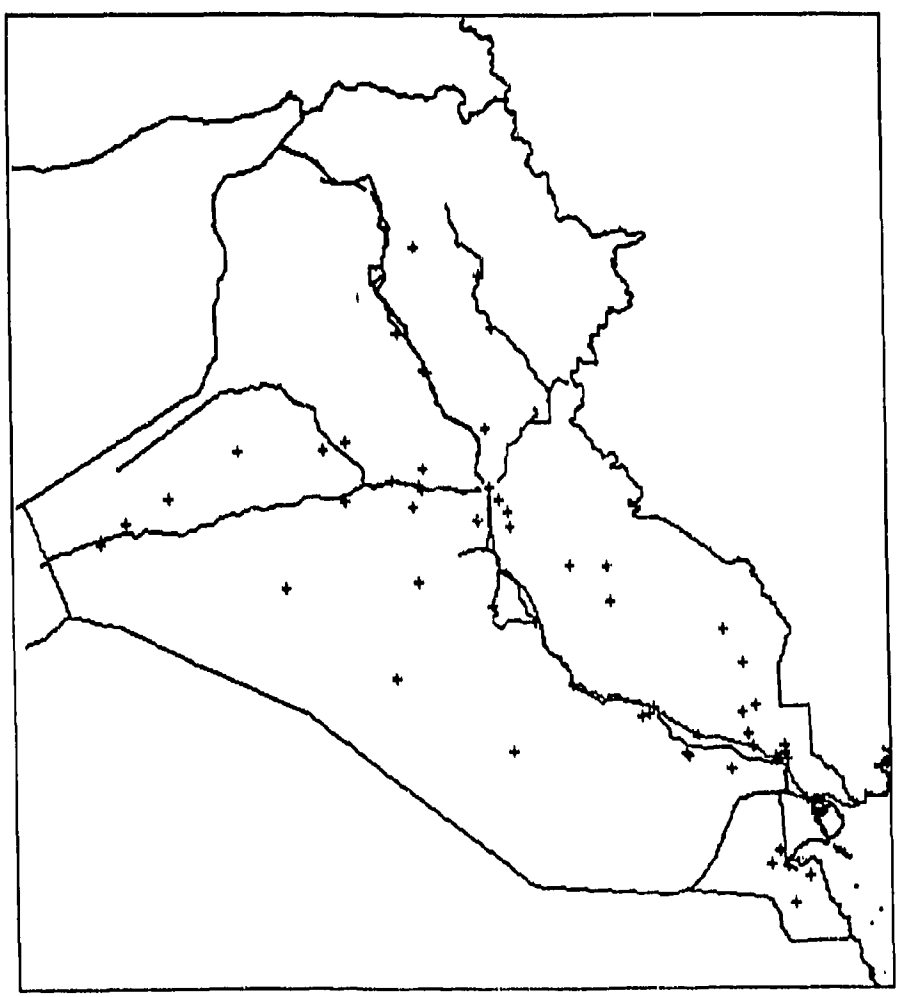


Figure 47
F-111F Strikes: Days 22-43

The shift of the F-111Fs to tank plinking in the Kuwait theater of operations during the second half of the war is unmistakeable in this diagram.

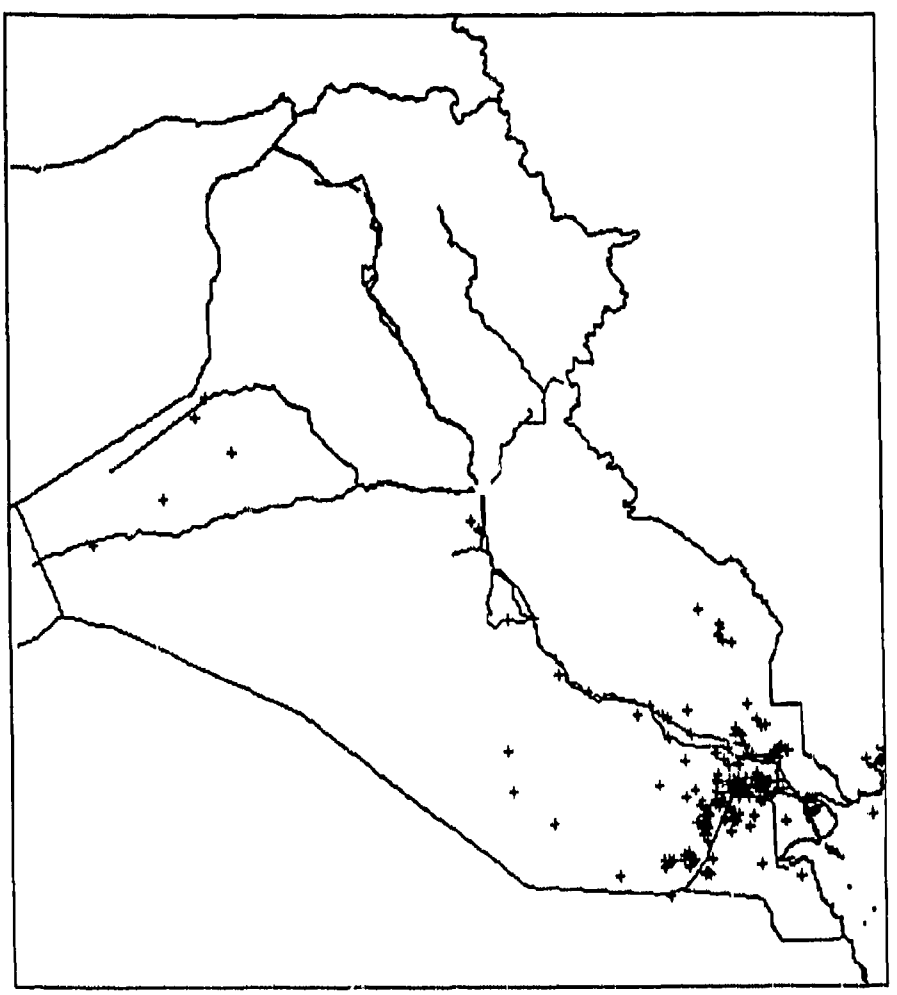


Figure 48
F-111E Strikes: Days 1-21

The distribution of F-111E strikes during the first half of the war indicates the portion of Iraq covered by Proven Force operations from Incirlik, Turkey.

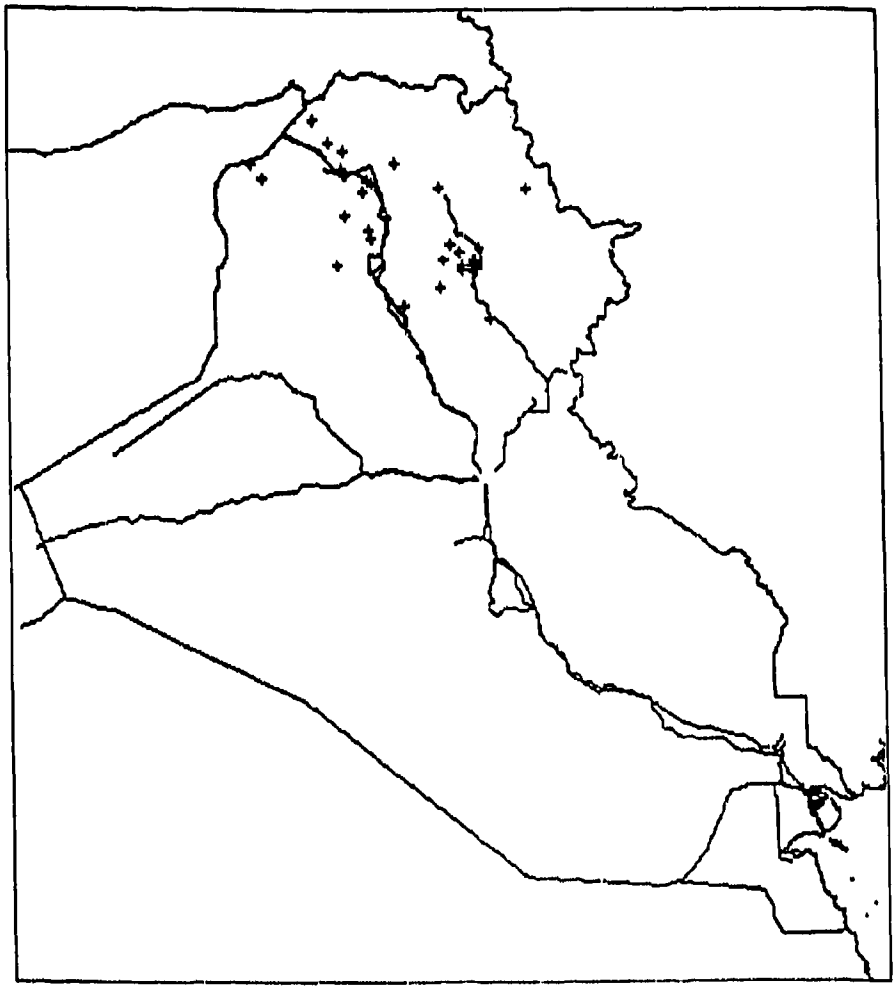


Figure 49
F-111E Strikes: Days 22-43

As in the case of the F-117, the geographic distribution of Proven Force F-111E strikes during the second half of the war shows little change from the first half.

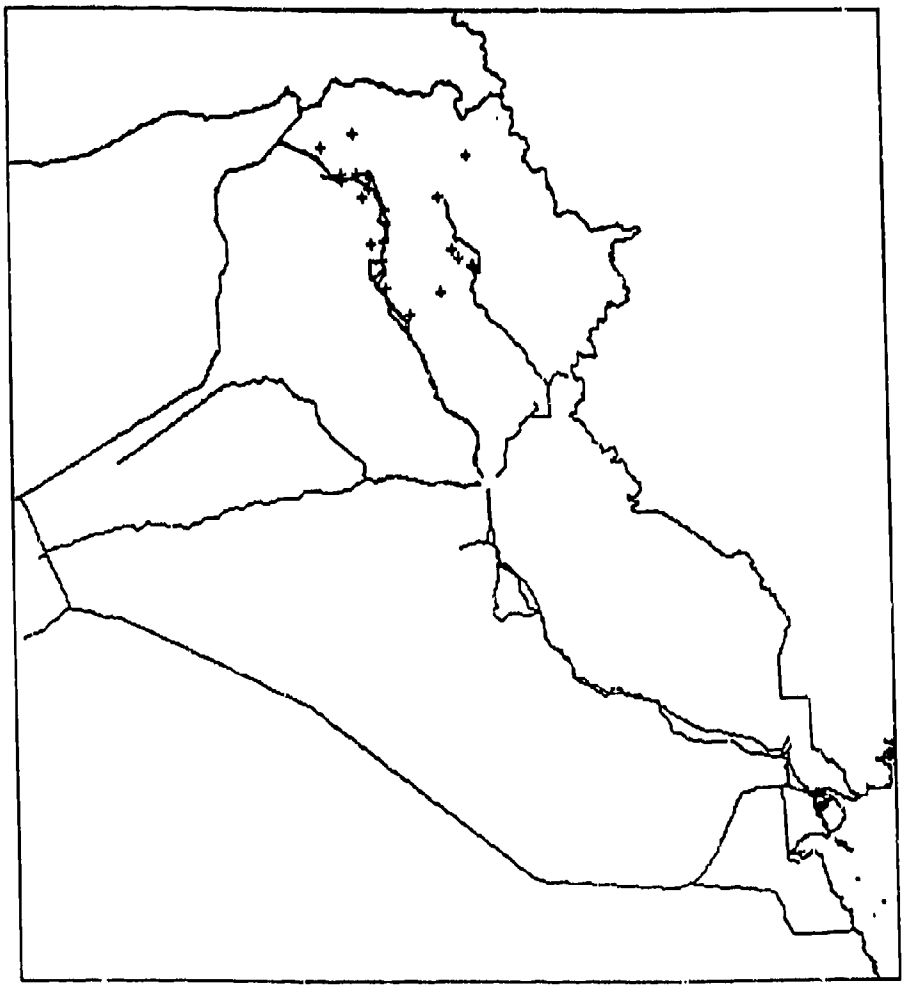
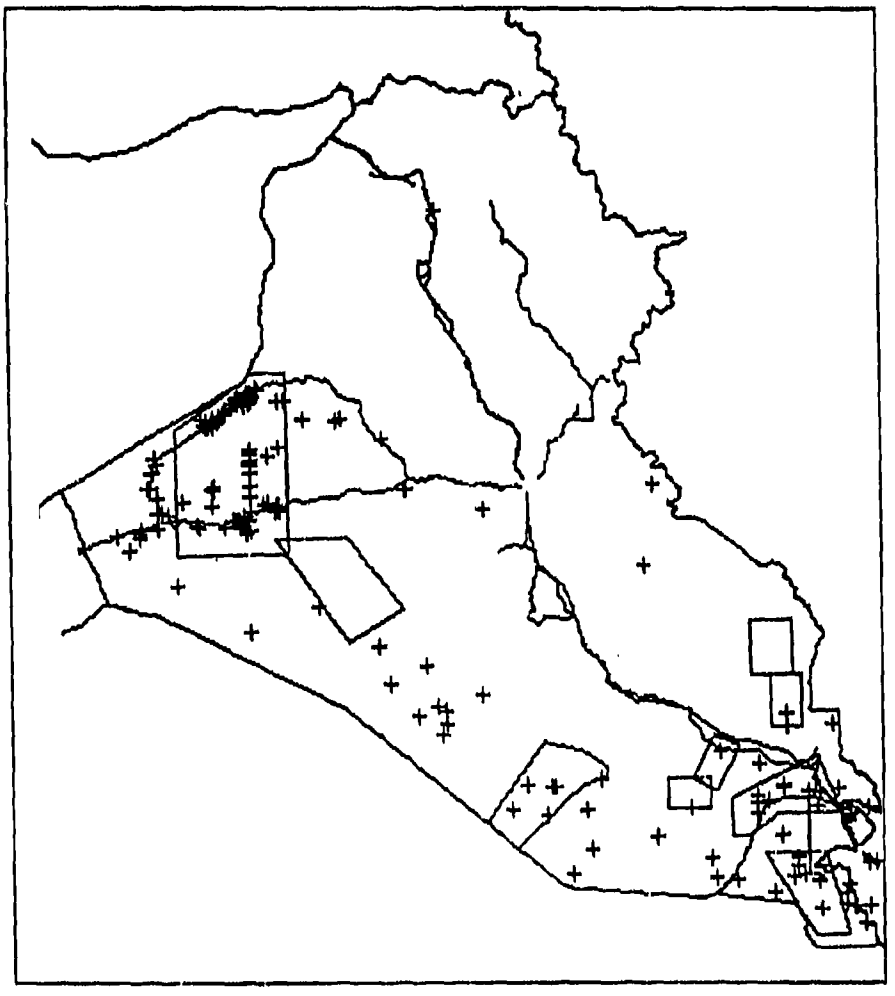


Figure 50
Strikes Against Missile Launchers: Days 1-43

This diagram plots the locations of strikes in the GWAPS Missions Database against fixed and mobile missile launchers over the course of Operation Desert Storm. The vast majority of the strikes shown were against Scud launchers. The concentrations against mobile Scud launchers in the western and south-eastern Scud "launch boxes" are readily evident. However, the data set also contains some strikes against Silkworm launch sites in south-eastern Iraq.



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Glossary

AAA	Antiaircraft Artillery
AAAM	Advanced Air-to-Air Missile
AADC	Area Air Defense Commander
AAI	Air-to-Air Interrogator Set
AAV	Amphibious Assault Vehicle
AAR	After Action Report
AASLT Div	Air Assault Division (US)
AB	Air Base
ABCCC	Airborne Battlefield Command and Control Center
ABDR	Aircraft Battle Damage Repair
ABF	Advanced Bomb Family
ABFDS	Aerial Bulk Fuel Delivery System
Abn Corps	Airborne Corps (US)
AC	Active Component
ACA	Airspace Control Authority or Airlift Clearance Authorities
ACAS	Air Combat Assessment Summary
ACC	Air Component Commander or Airspace Coordination Center or Arab Cooperation Council
ACCS	Airborne Command and Control Squadron
ACE	Airborne Command Element (USAF) or Aviation Combat Element (USMC) or Air Combat Element (NATO) or Armored Combat Earthmover (US Army)
ACM	Air Combat Maneuvers

ACO	Airspace Coordination Order or Airspace Control Order
ACR	Armored Cavalry Regiment
ACV	Armored Combat Vehicle (US Army) or Air Cushion Vehicle (USN)
AD	Air Division
ADA	Air Defense Artillery
A/DACG	Arrival/Departure Airfield Control Group
ADOC	Air Defense Operations Center
ADX	Air Defense Exercise
AECC	Aeromedical Evacuation Control Center
Aegis	Ship based long-range air defense system.
AELT	Aeromedical Evacuation Liaison Team
AES	Aeromedical Evacuation Squadron
AEW	Airborne Early Warning
AFB	Air Force Base
AFCOMAC	Air Force Combat Ammunition Center
AFDIGS	Air Force Digital Graphics System
AFEWC	Air Force Electronic Warfare Center
AFGWC	Air Force Global Weather Center
AFHRA	Air Force Historical Research Agency
AFLC	Air Force Logistics Command
AFLIF	Air Force Logistics Information File
AFLMC	Air Force Logistics Management Center
AFMSS	Air Force Mission Support System
AFR	Air Force Reserve

AFSC	Air Force Systems Command or Air Force Specialty Code
AFSOC	Air Force Special Operations Command
AFSOUTH	Allied Forces, South (NATO)
AFWMPRT	Air Force Wartime Manpower and Personnel Readiness Team
AGE	Aerospace Ground Equipment
AGL	Above Ground Level
AI	Air Interdiction
AIF	Automated Installation File
AIR	Air Inflatable Retarder
AIWS	Advanced Interdiction Weapons System
ALARM	Air-Launched Anti-Radiation Missile
ALC	Air Logistics Center
ALCC	Airlift Control Center
ALCE	Airlift Control Element
ALCM	Air-Launched Cruise Missile
ALMSNSCD	Airlift Mission Schedule
ALO	Air Liaison Officer
AMI	Aeronautical Militare Italiana
AMRAAM	Advanced Medium-Range Air-to-Air Missile
AMU	Aircraft Maintenance Unit
ANG	Air National Guard
ANGLCO	Air and Naval Gunfire Liaison Company (USMC)
AO	Area of Operation
AOB	Air Order of Battle
AOR	Area of Responsibility
APC	Armored Personnel Carrier

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APCC	Aerial Port Control Center
APOD	Aerial Port of Debarkation
APS	Afloat Prepositioning Ship
ARBS	Angle Rate Bombing Set (USMC)
ARC	Air Reserve Components
ARCENT	U.S. Army Forces, Central Command
AREFS	Air Refueling Squadron
ARM	Antiradiation Missiles
ARNG	U.S. Army National Guard
ARS	Air Rescue Service
ARW	Air Rescue Wing
ASARS	Advanced Synthetic Aperture Radar System
ASD(PA)	Assistant Secretary of Defense (Public Affairs)
ASD(SO-LIC)	Assistant Secretary of Defense (Special Operations and Low Intensity Conflict)
ASM	Air-to-Surface Missile
ASMA	Air Staff Management Aide (UK and Iraq)
ASOC	Air Support Operations Center (Army/USAF)
ASUWC	Anti-to-Surface Unit Warfare Commander (USN)
ATACMS	Army Tactical Missile System
ATAF	Allied Tactical Air Force (NATO)
ATC	Air Training Command (USAF)
ATGM	Anti-Tank Guided Munition
ATO	Air Tasking Order
ATTG	Automated Tactical Target Graphic

AUTODIN	Automatic Digital Network
AVCAL	Aviation Coordinated Allowance List (USN)
AVLB	Armored Vehicle-Launched Bridge
Avn Bde	Aviation Brigade (US)
AWACS	Airborne Warning and Control System
AWN	Automated Weather Network
AWS	Airborne Warning System
BAAF	Bahrain Amiri Air Force
BAI	Battlefield Air Interdiction
BARCAP	Barrier Combat Air Patrol
BAS	Basic Allowance for Subsistence
BBBG	Battleship Battle Group
BCE	Battlefield Coordination Element
BDA	Bomb Damage Assessment
Bde	Brigade (US)
BDU	Battle Dress Uniform
BE or BEN	Basic Encyclopedia (number)
BEEF	Base Engineer Emergency Force
BLT	Battalion Landing Team (USMC)
BMP	Soviet armored personnel carrier
BMS	Bombardment Squadron
BMW	Bombardment Wing
B/N	Bombardier/Navigator
BND	German Federal Intelligence Service
BTG	Basic Target Graphic
BVR	Beyond Visual Range
BW	Biological Warfare

C-Day	Deployment Day
C3	Command, Control, and Communications
C3CM	Command, Control, Communications Countermeasures
C3I	Command, Control, Communications, and Intelligence
C3IC	Coordination, Control, Communications, and Intelligence Center
C4	Command, Control, Communications, and Computers
CA	Civil Affairs
CADOB	Consolidated Air Defense Order of Battle
CAF	Canadian Air Force
CAFMS	Computer Aided Force Management System
CAFT	Center for Anti-Fratricide Technology
CALCM	Conventional Air Launched Cruise Missile
CAMS	Core Automated Maintenance System
CAP	Combat Air Patrol
CAS	Close Air Support or Combat Ammunition System
CASSUM	Close Air Support Summary
CAT	Crisis Action Team
CB	Chemical/Biological
CBU	Cluster Bomb Unit
CBW	Chemical/Biological Weapons
CCD	Camouflage, Concealment and Deception

CCIP	Continuously Computed Impact Point
CCRC	Combined Control and Reporting Center
CEM	Combined Effects Munition
CEMIRT	Civil Engineering Maintenance, Inspection, Repair, and Training
CENTAF	U.S. Air Force, Central Command
CENTCOM	U.S. Central Command
CEP	Circular Error Probable
CES	Civil Engineering Squadron
CEV	Combat Engineer Vehicle
CFT	Conformal Fuel Tank
CI	Civilian Internees
CIA	Central Intelligence Agency
CIFS	Close-In Fire Support (USMC)
CINC	Commander-in-Chief
CINCCENT	Commander-in-Chief U.S. Central Command
CINCMAC	Commander-in-Chief, Military Airlift Command
CINCSPACE	Commander-in-Chief U.S. Space Command
CINCTRANS	Commander-in-Chief, U.S. Transportation
CINCTRANSCOM	Commander-in-Chief U.S. Transportation Command
CJCS	Chairman, Joint Chiefs of Staff
CMMS	Congressionally Mandated Mobility Study
CNN	Cable News Network

COCOM	Combatant Command (Command Authority)
COMALF	Commander, Airlift Forces
COMAO	Composite Air Operation
COMMZ	Communications Zone
COMPES	Contingency Operations Mobility Planning and Execution System
COMSEC	Communications Security
COMTAC	Commander of Tactical Air Command
COMUSCENTAF	Commander, U.S. Air Force, Central Command
COMUSCENTCOM	Commander, U.S. Central Command
CNA	Center for Naval Analysis
CNO	Chief of Naval Operations
COMINT	Communications Intelligence
COMSAT	Communications Satellite
CONUS	Continental United States
COSCOM	Corps Support Command (US Army)
CPX	Command Post Exercise
CRAF	Civil Reserve Air Fleet
CRC	Control and Reporting Center
CS	Combat Support
CSAR	Combat Search and Rescue
CSG	Contingency Support Graphic
CSS	Combat Service Support
CSSA	CENTAF Supply Support Agency or Combat Service Support Area
CT	Counterterrorism
CTJTF	Counterterrorism Joint Task Force
CVBG	Aircraft Carrier Battle Group (USN)

CW	Chemical Warfare
CWEP	Conventional Weapons Enhanced Penetration
CWP	Contingency Weather Package
D&D	Decoy and Deception
DACT	Dissimilar Aerial Combat Tactics
DARPA	Defense Advanced Research Projects Agency
DAS	Deep Air Support (USMC)
DASC	Direct Air Support Center (USMC)
DCA	Defense Communications Agency
DCI	Director of Central Intelligence
D-Day	Unnamed day on which an operations begins
DDN	Defense Data Network
DF	Direction Fired or Direction Finding
DFR/ME	Defense Fuel Region, Middle East
DFSC	Defense Fuel Supply Center
DFSP	Defense Fuel Supply Point
DIA	Defense Intelligence Agency
DIS	Daily Intelligence Summary
DISA	Defense Information Systems Agency
Div	Division
DLA	Defense Logistics Agency
DLIR	Downward Looking Infrared
DMA	Defense Mapping Agency
DMDC	Defense Manpower Data Center
DMI	Directorate of Military Intelligence (Israel, Iraq, Egypt)

DMSP	Defense Meteorological Satellite Program
DMPI	Desired Mean Point of Impact
DNA	Defense Nuclear Agency
DOC	Designed Operational Capability
DOD	Department of Defense
DOE	Department of Energy
DOPMA	Defense Officer Personnel Management Act
DOS	Department of State
DOT	Department of Transportation
DOWSR	Directorate of Weather for Strategic Reconnaissance
DPA	Defense Production Act
DPG	Defense Planning Guidance
DSB	Defense Science Board
DSCS	Defense Satellite Communication System
DSFU	Desert Storm Forecast Unit
DSMAC	Digitized Scene Mapping and Correlation
DSP	Defense Support Program
EAC	Echelon Above Corps or Eastern Area Command
ECM	Electronic Countermeasures
ECS	Electronic Combat Squadron
EDS	European Distribution System
EDT	Eastern Daylight Time
ELINT	Electronic Intelligence
EMIS	Electro-Magnetic Isotope Separation

EOB	Electronic Order of Battle
EOD	Explosive Ordnance Disposal
EOGB	Electro-Optically Guided Bomb
EOTDAS	Electro-Optical Tactical Decision Aid Software
EPW	Enemy Prisoner of War
ESA	European Space Agency
EST	Eastern Standard Time
ETTF	European Tanker Task Force
EUCOM	European Command
EW	Electronic Warfare
EWO	Electronic Warfare Officer
EWWS	Electronic Warfare Warning System or Set
FAC	Forward Air Control
FAE	Fuel Air Explosive
FAF	French Air Force
FAPES	Force Augmentation Planning and Execution System
FEBA	Forward Edge of the Battle Area
FEWS	Follow-on Early Warning System
FHTV	Family of Heavy Tactical Vehicles
FID	Foreign Internal Defense
FLIR	Forward-Looking Infrared
FLOGEN	Flow Generation computer model
FLOT	Forward Line of Own Troops
FMC	Fully Mission Capable
FMF	Fleet Marine Force
FMS	Foreign Military Sales

FMSE	Fuels Management Support Equipment
FMTV	Family of Medium Tactical Vehicles
FNOC	Fleet Numerical Oceanography Center (USN)
FOL	Forward Operating Location
FORSCOM	U.S. Army Forces Command
FOSK	Follow-on Spares Kits
FOV	Field of View
FROG	Free Rocket Over Ground
FSCL	Fire Support Coordination Line
FSS	Fast Sealift Support
FTX	Field Training Exercise
G-Day	Day the ground war began
GAO	General Accounting Office
GC	Geneva Convention
GCC	Gulf Cooperation Committee
GCI	Ground Control Intercept
GCU	Guidance and Control Unit
GDSS	Global Decision Support System
GENA	Ground Air Navigation Aids radar (U.K./Saudi)
GHQ	General Headquarters (usually theater level)
GLO	Ground Liaison Officer
GMT	Greenwich Mean Time
GNA	Goldwater-Nichols DOD Reorganization Act
GOB	Ground Order of Battle
GOK	Government of Kuwait
GOSC	General Officer Steering Committee

GP	General Purpose bomb
GPS	Global Positioning System or Satellite
H-Hour	Specific time at which operations commence
HA	Heavy Armor
HARM	High Speed Antiradiation Missile
HAB	Hardened Aircraft Bunker
HAS	Hardened Aircraft Shelter
HEMTT	Heavy Expanded Mobility Tactical Truck
HET	Heavy Equipment Transporter
HF	High Frequency
HIDACZ	High Density Airspace Control Zone
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HNS	Host-nation Support
HTPM	Hard Target Penetrator Munitions
HUD	Heads-Up Display
HUMINT	Human Resources Intelligence
HVAA	High Value Airborne Assets
I&W	Indications and Warnings
IAADF	Iraqi Air and Air Defense Forces
IADF	Iraqi Air Defense Forces
IADS	Integrated Air Defense System
IAEC	International Atomic Energy Commission
IAF	Italian Air Force
ICAO	International Commercial Aviation Organization

ICRC	International Committee of the Red Cross
IDF	Israel Defense Force
IFF	Identification Friend or Foe
IFR	Instrument Flight Reference
IFV	Infantry Fighting Vehicle
IIR	Intelligence Information Report or Imaging Infrared
ILM	Intermediate-Level Maintenance
ILMC	Intermediate-Level Maintenance Center
IMA	Individual Mobilization Augmentee
IMET	International Military Education and Training
IMINT	Imagery Intelligence
IMQT	Initial Mission Qualification Training
INS	Inertial Navigation System
IOC	Intercept Operations Center or Integrated Operations Center
IOT&E	Initial Operational Test and Evaluation
IP	Initial Point
IPDS	Inland Petroleum Distribution System (US Army)
IR	Infrared
IRR	Individual Ready Reserve
ISW	Integrated Strike Warfare
ITAC	Intelligence and Threat Analysis Center (US Army)
ITF	Intelligence Task Force (DIA)
IZAF	Iraqi Air Force
J-1	Manpower & Personnel Directorate (Joint)

J-2	Intelligence Directorate (Joint)
J-3	Operations Directorate (Joint)
J-4	Logistics Directorate (Joint)
J-5	Strategic Plans & Policy Directorate (Joint)
J-6	Command, Control & Communications Systems Directorate (Joint)
J-7	Operational Plans & Interoperability Directorate (Joint)
J-8	Force Structure Resource & Assessment Directorate (Joint)
JAAT	Joint Air Attack Team
JAG	Judge Advocate General
JAIC	Joint Atomic Intelligence Committee
Jaguar	Land-based ground attack aircraft
JAMPS	Joint Automated Message Program
JCEOI	Joint Communications Electronics Operations Instructions
JCMEC	Joint Captured Material Exploitation Center
JCS	Joint Chiefs of Staff
JCSE	Joint Communications Support Element
JDOP	Joint U.S./Saudi Directorate of Planning
JDS	Joint Deployment System
JFACC	Joint Force Air Component Commander.
JFC	Joint Forces Commander
JFC-E	Joint Forces Command East
JFC-N	Joint Forces Command North

JFLCC	Joint Forces Land Component Commander
JFMCC	Joint Forces Maritime Component Commander
JFSOCC	Joint Forces Special Operations Component Commander
JIB	Joint Information Bureau
JIC	Joint Intelligence Center
JIPC	Joint Imagery Production Center
JIST	Joint Intelligence Survey Team
JMCC	Joint Movement Control Center
JMEM	Joint Munitions Effectiveness Manual
JOPES	Joint Operations Planning and Execution System
JPEC	Joint Planning and Execution Community
JPTS	Jet Propellant Thermally Stable
JRC	Joint Reconnaissance Center
JRCC	Joint Rescue Coordination Center
JS	Joint Staff
JSCP	Joint Strategic Capabilities Plan
JSEAD	Joint Suppression of Enemy Air Defenses
JSIPS	Joint Service Imagery Processing System
JSOTF	Joint Special Operations Task Force
JSPS	Joint Strategic Planning System
JSTARS	Joint Surveillance Target Attack Radar System (E-8)
JTACMS	Joint Tactical Missile System
JTCB	Joint Target Coordination Board

JTF	Joint Task Force
JTFME	Joint Task Force Middle East
JTIDS	Joint Tactical Information Distribution System
JTTP	Joint Tactics, Techniques and Procedures
JULL	Joint Uniform Lessons Learned
KAF	Kuwaiti Air Force
KCATF	Kuwait Civil Affairs Task Force
KHZ	Kilohertz
KKMC	King Khalid Military City
KIA	Killed In Action
KTO	Kuwait Theater of Operations
LAMPS	Light Airborne Multi-Purpose System (USN)
LANDSAT	Land Satellite, NASA/NOAA Satellite Program
LANTCOM	Atlantic Command
LANTIRN	Low Altitude Navigation and Targeting Infrared System for Night
LAV	Light Armored Vehicle
LCAC	Air Cushioned Landing Craft
LCC	Land Component Commander
LDGP	Low Drag General Purpose bomb
LENSCE	Limited Enemy Situation/Correlation Equipment
LG	Logistics
LGB	Laser Guided Bomb
LGGAIR	Logistics Airlift
LIATE	LANTIRIN Intermediate Automatic Test Equipment

LOC	Lines of Communication
LOS	Line of Sight
LOTS	Logistics Over the Shore
LRC	Logistics Readiness Center (USAF)
LRI	Long Range International
LVS	Logistics Vehicle System
MAC	Military Airlift Command
MACCS	Marine Air Command and Control System
MACG	Marine Air Control Group
MAG	Marine Airlift Group
MAGTF	Marine Air Ground Task Force
MAIRS	Military Airlift Integrated Reporting System
MAJCOMS	Major Commands
MAP	Master Attack Plan
MARCENT	U.S. Marine Corps, Central Command
MARDIV	Marine Division
MASF	Mobile Aeromedical Staging Facility
MASS	MICAP Asset Sourcing System
MAW	Marine Aircraft Wing
MCI	Ministry of Culture and Information (Iraq)
MCM	Mine Countermeasures or Multi-Command Manual
MEB	Marine Expeditionary Brigade
Mech Div	Mechanized Infantry Division
MEF	Marine Expeditionary Force
MEL	Mobile Erector-Launcher used for mobile missiles

METS	Mobile Electronic Test Set
METSAT	Meteorological Satellite
MEU	Marine Expeditionary Unit
MHE	Materiel Handling Equipment
MIA	Missing In Action
MIF	Maritime Interdiction Force
MICAP	Mission Critical Parts or Mission Capable or Mission Capability Limiting
MILCON	Military Construction
MILSATCOM	Military Satellite Communications
MILSTAR	Military Strategic and Tactical Relay System
MIO	Maritime Intercept Operations
MIPE	Mobile Intelligence Processing Element
MIS	Military Intelligence Study
MISREP	Mission Report
MLRS	Multiple Launch Rocket System
MLV	Memory Loader Verifier
MOBREP	Manpower Mobilization and Accession Status Report
MOD	Ministry of Defense
MODA	Ministry of Defense and Aviation (Saudi Arabia)
MOPP	Mission Oriented Protective Posture
MPES	Medical Planning and Execution System
MPF	Maritime Prepositioning Force
MPS	Maritime Prepositioning Ships
MRE	Meals Ready to Eat

MRR	Minimum Risk Route
MRS	Mobility Requirements Study
MSC	Military Sealift Command
MSE	Mobile Subscriber Equipment
MSI	Multi-Spectral Imagery
MSK	Mission Support Kits
MTACC	Marine Tactical Air Command Center
MTI	Moving Target Indicator
MTL	Master Target List
MTMC	Military Traffic Management Command
NAC	Northern Area Command
NALE	Naval Amphibious Liaison Element
NATO	North Atlantic Treaty Organization
NAVCENT	U.S. Navy, Central Command
NAVEUR	Naval Forces, Europe
NAVSTAR	Navigational Satellite Timing and Ranging
NBC	Nuclear, Biological, and Chemical
NCA	National Command Authorities
NCTR	Noncooperative Target Recognition
NDRF	National Defense Reserve Fleet
NDS	NPIC Data Systems
NF or NOFORN	Not Releasable to Foreign Nationals
NGB	National Guard Bureau
NGFS	Naval Gunfire Support
NIE	National Intelligence Estimate
NMAC	Near Mid-Air Collision
NMCS	Not Mission Capable Supplies

NMCM	Not Mission Capable Maintenance
NMIC	National Military Intelligence Center
NMIST	National Military Intelligence Support Teams
NOAA	National Oceanographic and Atmospheric Administration
NOB	Naval Order of Battle
NODDS	Naval Oceanographic Data Dissemination System
NPIC	National Photo Interpretation Center
NSA	National Security Agency
NSC	National Security Council
NTC	Night Targeting Cell (in GAT)
NVG	Night Vision Goggles
O&M	Operations and Maintenance
OAS	Offensive Avionics System
OASD/(DR&E)	Office of the Assistant Secretary of Defense (Defense Research & Engineering)
OASD/(SO/LIC)	Office of the Assistant Secretary of Defense (Special Operations/Low Intensity Conflict)
OB	Order of Battle
OCA	Offensive Counter Air
OCP	Observation Command Post
OICC	Operational Intelligence Crisis Center
OP	Observation Post
OPAIR	Opposing Air
OPCON	Operational Control
OPDS	Offshore Petroleum Distribution System (USN)

OPEC	Organization of Petroleum Exporting Countries
OPLAN	Operation Plan
OPORD	Operation Order
OPSEC	Operational Security
OSD	Office of the Secretary of Defense
OSI	Office of Special Investigations (USAF)
OSP	Operational Support Package
PACOM	Pacific Command
PA	Public Affairs
PAO	Public Affairs Officer
PCITF	Positive Combat Identification Task Force
PGM	Precision Guided Munitions
PIN	Primary Identification Number
PLO	Palestine Liberation Organization
PLS	Palletized Loading System
PLV	Program Loader Verifier
PMC	Partially Mission Capable
PMEL	Precision Measurement Equipment Laboratory
PMT	Pastoral Ministry Team
PNVS	Pilot Night Vision System
POG	Psychological Operations Group
POL	Petroleum, Oils and Lubricants
POMCUS	Pre-positioning of Material Configured to Unit Sets
POW	Prisoner of War
PREPO	Pre-positioned

PSYOP	Psychological Operation
PSYOPS	Psychological Operations
PTAS	Provisional Tactical Airlift Squadron
QEAF	Qatari Emiri Air Force
QRCT	Quick Reaction Communications Terminal
R&D	Research and Development
R&M	Reliability and Maintainability
RADIC	Rapidly Deployable Integrated Command and Control system
RAF	Royal Air Force (U.K.)
RAFVR	Royal Air Force Voluntary Reserve
RAM	Radar Absorptive Material
RC	Reserve Component
RCAF	Royal Canadian Air Force
RCC	Rescue Coordination Center or Revolutionary Command Council (Iraq)
RDAF	Royal Dutch Air Force
RDF	Rapid Deployment Force or Radio Direction Finding
RDIT	Rapid Deployment Imagery Terminal
RDJTF	Rapid Deployment Joint Task Force
Red Horse	Rapid Engineer Deployable, Heavy Operational Repair Squadron, Engineer
REMIS	Reliability and Maintainability Information System
RFI	Request for Information
RFMD	RED FLAG Measurement Debriefing
RGFC	Republican Guard Force Command (Iraq)
RIBS	Readiness in Base Services

RJAF	Royal Jordanian Air Force
RLT	Regimental Landing Team (USMC)
RO/RO	Roll On/Roll Off
ROE	Rules of Engagement
ROTHR	Relocatable Over-The-Horizon Radar
RPV	Remotely Piloted Vehicle
RRF	Ready Reserve Force or Ready Reserve Fleet
RSADF	Royal Saudi Air Defense Force
RSAF	Royal Saudi Air Force
RSLF	Royal Saudi Land Force
RTNEPH	Real-Time Nephanalysis
RW	Reconnaissance Wing
RWR	Radar Warning Receiver
S&TI	Scientific and Technical Intelligence
SA	Selective Availability
SAAF	Saudi Arabian Armed Forces
SAC	Strategic Air Command
SAG	Saudi Arabian Government or Surface Action Group (USN)
SAM	Surface-to-Air Missile
SAMAREC	Saudi Arabian Marketing and Refining Company
SANG	Saudi Arabian National Guard
SAR	Search and Rescue
SAS	Special Air Service (U.K.)
SATCOM	Satellite Communications
SBS	Special Boat Service (U.K.)
SBSS	Standard Base Supply System

SCUD	Soviet surface-to-surface missile
SCI	Sensitive Compartmented Information
SCIF	Sensitive Compartmented Information Facility
SEAD	Suppression of Enemy Air Defenses
SEAL	Sea Air Land
SECDEF	Secretary of Defense
SFG	Special Forces Group
SFW	Sensor Fuzed Weapon
SHAPE	Supreme Headquarters, Allied Powers, Europe
SHF	Super High Frequency
SIDS	Secondary Imagery Dissemination System
SIGINT	Signals Intelligence
SINCGARS	Single Channel Ground/Airborne Radio Subsystem
SIOP	Single Integrated Operations Plan
SITREP	Situation Report
SLAM	Standoff Land Attack Missile
SLAR	Side-Looking Airborne Radar
SLOC	Sea Lines of Communications
SMESA	Special Middle East Shipping Agreement
SNIE	Special National Intelligence Estimate
SOAF	Sultanate of Oman Air Force
SOC	Sector Operations Center (Air Defense) or Special Operations Command
SOCCENT	Special Operations Command, Central Command

SOCOM	Special Operations Command
SOF	Special Operations Forces
SOFA	Status of Forces Agreement
SOG	Special Operations Group
SOS	Special Operations Squadron
SOW	Special Operations Wing
SPACC	U.S. SPACECOM Space Control Center
SPEAR	Strike Projection Evaluation and Anti-Air Warfare Research (USN)
SPINS	Special Instructions
SPOT	French Satellite Probatoire d'Observation de la Terre
SRBM	Short-range Ballistic Missile
SRP	Sealift Readiness Program
SRW	Surveillance and Reconnaissance Wing
SSA	Selective Service Act
SSM	Surface-to-Surface Missile
STAMP	Standard Air Munitions Package
STGP	Special Tactics Group (USAF)
STON	Short Ton (2,000 pounds or 0.9 metric tons)
STPJ	Special Tactic Paramedics (USAF)
STRAPP	Standard Tank, Rack, Adapter, and Pylon Package
STRATFOR	Strategic Forces Advisors
STU	Secure Telephone Unit
SURVIAC	Survivability and Vulnerability Information Analysis Center
SWA	Southwest Asia

SYERS	Senior Year Electro-Optical Reconnaissance System
TAC	Tactical Air Command
TACAIR	Tactical Air
TACC	Tactical Air Control Center
TACON	Tactical Control
TACP	Tactical Air Control Party
TACS	Tactical Air Control System
TACSAT	Tactical Satellite
TADIL	Tactical Digital Information Link or Tactical Data Interface Link
TAF	Tactical Aircraft Forces
TAG	Tactical Airlift Group
TAIRCW	Tactical Air Control Wing
TALD	Tactical Air-Launched Decoy
TALO	Theater Airlift Liaison Officer
TANKREP	Tank Killer Report
TAOC	Tactical Air Operations Center (USMC)
TARCAP	Target Combat Air Patrol
TARPS	Tactical Air Reconnaissance Pod System
TAW	Tactical Airlift Wing
TAWC	Tactical Air Warfare Center
TBM	Tactical Ballistic Missile
TCN	Transportation Control Number
TDA	Tactical Decision Aid
TEL	Transporter-Erector-Launcher
TEMPER	Tent Expendable Modular Personnel
TER	Triple Ejector Rack

TERCOM	Terrain Contour Matching
TFS	Tactical Fighter Squadron
TFW	Tactical Fighter Wing
TIALD	Thermal Imaging and Laser Designating
TIARA	Tactical Intelligence and Related Activities
TIBS	Tactical Information Broadcast System (USAF)
TIROS	Television and Infrared Observation Satellites
TIS	Tactical Intelligence Squadron
TLAM	Tomahawk Land-Attack Missile
TMD	Tactical Ballistic Missile Defense
TO	Technical Order
TO&E	Table of Organization and Equipment
TOAF	Tactical Operations Area Forecast
TOT	Time Over Target
TPFDD	Time-Phased Force Deployment Data
TPFDL	Time-Phased Force Deployment List
TR	Theater Reserves
TRADOC	Training and Doctrine Command (US Army)
TRAM	Target Recognition and Acquisition Multisensor (USN)
TRANSCOM	U.S. Transportation Command
TRAP	Tanks, Racks, Adapters, and Pylons
TRG	Tactical Reconnaissance Group
TTF	Tanker Task Force
TTM	Tactical Target Material

TTP	Tactics, Techniques, and Procedures
UAE	United Arab Emirates
UAEAF	United Arab Emirates Air Force
UAV	Unmanned Aerial Vehicle
UAWS	USAREUR Automated Weather System
UCMJ	Uniform Code of Military Justice
UHF	Ultra High Frequency
UK	United Kingdom
ULN	Unit Line Number
UMMIPS	Uniform Military Management and Movement Indicator System
UN	United Nations
UND	Urgency of Need Designator
UNSC	United Nations Security Council
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USAFE	U.S. Air Force Europe
USAFR	United States Air Force Reserve
USAR	U.S. Army Reserve
USC	United States Code
USCENTCOM	Central Command
USCG	U. S. Coast Guard
USCINCCENT	Commander-in-Chief U.S. Central Command
USCINCCENT	U.S. Commander-in-Chief, Central Command
USDAO	U.S. Defense Attache Office
USEUCOM	U.S. European Command
USG	United States Government

USIA	U.S. Information Agency
USMC	U.S. Marine Corps
USN	U.S. Navy
USNAVCENT	U.S. Navy, U.S. Central Command
USNR	U.S. Navy Reserve
USPACCOM	U.S. Pacific Command
USSOCOM	U.S. Special Operations Command
USSOUTHCOM	U.S. Southern Command
USSPACECOM	U.S. Space Command
USTRANSCOM	U.S. Transportation Command
UTC	Unit Type Code
UTE	Utilization Rate
VA	Department of Veteran's Affairs
VCJCS	Vice Chairman, Joint Chiefs of Staff
VFR	Visual Flight Reference
WAM	Wide Area Mine
WATCHCON	Watch Condition
WCDC	War Crimes Documentation Center
WFOV	Wide Field of View
WHNS	Wartime Host-Nation Support
WIA	Wounded in Action
WIN	Worldwide Military Command and Control System Intercomputer Network
WN or WNINTEL	Warning Notice: Intelligence Sources and Methods Involved
WOC	Wing Operations Center
WRM	War Reserve Material
WRSK	War Readiness Spares Kits
WSO	Weapons System Operator

WWIMS	Worldwide Indicators and Monitoring System
WWMCCS	Worldwide Military Command and Control System
WXG	Weather Group

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