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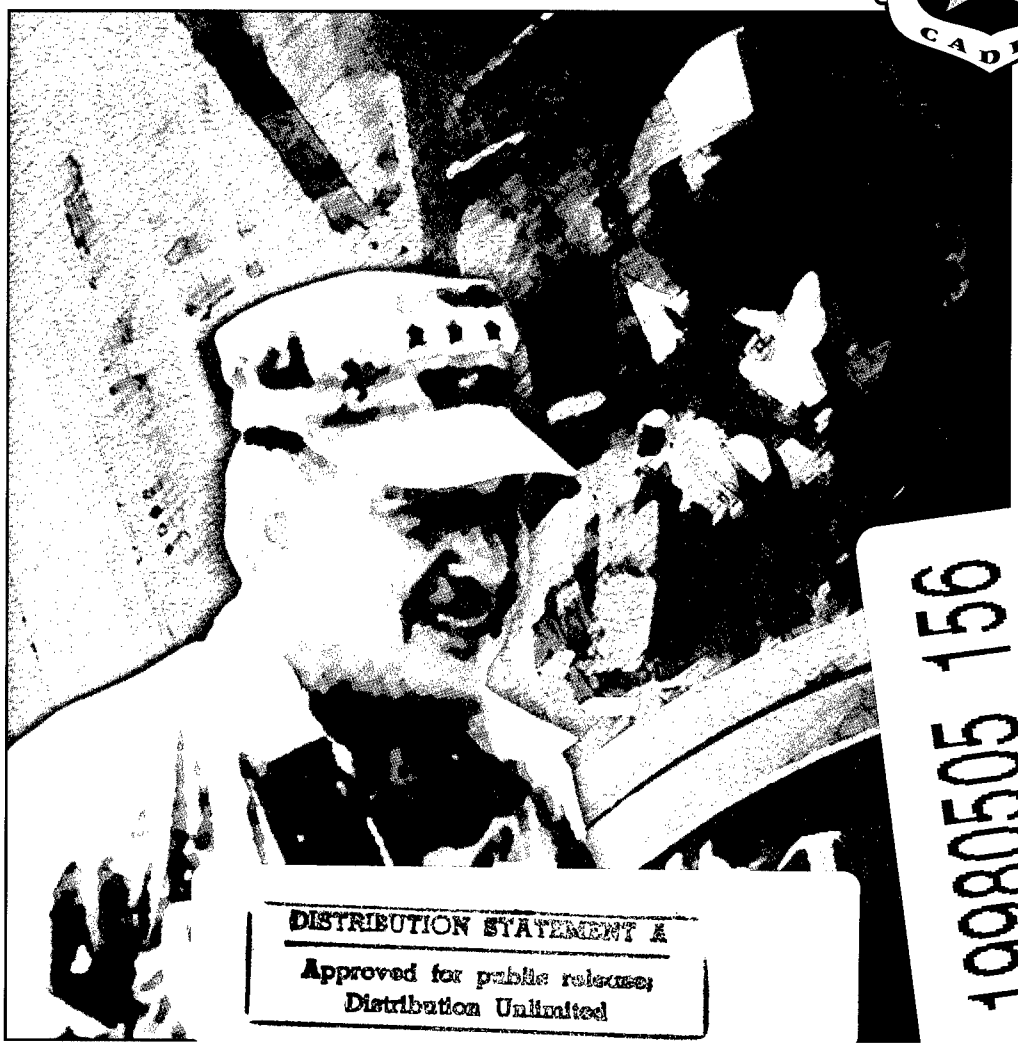

AIRPOWER AGAINST AN ARMY

Challenge and Response in CENTAF's Duel with the Republican Guard

Lt Col William F. Andrews, USAF

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Airpower against an Army

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Andrews

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Airpower against an Army

Challenge and Response in CENTAF's Duel with the Republican Guard

WILLIAM F. ANDREWS
Lt Col, USAF

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Associate Director of Research
Airpower Research Institute
CADRE
401 Chennault Circle
Maxwell AFB AL 36112-6428
Tel: (334) 953-6875
DSN 493-6875
Fax: (334) 953-6739
Internet: jtitus@max1.au.af.mil

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Foreword

In January and February 1991, Central Command Air Forces (CENTAF) conducted an air-to-ground onslaught against Iraq's Republican Guard. The requirements of this operation conflicted in a number of respects with the US Air Force's extended preparations for conflict on a European battleground. A major case in point involved the low-altitude tactics CENTAF crews had practiced for the previous decade and a half, tactics that were manifestly unsuited for the task that confronted them in Iraq.

This paper was originally submitted as a thesis by Maj (now lieutenant colonel) William F. Andrews to the faculty of Air University's School of Advanced Airpower Studies for completion of graduation requirements, academic year 1995–96. Colonel Andrews's study, *Airpower against an Army: Challenge and Response in CENTAF's Duel with the Republican Guard*, examines how CENTAF adjusted air operations against the Republican Guard to meet the realities of combat.

Initial F-16 and B-52 attacks on the Republican Guard met little success. In response, CENTAF instituted six significant tactical innovations in the space of one week: A-10 deep interdiction, A-10 reconnaissance, F-16 killer scout operations, F-16 forward basing, F-111 and F-15E tank plinking, and the use of cockpit videotape as a source for bomb damage assessment. These innovations required CENTAF aviators to create new tactics in the midst of combat operations. Quickly devised and implemented, these new tactics markedly improved CENTAF's effectiveness against the Republican Guard. Critically weakened by air attack, the two guard divisions that stood and fought were annihilated during the ground phase of Operation Desert Storm.

As Colonel Andrews makes clear, four factors proved instrumental in facilitating CENTAF's rapid adaptation to the realities of war: (1) air superiority which created a permissive environment for innovative tactics; (2) open-minded attitudes

of senior commanders which nurtured the growth of new methods of operation; (3) the faith of senior commanders in highly motivated and well-trained subordinates which permitted—and inspired—lower echelon units to find optimal solutions to complex problems in minimum time; and (4) the high degree of personal initiative—cultivated on training and tactics ranges, in classrooms at Nellis Air Force Base, Nevada, and flight briefing rooms across the USAF—which served as the ultimate sine qua non of the adaptation process. Colonel Andrews's study also serves to powerfully reaffirm the fundamental truth of the old Air Force adage that "flexibility is the key to airpower." As we confront an uncertain international security environment, a fundamental lesson of *Airpower against an Army* is that we must encourage flexibility in peacetime if we are to possess the physical, mental, and organizational agility that will be required to master the unforeseen realities of the next war.

I commend *Airpower against an Army* to anyone seeking to better understand the capabilities of modern airpower and the organizational dynamics that profoundly shape the effectiveness with which it is employed.

MARK S. ORDESS, Col, USAF
Director, Airpower Research Institute

About the Author

Lt Col William F. Andrews (BS, US Air Force Academy; MA, University of Alabama), a senior pilot with more than 3,500 flying hours, is operations officer of the 389th Fighter Squadron at Mountain Home Air Force Base (AFB), Idaho. After receiving his wings at Columbus AFB, Mississippi, he instructed primary jet training in the T-37. In 1984 he converted to EF-111s at Mountain Home AFB and was an EF-111A instructor pilot as well as the squadron chief of weapons and tactics in the 390th Electronic Combat Squadron. Colonel Andrews converted to the F-16 in 1989 at Hahn Air Base (AB), Germany, and served as chief of programming, flight commander, and assistant operations officer. On 31 December 1990 he deployed with the 10th Tactical Fighter Squadron to Al Dhafra AB, United Arab Emirates, for operations Desert Shield and Desert Storm. During Desert Storm, he was a mission commander and flew 35 combat missions over Kuwait and Iraq. On 27 February 1991, while attacking Iraqi ground troops, Colonel Andrews was forced to eject from a damaged F-16C and was captured by the Republican Guard. He was held as a prisoner of war until the end of hostilities. After a three-month convalescence, he returned to flying status and was reassigned to Luke AFB, Arizona, where he served as an instructor pilot in F-16 night attack using the low-altitude navigation and targeting infrared for night system. In 1955 he was assigned to Headquarters Air Combat Command (ACC) at Langley AFB, Virginia, where he directed the ACC Commander's Action Group. Colonel Andrews is a graduate of Air Command and Staff College and the School of Advanced Airpower Studies. He is married to the former Stacey Williams of Colorado Springs, Colorado. They have three children, Sean, Shannon, and Patrick.

Introduction

For nearly two decades the United States Air Force (USAF) oriented the bulk of its thinking, acquisition, planning, and training on the threat of a Soviet blitzkrieg across the inter-German border. The Air Force fielded a powerful conventional arm well rehearsed in the tactics required to operate over a central European battlefield. Then, in a matter of days, the 1990 invasion of Kuwait altered key assumptions that had been developed over the previous decade and a half. The USAF faced a different foe employing a different military doctrine in an unexpected environment. Instead of disrupting a fast-paced land offensive, the combat wings of the United States Central Command Air Forces (CENTAF) were ordered to attack a large, well-fortified, and dispersed Iraqi ground force. The heart of that ground force was the Republican Guard Forces Command (RGFC). CENTAF's mission dictated the need to develop an unfamiliar repertoire of tactics and procedures to meet theater objectives. How effectively did CENTAF adjust air operations against the Republican Guard to the changing realities of combat? Answering that question is central to this study, and the answer resides in evaluation of the innovations developed by CENTAF to improve its operational and tactical performance against the Republican Guard. Effectiveness and timeliness are the primary criteria used for evaluating innovations.

Although CENTAF conducted operations against a variety of Iraqi organizations—all requiring some degree of adaptation—the operations against the Republican Guard are the subject of this publication for three reasons. First, the Republican Guard was the most important element of the Iraqi Army because its defeat guaranteed the defeat of the remainder, and it captured much of CENTAF's efforts and attention. Second, changes to operations against the RGFC provide a significant case for analyzing wartime adaptation. USAF doctrine that outlined operations against a land force was based on assumptions different than those encountered during the Persian Gulf War. As a result, air operations against the guard units underwent several changes during the war, validating

the need to adapt preconceived tactics and procedures during war. Third, evaluation of operations against the Republican Guard is feasible within the limits of a study of this scope.

This study examines the extent to which USAF doctrine prepared CENTAF for its mission against the Republican Guard. How closely Air Force doctrine "fit" the situation at hand provides a baseline for the amount of adaptation required. This examination of CENTAF's adaptation identifies the main elements of the adaptive process, especially those factors that helped and hindered the process, and the sources of CENTAF's innovations. This study is confined to USAF operations against the Republican Guard within the Kuwaiti theater of operations (KTO).[1] The CENTAF commander (CC), Lt Gen Charles A. Horner, directed USAF, Navy, Marine, and allied air units, but the main weight of the air effort against the RGFC was generated by the United States Air Force.[2]

Most documentary evidence was obtained from the USAF Historical Research Agency (HRA) at Maxwell Air Force Base (AFB), Alabama. Its extensive collection of documents and briefing slides was only partially usable due to the secret classification assigned to most of the Gulf War materials. Some declassified excerpts are reproduced in the *Gulf War Air Power Survey (GWAPS)*, which also provides important Gulf War statistical data. Personal accounts in professional military journals were useful additional sources. Much business during the war was conducted via telephone, with little documentation. Personal interviews, therefore, were an important source of information. Because this study deals with ideas and their origins, some uncertainty exists seven years after the fact.

The discussion that follows examines the theoretical basis for adaptation during war, definitions, and criteria to evaluate innovations. The theory is followed by a description of the combatants, their doctrines, and the USAF's plan for defeating the Republican Guard. The ensuing narrative of the first 10 days of air attacks on the RGFC suggests CENTAF saw the need to adapt. The subsequent section describes several major innovations that were incorporated into the air campaign. A relatively static period followed, culminating in the ground war

that subjected USAF efforts against the Republican Guard to a final audit.

The conclusions—springing from one specific set of conditions—may not apply to all situations in the future. One other significant limitation is that a true measurement of effectiveness against guard units cannot be known without Iraqi assistance and, even with that, Iraqi knowledge of the status of their own forces is questionable. Iraqi defector and prisoner of war (POW) debriefings would help, but these reports are classified and cannot be cited.

The Innovation Imperative

> *I am tempted indeed to declare dogmatically that whatever doctrine the armed forces are working on now, they have got it wrong. I am also tempted to declare that it does not matter that they have got it wrong. What does matter is their capacity to get it right quickly when the moment arrives.*
>
> —Sir Michael Howard

Innovations bridge the gaps that separate doctrines developed in peacetime from the realities of war. They range from minor modifications of existing procedures to fundamental changes that establish entirely new methods. They should be evaluated in terms of timeliness and effectiveness.

Military doctrines and practices established in peacetime are designed to meet the anticipated challenges of war. Based on past experiences and a vision of how future conflict should be fought, a military organization's doctrine is "a codified and sanctioned body of propositions related to war and conflict" that link theory and practice.[3] By serving as a point of departure for all of a service's activities, doctrine defines how that service intends to fight, how it will be organized, and with what weapons it will fight.

A military organization's practices are equal in importance to its doctrine because methods exercised in peacetime result in the formulation of common perceptions of how war should and will be waged in the future by those who will do the

fighting. Peacetime training forms patterns and establishes standard operating procedures. Doctrine and practices have an interactive relationship, each taking the lead at times and producing change in the other.

The reality of war will differ from that which is anticipated in peacetime. This realization stems from an inability to predict adequately the continuing multitudinous changes that influence the conduct of war.[4] Technological changes are especially problematic, as those who formulate doctrine may not recognize technical opportunities or imperatives until it is too late. Doctrines based on experience may fail due to altered circumstances, while those based on theory may fail due to lack of feedback.[5] American military doctrine is especially vulnerable to being undermined by invalidated assumptions because we are hard-pressed to identify accurately our next opponent.

Doctrine and practices must change to meet the demands of the new realities encountered on the field of battle. Military adaptation during war is the process by which a military institution modifies its methods to meet the changing requirements of the wartime environment. This process of military adaptation involves a form of organizational learning through which military institutions change in response to experience and find more effective or efficient methods of waging war. Success may be possible without adaptation but will come at an increased cost in terms of time, treasure, or blood.[6] Conversely, useful adaptation does not guarantee success. The German Army, for example, adapted well to the realities of World War I and World War II battlefields, yet Germany lost both wars. "First-rate operational and tactical performance is a *virtue to be sought* by those responsible for military forces," stated Lt Gen John H. Cushman.[7] Adaptation is required to achieve first-rate performance.

One product of adaptation in war is military innovation: a change that deviates from doctrine or practices established in peacetime. Stephen P. Rosen distinguishes between peacetime, wartime, and technological innovations and the unique challenges of each.[8] By acknowledging the importance of each, this study concentrates on tactical innovation during war.

The amount of innovation required is dependent on how closely established doctrine and procedures match battlefield realities. A wing trained and equipped to wage intercontinental nuclear war sent to fight guerrillas is likely to require more extensive innovations to succeed than a unit trained to perform close air support (CAS).[9] Wartime innovations can be categorized as minor, major, or fundamental and are easily thought of in terms of modified methods. Rosen, however, emphasizes the possibility of adopting altered military objectives as an innovation.[10] Blending the two criteria, I consider a minor innovation to be a modification of existing methods towards an anticipated objective. Improving tactical formations to maximize visual search within the context of an existing mission is an example of a tactical innovation. A major innovation is the substitution of existing or modified methods in unexpected combinations towards an anticipated or modified objective. The use of the US Army (USA) Apache and USAF special operations helicopters to attack the Iraqi early warning system the first night of Operation Desert Storm is one such unexpected combination. A fundamental innovation is the replacement of existing methods with unprecedented methods or the replacement of an existing objective with an entirely new objective. The change in the objective of Eighth Air Force's long-range fighters from protecting the bombers to seeking out and attacking Luftwaffe fighters as a means to enable strategic bombing attacks is one such replacement of objective.[11]

Innovations are judged in terms of effectiveness and timeliness. An innovation is effective if it improves operational progress towards the objective, while saving time, manpower, or materiel, or if it produces enhanced results with an equal expenditure of resources. An innovation that yields little change in effectiveness is of limited value. An innovation is timely if it takes effect within the planned campaign schedule. Subjective consideration, however, must be given to unnecessary losses of materiel, manpower, or time during the interval required to implement the innovation. Because an adversary's adaptive process will attempt to negate one's actions, there are advantages of one's own adaptive process being faster than the enemy's. "The advantage goes to the side

which can most quickly adjust itself to the new and unfamiliar environment and learn from its mistakes."[12]

There appears to be a tension, however, between the breadth and timeliness of an innovation. In order to limit enemy ability to react to an innovation, delayed but widespread implementation may be more beneficial than a very rapid piecemeal change. One example of a premature innovation was the first British tank attack at the Somme, which allowed the Germans time to develop countermeasures and sacrificed the potential surprise of a mass tank attack.[13] Attacks against command and control (C^2) nodes may relieve some of this scale-timeliness tension by decreasing the enemy capability to detect, analyze, and react to innovations.

Because innovations are the offspring of unique circumstances, they are unlikely to be of permanent value. The process of adaptation, however, may yield insights that could facilitate the formulation of future innovations. Cushman divides military responses (adaptation) into insight and execution; it appears beneficial to disaggregate the process further in order to better identify the elements necessary for successful adaptation.

An operable system of C^2 is assumed to be a necessary element of the adaptation process, otherwise adaptation takes place randomly. There are several alternative models of C^2, but the observe-orient-decide-act cycle (OODA loop) identified by Col John R. Boyd is one of the most widely recognized, and it does a credible job approximating reality.[14] The OODA loop—which divides C^2 into separate functions of observe, orient, decide, act—appears to be useful for identifying elements of adaptation.[15] All four functions are normally required for effective C^2 and appear to be required for effective adaptation. No function, however, is easily accomplished in wartime. Each step of the process must surmount formidable obstacles. If a step is obstructed, innovation is unlikely. Likewise, a series of impediments could have a cumulative effect on the entire system and prevent adaptation.

Observation describes the gathering of data regarding the status of enemy and friendly forces, the battlefield, or other significant areas of interest. Observation must be continuous. Before battle is joined, it is needed for the formulation of

plans; once fighting begins, observation is needed to detect the new reality that results from the initial battle and enemy reactions. It may also include surveillance by a variety of sensors, subordinate units, or individuals and has often included direct observation of the battle by the commander. Observation is a necessary element of adaptation because it is required to detect changed or unanticipated realities of the battlefield. Observation is an indispensable precondition of accurate orientation, the next step in the OODA process. Helmuth von Moltke recognized the need for observation and decreed that "*the most precise possible knowledge of the situation* is an absolute prerequisite for giving correct and appropriate orders."[16]

There are considerable obstacles to effective observation and, therefore, to adaptation. By labeling many intelligence reports in war as contradictory, false, or uncertain, Carl von Clausewitz adopts a pessimistic view of the commander's ability to penetrate the uncertainties of war.[17] Limitations of intelligence collection systems can be compounded by active measures employed by a thinking adversary to confound accurate observation. If the enemy is successful, adaptation is unlikely because the need to change is unlikely to be perceived. Rosen shares Clausewitz's pessimism on the ability to gather needed information: "Intelligence relevant to innovation very likely will not be available in wartime, and wartime innovation is likely to be limited in its impact."[18]

Orientation describes the translation of data into useful information; its product is the organization's perception of reality. Boyd considered orientation the most important part of the OODA loop: "Orientation is the *schwerpunkt.* It shapes the way we interact with the environment—hence orientation shapes the way we observe, the way we decide, the way we act."[19] Analysis and synthesis of an organization's observations should contribute to the formulation of insights into difficulties experienced on the battlefield.[20] With the formulation of these vital insights, the need to adapt can be perceived. Orientation is a necessary element of adaptation and must result in the perception that a need or opportunity exists to improve performance. Adaptation can be expected as a response to the challenges of war, but it may also spring

from the realization that an opportunity to achieve enhanced results exists. Chance events that improve performance may be observed, and if perceived as favorable, the decision to incorporate them can be made.

The synthesis of imperfect reports from a variety of sources is difficult from both the organizational and the personal perspectives. Martin van Creveld clearly illustrated the many organizational obstacles faced by military staffs in handling the increased information available (and required) to wage war, thus labeling them information pathologies.[21] Affirming van Creveld's findings is a 1992 article on Desert Storm that noted organizational blind spots due to information overload and undue attention given to particular forms of information.[22] Personal obstacles to accurate orientation are equally formidable, including "superficial thinking . . . self-satisfaction, complacency, and arrogance."[23] Emotions that spring from war can cloud the mind in what Clausewitz referred to as a "psychological fog" obstructing "clear and complete insights."[24]

Decision describes the formulation of courses of action (COA) and their selection. At this point alternative solutions are evaluated and optimal solutions selected. The formulation of new solutions is contingent on the participant's ability to imagine and articulate new options. It is the role of the organization to cultivate, encourage, and recognize valuable solutions. It then falls on the commander to decide whether or not to implement new solutions, or to delegate sufficient freedom of action to make such decisions at lower levels. The cultivation of ideas and the decisions to implement them are necessary for adaptation. Intuition, creativity, and imagination are all individual characteristics of the commander, his staff, and subordinates that can lead to the initiation of an innovation. For a proposed innovation to have an effect it must be implemented, which hinges on the decision of someone in a position of authority.

Obstacles to formulating or selecting appropriate COAs include a lack of flexibility in the mind of the commander, lack of flexibility in doctrine (dogma), or lack of organizational flexibility. Commanders who believe they have all the answers can be a tremendous obstacle to innovation: Sir Douglas Haig is

widely viewed as the epitome of inflexible thinking. One biographer notes that "before the war, Haig was quite sure he had uncovered all the rules of war. He was equally certain that these rules had to be accepted as dogma and not weakened by debate."[25] Rigid military hierarchies or organizations can restrict the flow of ideas either through many levels of command or restricted means of communication. For organizations with the requisite flexibility, anticipated costs of implementation may give sufficient cause for rejection of a potential innovation. All aspects of a potential innovation may not be beneficial; a gain in one area may penalize another.

Action describes the implementation of plans (i.e., combat operations), although it may also entail changes to organizations, procedures, or equipment. Although it may be easy to concentrate attention to only the actions of one's military forces and the effects of their activities on the enemy, there is another important dimension of action. Every decision must be transmitted through the organization in order for it to be implemented. Planning, coordination, training, and execution are all part of the process.

If innovations are not successfully implemented, the adaptive process fails. Ultimately, it is the output of the process of adaptation, the modified method itself, that will interact with the changing wartime environment. It is here—when actions are implemented—that innovations affect the system and should be graded for effectiveness and timeliness. It should be noted, however, that innovations cannot be graded without further observation and orientation.

The difficulties encountered while carrying out plans during war constitute a considerable impediment to adaptation and include poor communications, inadequate understanding of orders, inflexible attitudes, or imperfect execution. Labeled friction by Clausewitz, these myriad difficulties combine to turn war into "a medium that impedes activity" which must be overcome by "iron will-power."[26] There is also the danger that an innovation may exceed the unit's ability to carry it out. Timothy T. Lupfer's examination of the German tactical adaptation in the First World War noted the Germans were attentive to their army's ability to perform because "*an army that adopts tactical doctrine that it cannot apply will greatly*

multiply its misfortune."[27] Excessive caution, on the other hand can be equally costly. Overly concerned with the ability of its crews to execute complex tactics, Strategic Air Command (SAC) headquarters dictated predictable tactics during the first days of Operation Linebacker II, increasing risk to the bomber crews and perhaps suffering unnecessary losses.[28]

In a large military organization, numerous individuals and subunits accomplish part or all of the functions described. Discrete functions or the entire process may be accomplished at more than one echelon simultaneously. Since observation and action responsibilities are normally clearly defined, this study considers two questions: At what level are innovations developed? At what level does the orientation and decision take place?

There are three potential hypotheses: top-down, bottom-up, or a combination of the two. A top-down process involves a headquarters staff (at the theater or possibly national level) that analyzes reports from the field, develops innovations (possibly by refining suggestions from subunits) and disseminates them to the command. This process was used by the German Army to adapt tactical doctrine to realities of the western front in World War I, and the Red Army to find a suitable operational doctrine against the Wehrmacht during World War II.[29] Both involved orderly, centralized processes that disseminated changes uniformly across the theater. The drawbacks to centralized change are that it is potentially less responsive to immediate requirements, nor is it well suited for handling unique local conditions.

Bottom-up adaptation starts at the tactical unit level. Innovations are developed quickly in response to immediate problems and tactical units then advise headquarters. Headquarters then advises other units of ideas and lessons learned. During World War II, the US Army used bottom-up adaptation to adjust tactics to conditions encountered in the campaigns for France and Germany, capitalizing on "Yankee ingenuity . . . a hallmark of U.S. commercial production and manufacturing . . . that also accompanies [American] soldiers to the battlefield."[30] Bottom-up adaptations, it is argued, are more responsive to local conditions and better suited where incremental changes are desirable.[31] The decentralized

approach, however, is not well suited when fundamental changes are required or situations are beyond unit capabilities to handle.[32]

There is the possibility of a third option, which is that innovations originate from both sources and flow both directions. Theoretically, this arrangement could permit fundamental or widespread adaptations to be directed from above, yet permit tactical units the flexibility to quickly adapt to immediate needs. This possibility would require organizational flexibility of the headquarters as it would be required to perform both advisory and directive functions. A means to resolve conflicting guidance might also be required.

To recapitulate, issues to consider in examining the attack on the Republican Guard are what was USAF prewar doctrine; how much adaptation was required to cope with the realities of war; how effective and timely were CENTAF's innovations, what facilitated or hindered adaptation, and from where did changes originate? Because Operation Desert Storm pitted the USAF directly against the Republican Guard, it is important to describe these opposing forces.

The Adversaries

On 3 August 1990, the Iraqi armed forces conducted an overwhelming combined arms assault on Kuwait. Iraqi ground units penetrated deep into Kuwait, reaching Kuwait City in less than five hours. The Kuwaiti armed forces collapsed, the government fled to Saudi Arabia, and the country was completely overrun within two days.

The Iraqi units that conducted the assault were divisions of Iraq's Republican Guard Forces Command. The ground attack was spearheaded by Iraq's most capable combat formations: the Hammurabi and Medinah Armored Divisions and the Tawakalna Mechanized Infantry Division. Three heliborne brigades of the RGFC Special Forces division supported the armored onslaught with a vertical envelopment south of Kuwait City. Behind the lead divisions, four Republican Guard infantry divisions were committed to mop up remaining Kuwaiti resistance.[33]

The Republican Guard

The Republican Guard's utility as a military force is evident in its origins, equipment, functions, and doctrine. The RGFC began as a brigade-sized praetorian guard formed shortly after Saddam Hussein's 1968 coup. The unit was formed by combining the most loyal Baathists serving in the Iraqi Army and was sustained by recruits from Saddam Hussein's hometown of Tikrit.[34] Although not used in the September 1980 invasion of Iran, the Republican Guard was committed to the bloody battle for Khorramshahr in October and thereafter saw intermittent action as a "fire brigade" along the southern front.[35] By 1986 the Republican Guard had expanded to five brigades, the bulk of which were committed to an ill-fated counterattack on the Al-Faw peninsula.[36] This Iraqi defeat has been convincingly described as the turning point of the Iran-Iraq War, the catalyst for a shift from the static defensive strategy to an offensive strategy that would ultimately end the war.[37] Guard recruiting was expanded to include previously deferred university students, and guard formations soon grew to 25 brigades.[38] These units were extensively trained in offensive combined arms tactics, signifying a major departure from the static-defensive mind-set gripping the rest of the Iraqi Army. Committed to a series of well-planned, set-piece offensives from April to August of 1988, these Republican Guard formations quickly swept away depleted Iranian formations, helping to bring decision to long-stalemated battlefields and a brief peace to the northern Persian Gulf.

The Republican Guard formations were equipped with Iraq's best and most modern equipment. While regular heavy divisions were primarily equipped with obsolescent T-55, type 59, and T-62 tanks, guard heavy divisions were equipped with the "well-known and very capable" T-72.[39] Reflecting their offensive and mobile orientation, RGFC heavy divisions were equipped with modern Soviet built self-propelled artillery in addition to towed weapons that equipped the remainder of the Iraqi Army. Air defense artillery units assigned to guard divisions were more robust than regular army units, as some operated radar-guided SA-6 batteries in addition to the

normal infrared-guided surface-to-air missiles (SAM) and antiaircraft artillery (AAA) systems.[40] Additionally, the RGFC maintained an independent supply system and enjoyed priority for all supplies.[41]

Western impressions of the Republican Guard were shaped by its offensive role in 1988, its elevated reputation, and robust tables of organization and equipment. Rightly acknowledged as Iraq's best troops, many writers have found it easy to overestimate the abilities of the Republican Guard. Analogies have been made in US military writings between the RGFC and Napoleon's Old Guard, or Hitler's politico-military elite, the Waffen SS. Oft-touted as an elite force hardened by years of battle, proud of the "fire brigade" role, "possessing excellent reactive abilities," and "the world's most seasoned [troops] in carrying out assaults preceded by chemical attack," guard formations gained a fearsome reputation.[42] Indeed, when compared to the armed forces of Iraq's neighbors, the Republican Guard was the most powerful military organization in the Persian Gulf region.

An evaluation of the Republican Guard must be balanced by an examination of Iraqi military doctrine, which reveals major shortcomings. Despite the guard's offensive successes of 1988 and 1990, some important limitations have been illuminated by several authors. Republican Guard tactical successes were largely set-piece affairs, hinging on extensive planning, logistics stockpiling, and rehearsals. After 1987 all guard offensives were conducted against vastly weaker forces: Iranian formations encountered in 1988 were debilitated by the failed Karbala offensives of 1987 and collapsing civilian morale.[43] Kuwaiti armed forces were taken by surprise in 1990, only one brigade of which opposed the RGFC as the bulk of the Kuwaiti forces were overrun in garrison. Republican Guard tactical doctrine was probably strongly shaped by (if not identical to) regular army tactical doctrine. The only significant tank battle the Iraqis fought was a static defense against a grossly mishandled Iranian armored division in January 1981. The Iranian division blundered into an Iraqi antitank kill zone piecemeal (over the period of three days) and was obliterated.[44] An excellent analysis by Col Wallace Franz, USA, Retired, further emphasized the likelihood of a

static Iraqi strategy because the army had been molded by its eight years of fighting a "war of position, tied to fortifications, communications nets, against a low-tech enemy." Iraqi officers were inexperienced at handling large mechanized formations in mobile operations and would be unable to "think rapidly" or "improvise in the heat of battle" due to Iraqi political preferences for loyalty over independent thought or initiative.[45]

Despite doctrinal shortcomings, the Republican Guard was the most potent and best equipped units in the Iraqi Army, marking them as an important operational center of gravity (COG) in the campaign to liberate Kuwait. As the offensive arm of the Iraqi Army and the most potent military force in the region, the Republican Guard was also a strategic COG, a powerful military instrument of coercion or decision. The Republican Guard also played an important political role. Guard units were the most overt element of the Baath Party's control over the country. The superior equipment operated by the Republican Guard units ensured that they would be well equipped to defeat potentially rebellious regular army units. An RGFC mechanized division was stationed in Baghdad throughout the Gulf War, a visible and powerful deterrent to potential mutineers. Additionally, four RGFC infantry divisions, not committed to the KTO, were formed during the war to provide internal security.[46] Guard units were believed to have been involved in the suppression of dissent before the Gulf War, and surviving elements were reported to have participated in the suppression of the Shia and Kurdish revolts after the war. Top US military commanders, Gen Colin L. Powell and Gen H. Norman Schwarzkopf correctly perceived the Republican Guard as operational and strategic COGs, forming perceptions that profoundly affected US planning.

Although there were seven Republican Guard divisions deployed in the KTO, the three guard heavy divisions that spearheaded the Kuwait invasion captured the interest of the theater commander in chief (CINC). These three divisions were emplaced along the Kuwait-Iraq border as a theater reserve. The remaining four divisions were infantry formations entrenched in an east-west line between the heavy units and the Euphrates River.

The guard divisions used the five-month lull between the invasion of Kuwait and the coalition counteroffensive to prepare vast defensive positions. The units were widely dispersed and deeply entrenched. Engineers prepared thousands of horseshoe-shaped berms to protect individual vehicles. Personnel were protected by shallow five- to 10-man bunkers.[47] Units were stocked with up to 30 days of provisions, and the Guard Corps straddled a huge fortified corps-sized depot and logistics area.[48]

Iraqi intentions for the use of the RGFC were unclear to coalition commanders. Once the threat of an invasion of Saudi Arabia subsided, it was widely believed the Republican Guard divisions would be held in reserve and then committed to repulse coalition ground units depleted by battles with the first and second Iraqi echelons.[49] This mission—counterattack—would be similar to much of the guard's experience in the Iran-Iraq War; heavy air attack, however, would be a new experience for a force that had always enjoyed air superiority.

The United States Air Force

The USAF waged an intense air-to-ground battle against the Republican Guard for 43 days; its ability to conduct this battle was shaped by prewar doctrine, training, and equipment. Doctrine provided the basis for many USAF weapons system acquisitions and, within the context of the European NATO-Warsaw Pact scenario, shaped Air Force tactics throughout the 1980s.

"The [US] Air Force has articulated aerospace doctrine at different levels and depths of detail in the forms of basic, operational, and tactical doctrine."[50] Basic USAF doctrine, as established in Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force,* anticipated the attack on the Republican Guard in the broadest sense. Air operations to "attack the enemy in depth" were considered an "imperative of effectively employing aerospace forces" by the authors of the 1984 version of AFM 1-1.[51] More explicitly, air commanders were urged to exploit airpower's "devastating firepower" to disrupt enemy momentum and "place his surface forces at risk" with attacks on enemy forces in "reserve or rear

echelons."[52] Such attacks fell under the category of air interdiction (AI), which was intended to "delay, disrupt, divert, or destroy an enemy's military potential before it [could] be brought to bear broadly against friendly forces."[53] Although attacks on distant ground units have always been a subset of interdiction, they are considered to be best accomplished along lines of communication (LOC) when ground units are moving and vulnerable to air attack.[54]

Official operational-level doctrine was completely unsuitable for preparing USAF units for the attack on the Republican Guard because it focused entirely on enemy LOC. Prescribing attacks to disrupt the flow of "personnel, supplies, and equipment . . . required to sustain the enemy's war effort," AFM 2-1, *Tactical Air Operations—Counter Air, Close Air Support, and Air Interdiction,* was written in 1969 and reflected contemporary interdiction efforts being used in Southeast Asia.[55] Elusive enemy forces were not considered to be a suitable target for interdiction. Instead, interdiction efforts were directed against LOC, enemy concentration points, supply stockpiles, and reconstitution facilities.[56] AFM 2-1 described the protracted interdiction battle waged over the Ho Chi Minh Trail. After Vietnam, however, the possibility of a rapid Soviet blitzkrieg across Western Europe threatened to render this mode of interdiction less than optimal.

Semiofficial operational doctrine developed in the early 1980s had a much more profound effect in shaping the Air Force that would counter the Republican Guard in 1991. Developed in response to political requirements for increased conventional capability against growing Warsaw Pact conventional capability, the USAF's Tactical Air Command (TAC) and the Army's Training and Doctrine Command (TRADOC) developed the joint operational concept of joint attack of the second echelon (J-SAK). Published in 1982, J-SAK was an important adjunct to the US Army's AirLand Battle doctrine. J-SAK was semiofficial doctrine because its approving official, Gen W. L. Creech, TAC commander, could not speak for the entire USAF, nor was TAC a war-fighting command: Its role was to provide forces for the theater commanders in chief. TAC Pamphlet 50-26 (J-SAK) described a deep battle against second echelon units that was intended

to provide time and space for ground commanders to win the close battle being waged with the first echelon.

J-SAK was designed against the specific threat of echeloned attack posed by Soviet tactical doctrine. Echeloned attacks would "attempt to retain the initiative by maintaining momentum and rapidly exploiting the success of . . . first echelon forces."[57] Although TAC Pamphlet 50-26 briefly noted the possibility of countering a US-type reserve force vice a Soviet-style second echelon, virtually all other discussion focuses on defeating the Soviet model. Key elements of the Soviet doctrine included a fast-paced attack by a numerically superior enemy, continuous operations to sustain initiative and momentum, and the reinforcement of success until the enemy is defeated.[58] Second echelon targets included "combat forces, their support elements, as well as lines of communication."[59]

Follow-on forces attack (FOFA) was a similar doctrine approved by the North Atlantic Treaty Organization (NATO) Defense Planning Committee in November 1984.[60] Beginning in late 1979, the Supreme Headquarters Allied Powers Europe (SHAPE) staff developed FOFA to bolster the alliance's conventional capability against Soviet offensive doctrine and a "continuing massive Soviet conventional forces build-up."[61] Closely related to J-SAK, FOFA was more authoritative and prescriptive, but geographically limited to NATO's theater of operations. FOFA was designed to attack enemy forces "from just behind the troops in contact to as far into the enemy's rear as our target acquisition and conventional weapons systems will permit."[62]

The aim of J-SAK and FOFA (hereafter combined and referred to as deep air attack) was to delay, disrupt, or destroy second echelon mechanized units. This operational concept optimized airpower's ability to impose an "intractable dilemma" on the enemy commander: if the second echelon attempted to advance rapidly (as Soviet doctrine prescribed), it would be vulnerable to air attack. If advancing forces took defensive precautions against the air threat (through dispersal and camouflage), they would be unable to maintain a rapid rate of movement.[63] Maximizing the advantages of synchronized air and ground efforts, deep air attack principles resonated with many airmen.

Despite J-SAK's authoritative limitation and FOFA's geographical limitation, the combination of the two had a powerful impact on USAF equipment and tactics. Based in part on emerging weapon and sensor technologies, deep air attack generated the requirement to develop several weapons systems that would eventually be used against the Republican Guard. The most pressing need was to develop sensors capable of looking deep behind enemy lines and detecting advancing second echelon forces. Joint surveillance target attack radar system (JSTARS) was the USA/USAF solution; its powerful radar was capable of tracking moving vehicles over wide areas of the battlefield or examining selected fixed sites in a narrower mapping mode.[64] Another capable radar, advanced synthetic aperture radar system (ASARS) II, was fielded on the TR-1 aircraft, and dedicated downlink and command and control systems were deployed to take advantage of the real-time imagery available.[65]

The USAF and the USA fielded several air-to-ground delivery systems that enabled deep air attack, including the F-15E long-range interdiction aircraft, F-16C fighter-bombers equipped with radar capable of tracking moving vehicles, and night navigation and targeting systems—low-altitude navigation targeting and infrared for night (LANTIRN). Advanced antiarmor weapons developed and deployed during the 1980s included the imaging infrared (IIR) AGM-65D Maverick missile, an advanced cluster bomb—the CBU-87 combined effects munition (CEM), and an air scattered antitank and anti-personnel mine—the CBU-89 Gator. Army systems included the multiple launcher rocket system (MLRS), Army tactical missile system (ATACMS), and Apache attack helicopter.

Employment of these weapons systems is described in USAF tactical doctrine.[66] Tactical doctrine outlines a broad range of tactical considerations in the three-series multi-command manuals (MCM). There are separate volumes for each type of combat aircraft, a general planning volume, and an enemy threat volume.[67] Standardized volume outlines and chapter headings result in the consideration of a wide variety of potential missions. Tactical considerations described in these volumes are not prescriptive but are intended to "stimulate thinking."[68] MCM manuals "consolidate tactical

considerations learned from past armed conflicts, operational evaluations, training exercises, tactics development programs, and analyses of the threat."[69] Updated on a 24-month cycle, MCM 3-1, *Tactical Doctrine: Tactical Employment—F-16,* is a living document reflecting tactical thoughts of the combat air forces. Each volume encourages "personal initiative and innovative thinking . . . to improve our combat capability" and challenges "all echelons of the combat air forces" to "build and expand on these tactics."[70]

MCM 3-1 discusses the best available thoughts on a variety of potential missions. Its scope, however, is too wide to guide Air Force training and preparations; finite training resources and time limitations force tactical units to make choices and establish training priorities within 3-1's repertoire. Although headquarters staffs determine minimum semiannual training events for combat crews, the real tactical emphasis is determined within a flying squadron by the combined efforts of the commander, operations officer, flight commanders, and weapons officer. Normally following general guidance provided by the squadron commander, flight leaders conceive hypothetical scenarios, determine tactics, and evaluate performance during routine training missions. Although Pacific-based squadrons had a Korean orientation, most other TAC and United States Air Forces Europe (USAFE) squadrons were focused on the European scenario and prepared for it throughout the 1980s. All but one of the USAF wings that participated in Operation Desert Storm had formal tasking for the European theater in the event of war.[71]

The bulk of TAC's tactical training was geared towards executing deep air attack in the European environment. The Air Force's premier training program, Red Flag, emphasized deep interdiction in large gorilla formations to counter high-threat environment.[72] The exception was USAF CAS training, for A-10 wings, which concentrated attention on high-threat, low-altitude employment along the front lines to support an Army pressured by large enemy mechanized units. Many crews were exposed to flying in Europe during overseas assignments or frequent training deployments to European bases (Checkered Flag deployments). TAC's only fighter wing free from European tasking, the 363d Tactical Fighter Wing

(TFW), shared the remainder of TAC's tactical vision. Wing training focused on low-altitude deep attacks against a Soviet mechanized thrust into north Iran.[73] Virtually all air-to-ground training throughout the tactical air forces (TAF) involved low-level navigation and weapons deliveries, which were required for survival on the high-threat battlefields of central Europe, and for target acquisition which could be impaired by low European ceilings.[74]

Despite its Eurocentric orientation, the USAF's philosophy guiding weapons acquisition and training built in considerable flexibility. Most of the USAF's air-to-ground weapons systems were designed to perform several missions in a variety of environments (high- or low-altitude attack, in day or night). The swing-role F-15E and F-16 are prime examples. They were well equipped with highly capable radars capable of functioning in air-to-air or air-to-ground modes, and the latest air-to-air and air-to-ground munitions, and comprised most of CENTAF's fighter force. CENTAF's B-52 bombers had proven their flexibility long before Desert Storm. Specialized fighter aircraft were present in more limited numbers. The F-111 was optimized for night low-altitude interdiction, and the A-10 was designed for day low-level CAS. Both, however, proved versatile enough to operate in unanticipated environments. The major exception was the F-117 stealth fighter: with its highly specialized role of night precision penetration and limited bomb load had limited utility in other missions. USAF munitions were another key to flexibility. Radar fuses permitted all-altitude employment of cluster bombs, while guidance kits of US laser-guided bombs permitted a wide range of delivery options.[75] Flexible USAF weapons and munitions characteristics were of major significance because they allowed a considerable margin for error in tactical doctrine or practices.

Realistic and demanding training allowed USAF crews to accomplish unanticipated tasks in unexpected situations. Day-to-day training of aircrews emphasized tactical employment in realistic scenarios developed by flight leaders. Frequent multiunit exercises and composite force training with dissimilar aircraft (such as that done at Red Flag) built familiarity with other systems and enabled crews to solve

different tactical problems. Nellis Air Force Base (AFB), Nevada, home of the Tactical Fighter Weapons Center (TFWC), played a key role in the training of these combat aircrews. Red Flag is a recurring training exercise conducted at Nellis AFB to expose crews to the most realistic combat environment possible; it provides an opportunity to solve difficult tactical problems in a controlled environment. Adversaries for Red Flag exercises were often provided by the Aggressor Squadrons, two specialized units that simulated Soviet tactics. The Fighter Weapons School (FWS), also located at Nellis, is a graduate-level tactics school that cultivates aggressive problem solving in a select group of USAF crews. FWS students are required to solve a wide variety of demanding tactical problems throughout the course. Once back in their squadrons, FWS graduates (called patch wearers or target arms due to the distinctive patches awarded at graduation) provide a foundation of tactical know-how and problem solving within the unit. The thinking, teaching, and flying conducted at this center would have a powerful influence on USAF conduct in the Gulf War.

Both forces were products of their times and experiences: the Iraqi Army was a product of the static war of attrition with Iran, US forces were products of the cold war. Neither had tactical doctrines that adequately anticipated the Gulf War. USAF training, flexible weapons systems, and a core belief that "flexibility is the key to airpower" provided a sizable margin for errors in USAF doctrine.

The Plan
3 August 1990–15 January 1991

> *I want the Republican Guard bombed the very first day, and I want them bombed every day after that. They're the heart and soul of this army and therefore they will pay the price.*
>
> —Gen H. Norman Schwarzkopf

The plan against the Republican Guard was the product of several organizations that included elements of attrition, interdiction, and psychological operations (PSYOP). Three groups

planned air operations involving the Republican Guard. The Air Staff's Checkmate branch provided support to planners in the theater. CENTAF's special planning group (commonly called the Black Hole) concentrated on offensive operations to eject Iraqi forces from Kuwait, while CENTAF's Combat Plans staff made defensive preparations to stop an Iraqi invasion of Saudi Arabia. The initial Air Force plan, developed by Col John A. Warden's III Checkmate staff, concentrated on strategic targets deep in Iraq in an attempt to coerce the Iraqis from Kuwait.[76] Upon receiving the plan, Chairman of the Joint Chiefs of Staff Powell insisted that the USAF include operations against Iraqi armored units, demanding "smoking tanks as kilometer fence posts all the way to Baghdad."[77] Days later the theater CINC, General Schwarzkopf, identified the Republican Guard as an Iraqi COG and directed the air planners to incorporate operations against them in a four-phased theater air campaign plan.[78] Operations against the Republican Guard were concentrated in the third phase (attacks on the Iraqi Army) that would follow strategic air efforts (phase I) and a short operation to secure air superiority over Kuwait (phase II). Phase IV, a ground attack into Iraq and Kuwait, would hinge on the satisfactory completion of phase III.

In the early stages of planning, there was no explicit statement of phase III objectives. This void resulted in confusion and varying expectations of what phase III would accomplish. Draft briefing slides from late August list the objectives as: "reduce Iraqi ground force capability, soften ground forces to assure successful penetration and exploitation . . . destroy Republican Guard capability to reinforce into Kuwait."[79] Two months later, the objective of phase III was listed in briefings to the Joint Chiefs of Staff and president as simply "attrit [*sic*] enemy ground forces."[80] The following month on 14 November, phase III was briefed by General Schwarzkopf to his senior commanders as "battlefield preparation."[81] The groups that planned the phase III operations appear to have focused their thoughts on rendering the Republican Guard "combat ineffective" through attacks on several systems (infrastructure, logistics, C^2) and direct attrition of maneuver units.[82] Encouraging calculations regarding airpower's potential to attrite the Iraqi Army led

some planners to adopt "destroy" the Republican Guard as a goal of phase III.[83] This goal appears to have been overly ambitious and did not serve airpower in the long run because other positive aspects of airpower's effects on ground forces were eclipsed.

Air Staff planners developed early plans to destroy the entire Iraqi Army in the KTO. Analysts studied the Iraqi Army and planned to exploit the vulnerabilities of an army arrayed in the desert. Operations would begin with attacks against key systems that would affect all Iraqi forces in the theater (command and control, logistics, air defense), continue with attrition of the Republican Guard, then shift to the rest of the Iraqi Army. Much of the planning was quantitative in nature, using computer models and spreadsheets.[84] The Checkmate calculations considered multiple quantitative and qualitative factors. Quantifications included munitions available in the theater, aircraft numbers, sortie rates, target types, objectives, and expected success per sortie (based on Saber Selector, an advanced computer program modeling weapons deliveries). The product of these calculations was a graph that predicted an impressive and rapid attrition of the Iraqi forces in the KTO when subjected to concentrated air attacks. These calculations reportedly led Checkmate to conclude that the attack on the Iraqi Army could negate the 15,000+ anticipated US casualties of a ground war, particularly if the requirement for the ground war could be obviated by air action.[85]

Maj Roy Y. Sikes, a Checkmate analyst, considered the probability of Iraqi adaptation to an air attack and devised means to minimize the effects of Iraqi countermeasures. He emphasized concentration and massive attacks on specific ground units until the desired level of destruction was achieved (estimated to be between 20 percent and 40 percent of full strength). Under continuous attack and constant scrutiny from airborne forward air controllers (FAC), units would be unable to survive long enough to benefit from a learning curve. Air attacks would then rapidly shift to another unit, destroying it in turn. Coalition learning opportunities could be maximized through the FAC, who would become familiar with an area and ground units in that area until the objectives were achieved. Major Sikes was in frequent contact

with planners in the theater, and he suggested the desirability to concentrate effort against units in turn, noting some success as other individuals in the planning effort began to advocate similar positions.

Maj Mark "Buck" Rogers, a key Black Hole planner, shared some of Sikes's concepts. In November Major Rogers and Brig Gen Buster C. Glosson, chief of the Special Plans Group, fleshed out a concept of operations for attacking the Iraqi Army.[86] Their plan called for attacks on Iraqi air defenses, field headquarters, mechanized units and artillery, and logistics infrastructure. The Republican Guard units held a prominent place in their plans. Although C^2 attacks were designed to minimize Iraqi ability to react to air or ground attack, Iraqi reactions were anticipated. Continuous presence by FACs would be needed to identify targets as Iraqi units began to "thin and displace."[87] FACs would maintain "continuity" over designated sectors, maximizing coalition learning by "precluding [attacks on] previously destroyed targets," and compensating for anticipated intelligence limitations against transitory targets.[88] Rogers also advocated maintaining continuity between USAF combat wings and specific Iraqi ground units to boost effectiveness. USAF wings would enhance their learning by gaining experience with the terrain, unit layout, and capitalize on awareness of previous wing progress through attacks on the same division for an extended period.

CENTAF planners in Riyadh, led by Glosson, eagerly used the Checkmate analyses. Glosson adjusted some of the assumptions reducing, for example, the probability of locating targets from the recommended value of 95 percent to 75 percent.[89] He also adjusted the figures for increased aircraft availability as forces flowed into the theater. The USAF's quantitative analysis led to the adoption of a subobjective that quickly captured the attention of the CINC, ground commanders, air commanders, and their staffs. The Air Force agreed to destroy at least 50 percent of the Iraqi Army's tanks and artillery. This prospect was so riveting it nearly became the only goal of concern in the minds of some. Several possible attrition figures had been discussed during the planning.[90] General Glosson and the United States Central Command

(CENTCOM) planner, Lt Col Joe Purvis, agreed on 50 percent as an average point a ground unit could be considered combat ineffective.[91] Although the projections changed frequently, Glosson briefed the CENTAF wing commanders on 18 December that the Republican Guard would require 600 sorties per day for four days to reach the 50 percent goal, and that 90 percent could be achieved in nine days.[92] This figure represented an unprecedented operational task for an air force, and the USAF's progress towards it would be subjected to close scrutiny from many quarters during and after Desert Storm.

Even though the Air Force's planning was detailed and well thought out, the numerical calculations of complex operations are heavily dependent on many assumptions. These initial assumptions are delicate and can be quickly altered by the fog and friction of war.[93] Unexpected and unanticipated events are unavoidable in war and their cumulative effects can have significant impact on the most scientific calculations.[94] In spite of its fragility, the quantitative approach to war has an almost irresistible appeal. With a number to strive for, the goal assumes a crystal clarity. The innate uncertainty of war, however, inhibits the planner's ability to know if and when such seemingly clear goals have in fact been obtained.

CENTAF's Combat Plans staff led by Lt Col Samuel J. Baptiste simultaneously developed a plan to counter an Iraqi thrust into Saudi Arabia.[95] Emphasizing continuous CAS and interdiction, the D day plan was built on the assumption that outnumbered coalition forces would be under heavy ground attack requiring substantial amounts of CAS to survive.[96] The D day plan also had some characteristics of deep air attack, including interdiction of the Iraqi second echelon. Kill boxes (based on a Saudi grid system) were established along likely axes of Iraqi advance to direct coalition sorties against the Iraqi Army.[97] These boxes were eventually extended to cover the entire KTO and would exercise a significant influence over the entire course of the battle with the Iraqi Army.[98]

The plans merged when the CENTAF Combat Plans staff and the Black Hole were combined in a December staff reorganization. General Glosson assumed responsibility for all CENTAF planning functions, leading a group called the

guidance apportionment and targeting (GAT) cell. Colonel Baptiste assumed responsibility for planning against the KTO, while the former Black Hole staff planned operations in Iraq. At this late stage of the planning process, several key ideas posed by Checkmate and the Black Hole (concentration, sequential attacks on ground units, and FACs) appear to have faded away.

Glosson was also given operational control of all CENTAF fighter wings in December. A command reorganization established separate air divisions to control electronic warfare, command and control, and reconnaissance assets (15th Air Division, commanded by Brig Gen Glenn A. Proffitt II) and fighters (14th Air Division, commanded by General Glosson) to match the air division controlling SAC assets (16th Air Division, commanded by Brig Gen Patrick Caruana).[99] By assuming planning and command responsibilities, Glosson would play a pivotal role in the subsequent conduct of the campaign.

Republican Guard attacks were supported by operations against the LOCs into the KTO. These operations were identified by all three planning groups and were seen as a means to affect the entire Iraqi Army. Destruction of the bridges across the Euphrates appeared to be an ideal means of restricting the army's logistics flow. The Euphrates bridges were doubly significant, however, as their destruction could block an army withdrawal from the KTO. For a counterlogistics effort to succeed, the considerable supply depots south of the Euphrates would also have to be neutralized, and B-52 raids were identified as an ideal means of reducing Iraqi stockpiles. Historically, counterlogistics operations conducted by air have been most effective if synchronized with ground action to cause increased consumption of supplies. Large Iraqi unit-level stockpiles would be problematic, requiring considerable effort to destroy. Iraq's defensive doctrine posed additional problems because static units consume fewer supplies.

In addition to direct attack and interdiction, the plan against the Iraqi Army included a significant moral dimension. Psychological operations were integrated in the plans early when CENTCOM PSYOPs experts established liaisons with

CENTAF's planners.[100] General Schwarzkopf appears to have taken an early interest in PSYOPs and displayed a constant interest in using B-52s against the Republican Guard, even though the B-52 was a poor system for destroying dispersed and entrenched armored formations.[101] Leaflets, B-52 strikes, and around-the-clock operations were intended to break down the Iraqi Army's morale.

Republican Guard corps and division headquarters figured prominently in coalition air plans. As part of a broader counter-C^2 effort, planners anticipated that the attacks on headquarters would reduce Iraqi capability to react. CENTAF attempted to capitalize on the potential weaknesses of Iraq's highly centralized command structure by attacking key communications and leadership nodes. Communications with units in the field would be restricted (if not severed), hindering Iraqi control.

As the execution date for Desert Storm approached, the nature of the plans against the Republican Guard shifted as they solidified. The separate phases of the air campaign blended together, as targets from all phases were included in the first three days' air tasking orders (ATO) at the same time. General Schwarzkopf, for example, demanded the Republican Guard be hit on the very first day. Small F-16 and B-52 raids against the RGFC were therefore blended into the master attack plan for the first day of the campaign.[102] This gradual effort negated the potential advantages of Checkmate's concentrated operations, which gave the Iraqis a chance to adjust to early attacks before the main effort could shift to the KTO. A gradual approach also sacrificed potential psychological benefits by gradually conditioning the Iraqi Army to air attack.[103] Two other concepts, the use of airborne FACs throughout the KTO, and the matching up of wings to ground units appear to have fallen by the wayside.[104] The friction inherent in pushing a complex plan through a large diverse organization consumed some of its more significant features.

The counterlogistics, psychological, and countercommand operations were important elements of the attack on the Republican Guard divisions, but were even harder to evaluate than the attrition operation. Because there was little

opportunity to monitor progress and scrutinize impacts, these efforts received considerably less attention and generated far less controversy than the highly contentious attrition effort. CENTCOM virtually guaranteed a conflict over the attrition figures when it made the initiation of the ground war contingent on the accomplishment of 50 percent attrition, and gave the responsibility for determining the level of destruction to the ground components.

Clash of Arms
17–26 January 1991

Take apart the Republican Guard. Break their will! Keep your eye on the target.

—Lt Gen Charles A. Horner

No plan of operations extends with certainty beyond the first encounter with the enemy's main strength. Only the layman sees in the course of a campaign a consistent execution of a preconceived and highly detailed original concept pursued consistently to the end.

—Helmuth von Moltke

The air offensive began on the night of 17 January with attacks that struck across the depth and breadth of Iraq and Kuwait. The main weight of effort was initially aimed at disabling Iraq's integrated air defenses, weakening its national command and control, and eliminating its Scud missile force. CENTAF missions struck the Republican Guard within the first 24 hours and would continue for the next 43 days. Small F-16 and B-52 raids struck at Republican Guard field headquarters the first day; follow-up missions over the next two days attacked other preplanned RGFC targets. With the physical and intellectual energies of the air campaign focused deep inside Iraq, the Iraqi Army felt only slight pressure from the air. Air strikes (minus A-10 sorties which were concentrated on the border) hovered at approximately 100 sorties per day against all Iraqi ground units until 23 January.[105] During the first six days of the air campaign (17 to 23 January) approximately 92 F-16, 39 B-52, and six F-18

strikes hit the Republican Guard. On the 23d, strikes against all ground forces increased to 200–300 per day, indicating a shift of effort to the KTO.[106] At the end of the tenth day (26 January), cumulative counts of Republican Guard strikes had jumped to 569 F-16, 89 B-52, 48 F-15E, and 22 F-18 strikes.[107] Even with an emphasis on the KTO, daily sortie counts fell well short of the 600 missions called for in prewar plans.

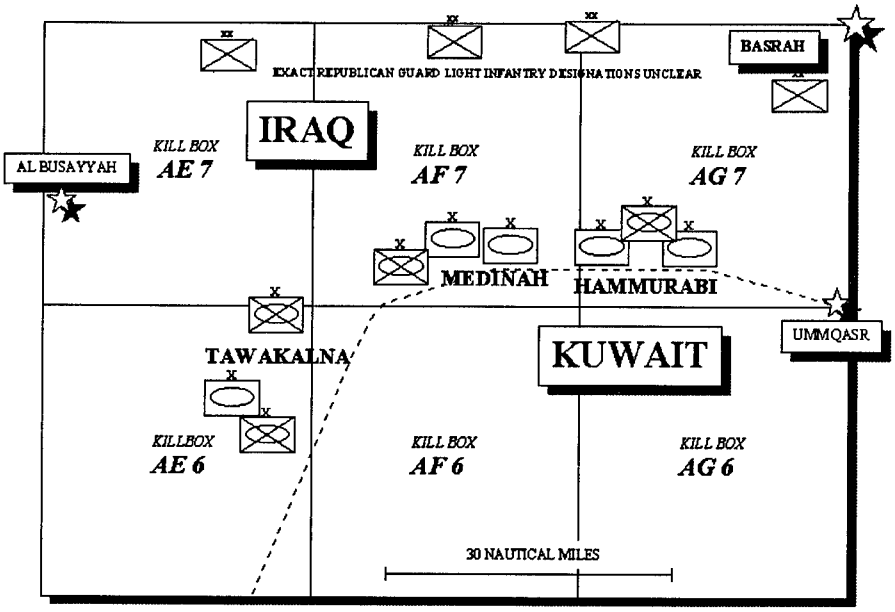


Figure 1. Republican Guard Dispositions in CENTAF Kill Boxes

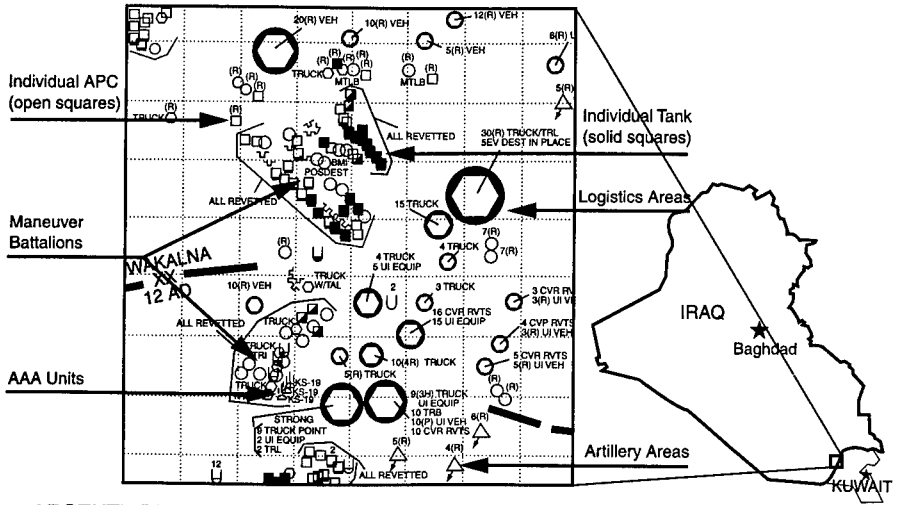
After 19 January KTO targeting became more decentralized. Instead of assigning specific point targets and designating desired mean point of impact (DMPI)—specific aim points, CENTAF sent missions against large, area targets (e.g., an armored battalion) that contained hundreds of discrete DMPIs often spread over a square mile or more. Some strikes received even less guidance, sent against generic target categories (e.g., armor) within specified kill boxes that covered 900 square miles. Targeting shifted to decentralized methods because the GAT cell and flying wings did not have the detailed targeting materials typically used for controlling and planning attacks

against fixed targets. USAF crews preparing for missions against fixed facilities (airfields, bridges, and other permanent structures) used numerous planning aids including precise target graphics and overhead imagery. Target photos are critical to mission success for visual weapons deliveries, as they compensate for navigational or imprecise target coordinates by improving chances of accurate target acquisition. Nonvisual deliveries also benefit from precise target graphics to identify desired aim points. Without accurate target acquisition, mission success is jeopardized. Only a few, critical KTO targets such as corps headquarters were identified, photographed, and targeted before the war. Precision graphics were unavailable for the bulk of the Iraqi Army, perhaps because the potential mobility of a ground unit was assumed to render precision graphics irrelevant.

Little information was available at the unit level to plan these missions, and pilots had difficulty identifying desired ground units within the immense target arrays sprawling across the KTO. Target information was seldom more than a set of coordinates indicating the position of a battalion-sized ground unit wedged among countless other identical units, any of which could be mistaken for the desired target.[108] Target intelligence personnel were unable to obtain imagery of the Iraqi positions from CENTAF intelligence because headquarters was overwhelmed trying to sort out the concurrent strategic, counterair, and anti-Scud operations. Wing target intelligence staffs ("targeteers") were intensely frustrated because they were unable to provide sorely needed target materials to the crews attacking the Iraqi Army.[109] Missions were launched to attack specific battalions with little more than approximate locations of the parent divisions.

Materials that would have enhanced CENTAF's ability to plan, direct, and attack the Iraqi Army were present in the theater but largely unknown to Air Force personnel. The Army Intelligence Agency (AIA) had been studying the Iraqi Army's dispositions in the theater continuously since the August invasion. Analysts in Washington mapped out Iraqi positions in great detail and provided Army units in the theater with detailed templates of each Iraqi division.[110] The theater joint imagery production complex (JIPC) integrated AIA's templates

and current imagery from RF-4s and U-2s onto 1–50,000 or 1–12,500 scale maps, producing up to 400 copies daily, with the assistance of the 30th Engineer Battalion, for distribution to US Army Central Command (ARCENT) "corps, division and brigade commanders and staffs."[111] These products plotted Iraqi positions down to the level of individual tanks and were so accurate that ground combatants remarked after the ground war that they were able to predict enemy contact and open fire based on the information from the charts.[112] These materials had the potential to help CENTAF orientation and targeting dramatically. Although the JIPC was "designed to support CENTAF," ARCENT became its primary customer.[113] General Horner later remarked that ARCENT "overloaded" the entire intelligence system with so many requests that the joint force air component commander (JFACC) "couldn't get [his] foot in the door . . . [and] just said, 'to he-- with it.'"[114] It is ironic that ARCENT monopolized these products for picking potential targets while CENTAF went without as it tried to find and attack many of those targets.[115]



ARCENT's Division Templates would have allowed CENTAF to better orient on the RGFC

Source: Brig Gen Robert H. Scales, USA, *Certain Victory: The US Army in the Gulf War* (Washington, D.C.: Government Printing Office, 1993), 378.

Figure 2. Section of Tawakalna Division Template

The lack of target materials severely retarded Air Force unit learning curves against the Republican Guard. Each crew member formed individual perceptions of the battlefield, based on what each had observed.[116] Within combat wings, there were hundreds of disjointed impressions of the battlefield, and crews had a difficult time blending these images into a coherent picture without a common framework to provide orientation. Little meaningful target information could be shared within the wing without a common reference. The nature of air war demands some means of maintaining continuity with the enemy. Each crew glimpses the enemy for only a few minutes each mission and then returns to base. Without a common reference, there is little potential for learning within a wing or squadron. This slowed the learning process because crews could not update a common image of the battlefield, and aircrews had to build a picture from scratch every mission. The problem was even more pronounced when wings attempted to communicate with other organizations.[117]

B-52 bombers and F-16 fighters conducted the bulk of the initial attacks on the Republican Guard in the KTO. Bombers conducted attacks from high altitude using radar aiming. Without a visual weapons delivery capability, the bombers needed precise coordinates to attack the guard units. The CENTAF target database, however, had few Republican Guard targets listed, and those listed were mostly division or brigades that were deployed over many miles. Without detailed target materials available, the GAT cell's bomber planner, Capt Steven Hawkins, developed an innovative targeting technique during Desert Shield. A chance conversation with a U-2 pilot revealed the U-2's ASARS II radar to be capable of determining accurate coordinates of ground units located by radar.[118] The U-2 radar was subsequently used throughout the war to locate army units in the KTO and provide coordinates to the bomber planner in Riyadh, which he then relayed to bombers en route to the theater.[119] Although this innovation gave the B-52s accurate coordinates in near real time, it masked another significant problem. The B-52s were attacking from high altitude and encountered system accuracy problems that had not been noted in training due to

the B-52's previous low-altitude focus.[120] Because target coordinates were being passed as the bomber was en route, few knew the exact desired points of impact; therefore, poststrike analysis was slow to detect accuracy problems.

Fighter formations of four-to-eight fighters also attacked the Republican Guard from high altitude. High-altitude tactics had been considered a relic of the Vietnam era by the majority of Air Force aviators and had been largely discarded after the mid-1970s. Survival and target acquisition in a European scenario appeared to require low flying, and training throughout the 1980s had a clear low-altitude focus. High-altitude training often met with resistance. The common attitude was that low flying is more demanding; if one can fly low, he can fly high. Although this may be so, a general lack of high-altitude experience masked some significant problems unique to high-altitude operations that would appear during Desert Storm.[121]

The renaissance of high-altitude tactics was an innovation generated at the unit level during Desert Shield. Individual units gradually shifted from low- to high-altitude tactics during the months before Desert Storm. Most wings began Desert Shield with the belief that low flying would be required to survive against the Iraqis. One wing commander attributed this to a widespread overestimation of the Iraqis' capabilities.[122] Observation of the desert environment and increased understanding of the Iraqi threat hinted at the need for change.[123] As familiarity with the desert increased, groups within the combat wings began to question the wisdom of low-altitude tactics.[124] A series of low-altitude training accidents (resulting in six fatalities) during Desert Shield precipitated a 1,000-foot (ft) minimum altitude restriction from CENTAF. Low-altitude advocates railed against the restriction, arguing that training should be conducted as low as 100 ft (most USAF crews were trained to fly as low as 300 ft).[125] The accidents gave many units an opportunity to reappraise their tactics and led to a gradual (but uneven) shift to high-altitude operations.[126]

This adaptation to the anticipated conditions of war took place before the outbreak of hostilities and was the result of considerable internal debate (and in some units, strife).[127] The

change, being bottom-up, was an uneven one. Observation opportunities were limited; there were no Iraqis available to test high-altitude propositions. Some units tested ideas by conducting simulated high-altitude attacks against friendly airfields and were encouraged because observers on the ground found it nearly impossible to acquire the raiders visually, even when attack times and directions were known beforehand.[128] The USAF units most reluctant to transition to high altitude were the night interdiction wings equipped with F-111s, F-15Es, and B-52s. These units saw low-altitude night operations as their forte, and their mental orientation was an obstacle to innovation. The low-flying ethos was so powerful in these wings that all flew some missions at low altitude the first days of the war. European units (British, French, and Italians) were similarly oriented and worse off in the sense that their aircraft were purpose-built for low-altitude operations. The Tornado and Jaguar weapons delivery systems were ill suited for high-altitude attacks.[129] Once the shooting began, feedback (observation and orientation) was instantaneous and all quickly and universally abandoned their low-altitude orientation.[130]

A primary reason for the uneven shift to high altitude is that CENTAF refused to dictate tactics, leaving those decisions to the tacticians and commanders at the unit level. It is likely that Generals Horner and Glosson shared the views of other Vietnam War aviators—that Vietnam was "a war of fatal oversupervision."[131] When General Glosson was queried by a pilot whether he could use low-altitude tactics during Desert Storm, his reply was "you can if that's what the wing decides to do. The mission commanders and smart captains should be the ones deciding tactics, not higher headquarters."[132]

Generals Horner and Glosson preached a philosophy that had a major influence on the command's tactical conduct of the war. The commanders' philosophy that "there's no target worth dying for" influenced the attitudes of the crews who fought the war and the commanders who led them into battle.[133] As long as there was no ground war taking place, many missions could avoid high-threat environments and wait for more advantageous circumstances. This is an advantage of

a cumulative strategy, where discrete actions are not contingent on other actions.[134]

USAF electronic superiority allowed air supremacy to be quickly achieved above 10,000 ft, but the numerous Iraqi AAA pieces and shoulder-launched SAMs denied low-risk operations at lower altitudes. USAF and US Navy (USN) jammers, antiradiation missiles, and the USAF's direct attack of critical Iraqi air defense nodes collapsed the Iraqi integrated air defense system (IADS) in the first days of the war, providing coalition airpower with a high-altitude sanctuary. Thousands of Iraqi AAA units firing autonomously could not be countered systematically and were best avoided by remaining at higher altitudes.

Although high-altitude operations entailed lower risk, they caused a variety of unanticipated problems. The most serious problems stemmed from the lack of high-altitude weapons delivery experience. High-altitude attacks revealed procedural and hardware shortcomings. Fighter units used visual deliveries that might have been appropriate for low-altitude attacks but held very poor prospects of success from high altitude.[135] Lack of familiarity with high-altitude weapons delivery characteristics led to misconceptions and mistakes. Hardware and software problems revealed poor high-altitude wind modeling. Wind modeling, critical to "dumb" bomb accuracy, attempts to predict winds at lower altitudes that will affect the weapons impact point. Limitations of wind models resulted in impacts well short of the target during B-52 and F-16 attacks.[136] Difficulties were encountered by the A-10. Its most fearsome weapon—the 30-millimeter (mm) cannon—had to be fired at more than double its normal slant range and suffered in accuracy and effectiveness.[137] Increased distance from fighter to target resulted from high-altitude ingress and egress, leading to reduced effectiveness in target acquisition, attack assessment, weapons effects, and weapons accuracy.

The problems of high-altitude tactics experienced by the F-16 units were quickly aggravated by CENTAF headquarters munitions decisions. A prewar weapons conference deprived F-16 units of guided antiarmor munitions and a wartime decision deprived them of their best unguided antiarmor weapon. Checkmate plans assumed all Maverick missile

(AGM-65) qualified units would fire these guided antiarmor weapons against Iraqi tanks, but these tank-killing weapons had been shifted to the A-10 wing during Desert Shield. The decision made at a wing weapons officer conference in Riyadh resulted in the transfer of the theater's Mavericks to the A-10 wing, capitalizing on A-10 expertise with Mavericks. The F-16 squadrons, on the other hand, could capitalize on their system's compatibility with a superior antiarmor cluster bomb, the CBU-87 CEM. Large lethal patterns of submunitions generated by these area weapons minimized high-altitude accuracy problems. CBU-87's radar (ground proximity) fuse allowed it to be used at all altitudes. High-consumption rates of CBU-87 during the first two weeks alarmed planners in Riyadh, and General Horner ordered CENTAF's best unguided antiarmor munition be saved for the ground war.[138] This decision was prudent if CENTAF believed it would have to provide a great deal of close air support, because many of CBU-87s features also made it CENTAF's best unguided CAS weapon. The tradeoff, however, was that the conservation of CENTAF's best unguided antiarmor weapon might increase the necessity for CAS.

F-16 squadrons then began to prosecute their attacks against the guards with suboptimal munitions for tank killing. Mk-20 Rockeye, an older antiarmor cluster bomb, was not well suited for high-altitude attack because its timer fuse led to erratic, unpredictable trajectories, which was not a problem at low altitude. Other cluster munitions, CBU-52, 58, and 72, armed with fragmentation munitions were ineffective against armor. Iron bombs (Mk-82 500 pounders and Mk-84 2,000 pounders) became the F-16's primary weapon. These munitions required a direct hit to kill a revetted tank, which was highly improbable from high altitude. The diminished accuracy of high-altitude tactics was aggravated by suboptimal munitions. The detrimental impact of this decision was not apparent because there was very little feedback on the state of operations against the RGFC formations. CENTAF headquarters knew little more than numbers of strikes flown.[139] Wings, therefore, received no feedback from higher headquarters, and wing impressions were formed by the highly individual (and

often inaccurate) impressions of the aircrews returning from strikes.

Successful orientation (and therefore adaptation) requires knowledge of the enemy state and actions in addition to knowledge of one's own condition and actions. CENTAF commanders were unable to perceive accurately the state of the Republican Guard. Observation of the Republican Guard formations was hindered by poor weather and the United States's highly centralized intelligence collection system.[140] Frequent cloud cover (the worst on record for the region) masked the Iraqi Army from overhead photography throughout the first week.[141]

When imagery began to flow, the intelligence system was overwhelmed by the target array, number of attack missions, and decentralized targeting. The massive size of the target array within the KTO (Iraqi positions covered more than 3,000 square miles) and the number of potential aim points (tens of thousands) were well beyond CENTAF intelligence's ability to observe, analyze, and synthesize. Large target systems were impossible to scrutinize because the entire theater intelligence system was built around and dependent on the imagery of a few centrally controlled surveillance systems. The intelligence system established in peacetime had never been exercised to the level required by Desert Storm and lacked the resources to adapt.[142]

In the absence of direct knowledge of the enemy condition, bomb damage assessment (BDA) was expected to provide insight by assessing effects of air attack on the enemy forces. CENTAF headquarters personnel attempted to synthesize the reports from each mission and apply the sum to the last estimated condition of the target system. This could help estimate the enemy condition and progress of the campaign for the commander. Two problems were quickly revealed with the BDA system. First, the system was overwhelmed by the number of BDA reports generated by CENTAF wings. Second, quality of the wing's reports was uneven; many reports did not quantify results into tank or unit kills.[143] Quantifiable results were hard to estimate, particularly when attack results were observed from high altitude.

Additional problems external to CENTAF arose in Desert Storm because the CINC gave ARCENT and the US Marine Corps, Central Command (MARCENT) responsibility to determine the condition of enemy ground formations in their areas. The rationale was that "if the ground campaign's initiation was to be determined by a point when air attacks had reduced Iraqi armor and artillery by 50 percent, then ARCENT should make that determination since the Army was to conduct the main attack."[144] A lack of common BDA guidelines led to interservice tensions and disagreements over the results of coalition air attacks. ARCENT, whose area of responsibility contained the Republican Guard, developed an independent means of reporting and processing BDA: ground liaison officers (GLO) reviewed mission results and reported through Army channels to ARCENT intelligence (G-2) for independent BDA processing.[145]

Although BDA was important to help headquarters orient on the battlefield, BDA in the form of poststrike photography was equally important for weapons delivery assessment at the unit level. Poststrike imagery can aid units in determining exact weapons impact points and helps the unit to judge munitions effectiveness. With poststrike imagery, the unit can accurately adjust weapons or tactics in response.[146] The immense target array combined with the decentralized aim point selection, however, rendered weapons delivery feedback impossible. Combat wings had a nearly impossible time obtaining imagery from overworked CENTAF intelligence. The occasional photos that filtered down to the units were of little use because they were photos of isolated formations that could not be oriented to the larger framework of the battlefield. Furthermore, with decentralized aim point selection and hundreds of strikes flown each day, there was no recognition of previous targets or attack parameters and little information could be gleaned from the materials presented.[147]

CENTAF had little more than a sortie count to measure its efforts against the guards, although this was no valid indication of effectiveness. The obstacles to observation and orientation revealed shortcomings of peacetime doctrine and training: large-scale target arrays were not practiced against,

feedback to the wings was not exercised, and interservice BDA principles were not agreed upon in peacetime. The consequences of air operations without BDA are increased uncertainty and a possible lack of insight into the true nature of the situation which can lead to a lack of adaptation.

Faced with a lack of feedback from intelligence channels, the GAT cell initiated a major innovation by creating a new process to obtain feedback by using cockpit videotapes.[148] Cockpit videotapes were originally collected in Riyadh to facilitate press conferences (General Horner's first press conference prominently featured footage of an F-117 attack on his "counterpart's headquarters"), but tapes of laser-guided bomb (LGB) deliveries were quickly recognized as a potential source of immediate feedback.[149] General Glosson directed wings to forward their videotapes to Riyadh where they were used by the GAT to bypass inoperative intelligence channels.[150] Although gun camera film, the predecessor of video tape recording (VTR) tapes, had been used in previous conflicts at the wing and squadron level by unit photointerpreters, most of those unit capabilities had been eliminated in the 1970s and 1980s in the belief that satellites could do all the collection centrally.[151] GAT planners further modified the process by communicating directly with the Air Staff and Defense Intelligence Agency (DIA), which had more manpower and access to data.[152] Tapes of non-LGB attacks had less ability to provide feedback for BDA purposes, because heads-up display tapes only record weapons aiming, not impacts. They did, however, provide important information to Riyadh as to what the units were doing.

A "flat" organizational structure, multiple formal and informal information channels, and the cockpit videotapes allowed CENTAF headquarters to follow closely the condition and activities of its own forces—an important element of orientation. "Organizational flatness," enabled the accurate flow of information between those doing the fighting and headquarters. Wing commanders and deputy commanders for Operations (DO) were flying combat missions and communicated routinely with Generals Glosson and Horner in Riyadh.[153] A parallel network of communications extended between the unit weapons officers and mission planners to the

planning and operations branches of CENTAF's air operations center. This linkage, via secure phones and fax lines, enabled the majors and captains manning these sections to communicate freely and often, fostering more effective operations by both. Wings used these links to communicate horizontally and coordinate actions.[154] Without a common perception of the KTO battlefield, however, operations against the Iraqi Army could not be well coordinated.

As CENTAF attempted to penetrate the fog of war, the staff and commanders knew they were experiencing major feedback problems but suspected F-16 attacks were less effective than anticipated. General Horner examined poststrike photos of several strategic targets attacked by F-16s and observed many misses.[155] Although feedback was lacking from the KTO, General Horner suspected that F-16s (carrying out most of the attacks against the RGFC) might be encountering difficulties there too. An F-16 pilot himself, Horner tasked an F-16 pilot, Major Rogers, working in the Black Hole to investigate. Rogers examined VTR tapes and observed F-16 units executing attacks with tactics that carried little probability of success. He shared his findings with an informal group of tactics experts in the tactical air control center (TACC) at CENTAF headquarters to help determine possible solutions.

Informal tactics discussions in Riyadh drew on the expertise of many aviators. Senior officers including Maj Gen Thomas Olsen, CENTAF/vice commander (CV), Maj Gen John A. Corder (CENTAF/DO), General Proffitt (15th Air Division/CC) and General Glosson (14th Armored Division/CC) took an active part in finding potential solutions to tactical problems.[156] Numerous contributions came from Black Hole and CENTAF's tactics experts, a group of Fighter Weapons School instructor pilots brought into the TACC from Nellis AFB as the war started. The FWS instructors flew missions with CENTAF wings to gain a firsthand appreciation of the problems experienced by the units. These individuals were able to use their direct knowledge of the battlefield to assist planning and execution from Riyadh. Like the Black Hole personnel, the FWS instructors had numerous personal connections to the wings and capitalized on this connection to find solutions to CENTAF's problems.

Feedback on B-52 activities reinforced the prewar perception that they were not well suited for the destruction of point targets. When photos of the KTO became available, B-52 attacks were clearly distinguished from other attacks, and the results were discouraging. Quarter-mile long strings of bomb craters were observed in the vicinity of ground units, with very few direct hits on the widely dispersed revetments. Dispersed, fortified, and armored Iraqi positions were well suited to minimize physical effects of B-52 "area fire."[157] The psychological value of B-52 attack, however, appears to have been recognized in Riyadh. Leaflets preceded and accompanied B-52 raids in an effort to demoralize Iraqi units, with great effect as Iraqi POW debriefings later indicated.

At this point it is appropriate to address the issue regarding how right USAF doctrines and practices were for the situation at hand. CENTAF's adversary was similarly equipped but employed differently than the opponent around which USAF doctrine was built. The Republican Guard defensive doctrine was quite different from the high-tempo offensive doctrine emphasized by the Soviets. The Iraqis did not present the lucrative target concentrations expected from Soviet rapid movement requirements. Defensive Iraqi doctrine led to immobility, dispersal, and fortification and the battle acquired the characteristics of an air-to-ground siege: a battle for which airpower has not been historically well suited.

The objective was different from that envisioned by deep air attack, reducing effectiveness and hindering measurement. Deep air attack's primary effects were delay and disrupt, with destroy as a tertiary objective. Against a rapidly moving opponent, delay and disruption may be accomplished economically with attacks on key transportation, logistics, and command nodes. Effectiveness can be measured by following the enemy unit's progress across a map and monitoring his mobile communications. In the case of the RGFC attack, delay became irrelevant (with the enemy immobile), disruption became less significant, and destruction became the key criterion of effectiveness. With destruction as the main measure of effectiveness, key nodes faded in importance. Thousands of discrete, hardened, and dispersed targets

gained equal significance, posing incredible targeting and measurement problems to CENTAF.

In spite of the problems posed by the altered objectives of the operation, USAF planning groups developed useful plans that called for attacks on important systems contributing to the RGFC's combat effectiveness. Several valuable ideas that might have facilitated the attrition effort (FACs, mass and concentration, matching wings to ground units) were lost in the friction of planning complex operations.

The combat wings executing the attack did a good job recognizing the opportunity to conduct operations at high altitude with minimal risk (a unit level innovation), although lack of high-altitude weapons delivery experience reduced effectiveness. High-altitude problems were aggravated by munitions choices that took away the F-16's best antiarmor weapons, marginalizing F-16 effectiveness towards the destruction objective.

Feedback and analysis of early attacks on the guard were unavailable, which led to a major innovation: the use of cockpit video tape as a means for planners to obtain feedback. Feedback (a combination of observation and orientation in the OODA context) would be a necessary but not sufficient condition for adaptation. Insights formed after the first 10 days of the war and additional feedback in the form of ARCENT analysis would stimulate considerable adaptations.

CENTAF Adapts
27 January–5 February 1991

> *I think we are making significant improvements in our targeting and execution against the Republican Guard. That's the result of a lot of good suggestions from a lot of people. There are no new ideas, but there's some that we collectively haven't been thinking about. So never hesitate to come forward if you have a suggestion.*
>
> —Lt Gen Charles A. Horner

Between 27 January and 5 February, CENTAF implemented or facilitated the adoption of at least six innovations in the battle with the Republican Guard. These changes, conceived

and implemented within a surprisingly brief 10-day period, adjusted some operations and initiated other new operations that considerably improved USAF's efforts against the RGFC. Several of CENTAF's changes, as indicated by General Horner's comments above, were adaptations of tactics used at some point in the Air Force's experience. Although a previous generation of Air Force aviators may have executed similar tactics, the crews that fought Desert Storm had been schooled in different techniques and had to create these unplanned, unanticipated, and unfamiliar tactics as they went.

The first innovation improved effectiveness against the Republican Guard with A-10 attacks on the Tawakalna Division. General Glosson reversed a decision to concentrate A-10s against the forward echelon by assigning this additional weapons system against the Republican Guard, possibly in response to unfavorable F-16 and B-52 feedback.[158] Use of the A-10, the USAF's prime CAS platform, on deep interdiction constituted a major innovation because it was contrary to the attack-pilot ethos. Deep, high-altitude interdiction by the A-10 had been discussed in some circles, mainly by weapons officers, but ran contrary to accepted practices and culture.[159] Deep interdiction was seen by many as a mission unsuited for the A-10: slow, and heavily armored, the A-10 would be exposed to enemy ground fire for extended periods of time during ingress and egress. If attacked, it would lack the energy and maneuverability required to evade SAMs at high altitude. Close air support was viewed as the A-10 raison d'être, many pilots believed the proper use of their weapon system should entail low-altitude Maverick attacks on enemy positions "while standing on the shoulders of the lead tankers."[160]

Several A-10 missions hit Iraqi radars beyond the border on the first day of the war, and A-10s were used deep over the largely undefended west Iraqi desert in a search for Scuds, but use of the A-10 deep behind the lines in the KTO was unexpected. On 27 February the commanders of the A-10 wings at King Fahd Air Base were told by General Glosson to prepare for attacks against the Tawakalna Division, located more than 50 miles behind Iraqi lines.[161]

Approaching the new tasking with caution, the A-10 mission planners obtained target materials through unofficial contacts and implemented innovative tactics to increase effectiveness and minimize risk. The wing commander insisted on additional target materials "to do this right" and assigned the planning to a pair of weapons officers.[162] Unofficial contacts with a reconnaissance unit allowed the wing to obtain a series of overhead photographs that the planners combined to form a mosaic of the entire division.[163] The GLO was able to obtain a detailed map of the division, markedly increasing mission effectiveness.[164] Concerned with increased risk and uncertainty of attacking deep behind the lines, wing planners scheduled hour-long wing-sized attacks. Eight aircraft formations hit the division in six waves, 10 minutes apart. These large formations maximized A-10 mutual support, simultaneously enhancing shock effect against the Tawakalna Division. The big formations presented some adjustment problems, as they were inconsistent with the A-10 pilot's prior experiences. Accustomed to making many passes over a target (due to the A-10's large payload and loiter time) in smaller and more manageable two-ship formations, some of the attack formations bunched up over the Tawakalna Division, and some flights had to leave the area due to the danger of midair collision.[165]

Three days of wing-sized attacks on the Tawakalna Division appeared to have had a powerful effect. The division offered little further resistance and seemed to have begun digging in deeper.[166] The Iraqis began to dig deep inside their revetments to decrease weapons effects and to use covers to mask the contents of the many revetments. They increased their use of deception tactics, including moving live vehicles to revetments that were scorched by previous kills and use of decoys in others.[167] Active measures included the lighting of fires beside vehicles when fighters were in the area to give the impression that the vehicle had already been attacked.[168]

The A-10 response was to fly lower to improve target acquisition and discrimination. There had been a constant grassroots pressure (frustration) to allow lower attack altitudes to utilize the A-10's superb cannon.[169] Reevaluating the nature of the Iraqi threat (now perceived as manageable)

and the problems with high-altitude attacks, the A-10 wing commanders allowed flights to make a pass as low as 4,500 feet. In addition normal A-10 tactics involving small two-ship elements were reinstated. The two-ship formations allowed more weapons passes and flexibility in the target area. Small formations operating over the battlefield allowed maximum effectiveness of each individual weapons pass. Increased familiarity with the deep interdiction environment and diminished Iraqi defenses led to a reversion back to more familiar operating procedures.

The A-10 attack on the Tawakalna Division is difficult to assess with certainty, but it appears that A-10 deep interdiction was an effective innovation. The tactics were left to the wing planners, who devised a good plan to deal with the uncertainty of a new situation. Personal efforts and connections led to the fortunate acquisition of valuable target planning materials. The wing was able to implement the changed tasking in a timely manner, two days from first tasking to execution. Inexperience with mass formations posed problems, but their use was a prudent measure to cope with uncertainty. Increased firepower allowed the formations to cope with Iraqi air defenses better, and presence of other aircraft helped the pilots to cope psychologically with a new, intimidating environment. Against the Iraqis, the large formations may have had enhanced psychological effects (shock, lowered morale) and cognitive effects (lower ability to react to massed raids), at some cost in terms of sheer physical effect (fewer passes over the target per aircraft). After three days, the perception of a decreased threat environment and familiarity with the new environment permitted a reversion to lower-threat tactical formations (two-ships) in order to maximize the physical effect of every mission.

As the first missions struck the Tawakalna Division, ARCENT estimated the strength of the Republican Guard to be essentially unaffected by the air attacks, catalyzing several other innovations within CENTAF. During the first two weeks of Desert Storm, CENTAF categorized feedback from the KTO as nonexistent.[170] On 29 January General Schwarzkopf voiced frustration with the lack of BDA from attacks on the Republican Guard, exclaiming that vehicles "have to be on

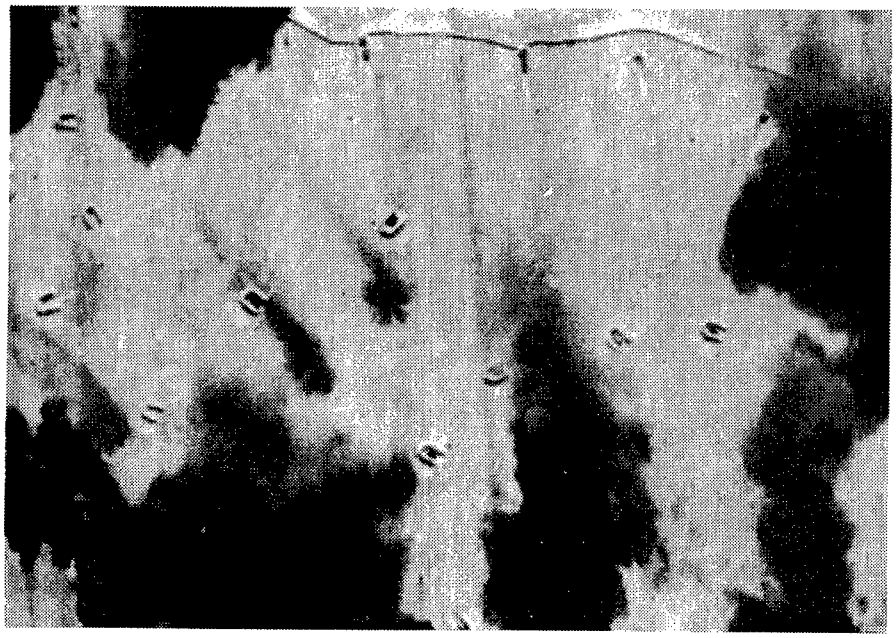
their backs like cockroaches for J-2 to assess a kill."[171] ARCENT commander, Lt Gen John Yeosock responded two days later with an assessment that the Republican Guard were at 99 percent of full strength.[172] Such poor results indicated the requirement for CENTAF to initiate considerable adaptation.

This ARCENT assessment was met with incredulity at CENTAF headquarters. Particularly since the air effort on 29–30 January contained the heaviest attacks on the Republican Guard of the entire war (458 and 408 air strikes hit the RGFC those two days).[173]

In an effort to improve its myopic view of the battlefield, CENTAF headquarters ordered A-10s to reconnoiter the Tawakalna Division to verify levels of destruction. Conventional reconnaissance (RF-4 photos) of the Tawakalna Division resulted in inconclusive findings, and the commanders in Riyadh decided to conduct close-in visual observation.[174] The substitution of this attack aircraft for purpose-built observation systems constituted a major innovation. The A-10's slow speed, armor, and survivability qualified it best to perform this mission. At great risk, two flights of A-10s visually inspected the Tawakalna Division from 2,000 ft on 1 February.

The pilots estimated the Tawakalna Division's strength at 50 percent or less; but more significantly, extensive Iraqi countermeasures to coalition bombing became apparent to the low-flying pilots. The pilots noted roughly half of the revetments were filled with targets and the rest with "old farm equipment, plywood decoys, old pickups, and barrels of oil."[175] From higher altitudes the decoys were indistinguishable from the live targets. Reflecting these findings, the A-10 wing commanders reported that "we're looking in the revetments from four to six thousand feet. It's nearly impossible to tell what's in them. . . . Our general impression is that we're hitting revetments that may or not be lucrative."[176]

Iraqi deception tactics represented a major obstacle to the coalition air effort. Camouflage and decoys denied any certainty that air strikes would hit valid targets. With live and false targets indistinguishable from altitude and only 50



Source: Col Owen E. Jensen, "Information Warfare: Principles of Third-Wave War," *Airpower Journal* 8, no. 4 (Winter 1994): 40.

Figure 3. Numerous Revetments Confounded CENTAF Targeting

percent of the revetments with valid targets, the potential existed for half of CENTAF's blows to be deflected. If air attention could be further drawn away from live targets by giving them the appearance of destroyed targets (e.g., blackening with oil), the probabilities become even worse. Iraqi movement between revetments compounded the coalition problem because "frequent movement compounds the enemy's problem of targeting in the absence of continuous observation."[177]

The problems posed by Iraqi countermeasures were not uniformly perceived throughout CENTAF. Units using nonvisual deliveries had little awareness of a decoy problem. Pilots performing visual attacks from high altitudes were aware of their inability to determine live from dead targets, but probably underestimated the Iraqi decoy effort. The following excerpts are from an F-16 pilot's war journal, illuminating the problems with target discrimination.

> 1-31-91: Hit the Hammurabis with rockeyes—no emotional satisfaction from the ride . . . pick whatever target looks least scorched.
>
> 2-16-91: The second sortie and . . . the 3rd sortie were hunt around and blow up whatever you happen to see. It's tough to discern what's worthwhile from 15–20[000 feet].
>
> 2-18-91: It's tough finding a place to bomb that looks like it hasn't been hit yet. God help the Kuwaitis, that place is a ravaged wasteland. We describe where our targets are from blown up things and bomb marks and craters.[178]

It is unlikely Riyadh appreciated the extent of the Iraqi deception effort.[179] Postwar comments of an Army officer assigned to CENTAF's battlefield coordination element indicate a complete lack of awareness of the deception problem: "We faced totally exposed target arrays that didn't move. *The Iraqi forces made few attempts to camouflage themselves or deceive us.*" (Emphasis added)[180] CENTAF headquarters was aware of a target acquisition problem, but saw it on a larger scale: CENTAF was concerned that Iraqi battalions and brigades were moving around the battlefield. At one point CENTAF was misled by a few reports to believe (briefly) that the entire Tawakalna Division had slipped away.[181] With the benefit of somewhat clearer hindsight, it appears that the Iraqi Army remained relatively static throughout the campaign.[182] Misled by the fog of war and false and misleading reports, CENTAF headquarters overestimated the magnitude of the problem of large unit movements and underestimated the magnitude of the target discrimination problems.

The general underappreciation of the deception problem appears to have inhibited innovations to deny its effects (orientation on the problem is a necessary condition for successful adaptation). Those most familiar with the Iraqi deception efforts were the A-10s pilots. To counter Iraqi deception, the wing commanders offered the following suggestion. "We're hurting him but feel we could be doing it better through mass and concentration of effort. . . . We feel we need to pick the most lucrative areas at least one day in advance from all sources of intel (imagery immensely improves effectiveness—reference A-10 SEAD results); preplan

concentrated, multiple aircraft raids against those areas; strike until those two or three are sanitized with the most penetrating weapons available and then move on. In summary: Pick it. Pound it. If it doesn't explode move on. . . ."[183] CENTAF, however, seemed either unaware of the scale of effort required to sanitize an area, or it was unable or unwilling to achieve the concentration required. Preplanned and well-supported wing-size attacks were not repeated after the initial assault on the Tawakalna Division, nor were additional planning materials made available to increase effectiveness. Although several areas received heavier attention than others, most days saw airpower spread throughout the KTO.

Several groups appear to have been pushing for increased concentration of air effort against the Republican Guard. General Schwarzkopf wanted CENTAF to break one division to serve as an example to the rest.[184] General Horner's comments repeatedly return to concentrating efforts on the guard.[185] The A-10 message called for concentration to counter Iraqi deception tactics, but the required concentration did not materialize. This may have been the innovation that did not happen.

One possible explanation is that CENTAF attempts to concentrate were unsuccessful due to the numerous competing demands on airpower. Horner continually stressed the importance of destroying the RGFC: "Do not lose focus on the Republican Guard. Everything else is secondary other than the defense of Saudi Arabia."[186] The command's best day against the guard was 29 January, in which the RGFC received 76 percent of the strikes within the KTO, but still amounted to only 50 percent of the coalition's total strikes for the day.[187] The RGFC received less than half of the strikes in the KTO for 39 of Desert Storm's 43 days. From a theaterwide perspective, the Republican Guard received less than one in six of the coalition's 41, 309 air strikes.[188] Strategic, counterair, interdiction, and Scud target sets required a certain level of "maintenance sorties" that may constitute part of theater airpower's "overhead." Demands for CAS from the corps commanders continuously pulled the A-10s from preplanned interdiction targets. Even the CINC confounded concentration efforts by frequently specifying RGFC divisions

as the "target of the day," impeding efforts at persistence by switching divisions each day.[189] Although the 600 sorties per day used by the planners may have seemed possible, the friction of war as manifested in the competing demands for airpower put this figure out of reach.

The bulk of the strikes against the Republican Guard were carried out by CENTAF's F-16 force, and the perception of poor effectiveness troubled both the commanders in Riyadh and the pilots in the wings.[190] Tacticians and commanders at both levels perceived problems and worked on solutions. Concerned with the F-16's poor accuracy from high altitude, General Glosson instructed F-16 units to bomb from lower altitudes.[191] This order had an uneven effect. Wings still had the Glosson/Horner "there's no target worth dying for" philosophy in mind, and released altitudes were largely left to the discretion of individual flight leaders. This highly subjective determination concerned some members of Glosson's staff who believed directives were not being followed after reviewing videotapes. Although this raises the issue of enforcing directed changes, Riyadh in almost all cases deferred final decisions on tactics to the wings.

Another means of achieving better results from the F-16 was developed in Riyadh. Nellis AFB tactics expert, Col Clyde "Joe Bob" Phillips devised a plan to capitalize on the F-16's capacity for fast, short turnarounds on the ground to increase daily sorties by creating an F-16 forward operating location (FOL).[192] Glosson ordered his largest "day-only" F-16 wing,[193] the 363d TFW(P), to deploy support elements and conduct operations from the Saudi airfield at King Khalid Military City (KKMC).[194] A-10s had been operating from KKMC located only 60 miles from the Iraqi border. F-16s operating there were able to exchange their drop-tanks for extra ordnance: KKMC-based missions carried four Mk-84 2,000-pound bombs (double the normal load of two). FOL operations allowed the wing to fly more sorties per day; KKMC missions launched from the 363d main base in Abu Dhabi to bomb the KTO; landed and rearmed at KKMC for a second sortie to the KTO (which did not require refueling); landed and rearmed at KKMC for a third mission and after attacking the KTO, air refueled to return to Abu Dhabi.

Colonel Phillips saw an opportunity to improve performance by using the same pilots on the KKMC missions to build familiarity with the terrain, mission, and timing.[195] An increase in effectiveness was anticipated. This effort, however, met with little success. CENTAF's ATO production section typically scheduled individual KKMC missions against two or three different targets per day. Furthermore, 363d wing planners do not appear to have received any guidance to use the same crews.[196] One aspect of this innovation was not realized, due in part to the friction of forcing ideas through an organization at war.

Although FOL operations were a minor innovation, the implementation of the concept required considerable effort. A-10s were already operating from KKMC, but work areas, quarters, and F-16 specific logistics, support, and ordnance had to be arranged prior to initiating FOL operations.[197] The concept was implemented with startling speed; the wing implemented a full-scale operation in four days. [198] Chief KTO planner, Colonel Baptiste planned for a gradual spin-up in sorties but was overruled. General Glosson and the 363d TFW (P) commander, Col Raymond Hout, decided to schedule the wing to launch 24 sorties from KKMC the first two days, but then generate a full 48 sorties after 5 February.[199] KKMC missions became "the cornerstone of the [363d] schedule, accounting for over 40% of [the wing's] combat sorties."[200] Although the wing was putting more bombs on target, effectiveness from a BDA standpoint was not improved because ARCENT refused to accept F-16 pilot reports, causing a conflict between ARCENT and CENTAF described later.

F-16 pilots perceived the requirement to increase targeting effectiveness against the Republican Guard. Within the 388th TFW (P), pilots saw poor weather and target identification as obstacles to increased effectiveness because each flight did not have a sufficient amount of time scheduled by Riyadh to allow them to locate and attack their assigned target.[201] 388th TFW (P) mission planners discussed and tried a new tactic (with their wing DO's approval) to improve target acquisition. The wing internally reallocated their time-over-target (TOT) windows, launching one flight before the rest to reconnoiter each of the wing's targets. The lead four-ship formation

reported back target status and weather conditions to the four trailing flights which were able to use a reduced spacing of only two minutes. The advance target and weather information allowed the following flights to locate and attack their targets quickly.[202] Subsequently, the wing suggested to Riyadh that "an airborne platform be stationed in the second echelon area to validate Air Tasking Order targets and find new targets if required."[203] This suggestion was well received in Riyadh, where Colonel Phillips's tactics group had been considering the use of F-16s as FACs to control attacks on the Republican Guard and provide BDA.[204] The concept was familiar to senior officers because it was similar to the Fast-FAC missions flown in Southeast Asia two decades earlier. General Horner approved the concept on 3 February and the 388th TFW (P) flew its first killer scout missions the next day.[205] Eight pilots with previous FAC or A-10 experience rotated between the Republican Guard positions and an air-refueling track to maintain a continuous presence over the Iraqi divisions for an eight-hour period.[206] Increased familiarity and continuity with the same area led to increased perceptions and orientation on the Iraqi positions. The pilots were able to note where Iraqi units had shifted overnight and record newly discovered "assembly areas, ammunition storage bunkers, trans-shipment points, artillery, and communications sites."[207] The wing repeated the effort over the next few days, and it was quickly expanded to cover four to six kill boxes simultaneously.[208] One of the 388th TFW (P)'s squadrons, the 4th Tactical Fighter Squadron (TFS), quickly "checked out" (through on-the-job training) all of its pilots, and by the end of the first week it was flying 99 percent of its sorties as killer scouts.[209] This innovation took place at an impressive pace. Once the requirement for the change was identified, CENTAF's senior leadership acted swiftly and demanded much of the pilots who would execute the missions. The success of this rapid change was based on the flexibility of the crews and an active interchange of ideas within the unit to optimize performance.

Although it began as a minor innovation within the unit, it became a major innovation with theaterwide impact as the entire squadron switched to the killer scout mission. The

full-time diversion of one of CENTAF's strike squadrons to forward air control was unanticipated. Although some of the pilots were fortunate enough to have had previous FAC experience, none had anticipated the role and undergone training for it in the F-16. Riyadh added responsibilities to the mission. From the first missions the 4th TFS was directed to collect BDA in addition to strike control, and as the ground war approached, the unit was further tasked to monitor friendly ground units to prevent fratricide on a fast-moving battlefield.

Riyadh believed the killer scouts "increased the effectiveness of the F-16 force . . . three or fourfold."[210] Killer Scouts also improved feedback to CENTAF headquarters. General Glosson noted on 14 February that "F-16 (killer scouts) have more than doubled the F-16 BDA per 24 hours."[211] A more distant appraisal reveals that this innovation clearly alleviated some problems that affected operations in the KTO but not all of them. The scouts definitely minimized large-scale target acquisition for many flights of fighters. When weather affected the theater, the scouts located areas suitable for operations and directed fighters there. This function was particularly important to the heavily armed F-16s flying missions from KKMC; with less loiter time due to light fuel loads, these missions needed to acquire the target quickly. The scouts may have increased BDA flowing to CENTAF, but their BDA did not affect ARCENT (or CENTCOM) figures because the ground components refused to accept F-16 BDA. One critical problem killer scouts did not normally resolve was that of precise target discrimination. The Iraqi deception efforts were not uniformly perceived within the squadron.[212] Although the scouts flew with binoculars and were the pilots most familiar with the KTO, there were limits to what could be discerned, and some Iraqi deception measures were very difficult to penetrate.[213] Even if decoys were detected, many of the killer scouts believed that their primary purpose was to identify lucrative target concentrations, not to provide close control.[214]

CENTAF's frustration and uncertainty with poor feedback and questionable effectiveness led to a major innovation that helped resolve both problems simultaneously. Two groups within the headquarters in Riyadh independently concluded

that the precision of LGBs coupled with the visual feedback provided by videotape could improve progress towards CENTAF's 50 percent attrition goal.[215]

The idea that LGB attacks on the Republican Guard might be practical had two foundations. Laser-guided bombs had been used against tanks during the Vietnam War on several occasions, and at least one member of General Glosson's staff, Lt Col Richard B. H. Lewis, was familiar with their potential.[216] A Desert Shield training exercise, Night Camel, had revealed that armored targets were visible at night when viewed through infrared sensors such as the F-111's Pave Tack laser designator.[217] Supported by these concepts, General Glosson made preparations for LGB attacks on the RGFC. As the GAT planners prepared to introduce F-111s to the KTO, TACC operations personnel led by Generals Olsen and Corder arrived at a similar conclusion regarding LGBs.[218]

The F-111 wing commander, Col Tom Lennon, was reported to have initially resisted the idea.[219] Loitering over the Republican Guard at high altitude ran contrary to the F-111 belief in the low-altitude, single pass, night attack as the key to survival. Lennon appears to have quickly been won over to the idea; he led a limited trial of two LGB-armed aircraft. The crews successfully expended 500-pound GBU-12s on revetted Iraqi positions on 5 February. With positive results from the initial effort, the wing increased its effort to 44 sorties the next night.[220] Quickly labeled tank plinking, LGB attacks were incorporated into the daily ATO, which scheduled roughly 50 F-111 sorties into the KTO per night.[221] The innovation required three days from conception to full-scale implementation illuminates the mental flexibility of commanders for seizing the opportunity and the initiative of crews in working out the tactics without training.

The wing's GLO displayed commendable enthusiasm in assisting the crews prepare for LGB missions. Demonstrating personal initiative and using contacts with ARCENT, he provided targeting information beyond what was available through normal intelligence channels.[222] The GLO's ground unit information increase the wing's orientation on the Republican Guard allowing F-111 crews to find target concentrations quickly. This assistance was a necessary step

for success because the infrared sensor used to designate aim points for LGBs is poorly suited for autonomous search for targets. Exact targeting information, however was beyond the wing's reach, and crews acknowledged many bad targets were likely to have been struck with the good.[223]

Additional weapons systems capable of employing LGBs were quickly incorporated into the effort. Navy A-6Es equipped with laser designators dropped some LGBs in the KTO but were constrained by limited numbers of LGB guidance kits on board the carriers.[224] F-15E Strike Eagles, already dropping CBU-87 and Mk-82 on KTO positions, were also tasked to commence LGB operations once the system was certified to carry the GBU-12 by aerodynamic engineers in the United States.[225] The F-15E wing was extremely limited in the number of LGB attacks it could generate because only a limited number of laser designator pods were available. Deployed almost direct from the factory to the desert, the targeting pod was new to F-15E crews and maintenance personnel. Roughly six to eight targeting pods were available each day, and crews with previous LGB experience (from F-111 or F-4 assignments) flew the first missions.[226]

F-15E crews showed considerable flexibility in developing new tactics and incorporating new hardware.[227] The lack of targeting pods caused the unit to develop imaginative "buddy lasing" tactics. This concept, founded partly on F-4 and F-111 laser tactics, allowed formations of F-15Es to use one designator-equipped aircraft to illuminate targets for itself and for a nonlaser equipped wingman. The problems of coordinating attacks on unplanned aim points at night were unique and considerable. In order to develop these tactics, flight leaders took their best guess as to how to accomplish the attacks and refined the tactics in careful postmission debriefings.[228] In the most successful instances, flights from the squadron were able to attack 16 discrete aim points in a single mission (dropping eight LGBs per aircraft).[229] The rapid tactics development and smooth integration of new technology without additional training reveals an impressive capacity for adaptation by the USAF's well-trained and highly motivated crews. Furthermore, it demonstrates considerable faith on the

part of Air Force leaders in allowing their crews to work out the best tactics in combat.[230]

The effectiveness of the tank plinking missions was difficult to argue with all weapons deliveries clearly recorded on a three-fourth-inch videotape. Literally thousands of targets were seen engulfed in flames as the bombs hit. In some turrets pieces of metal were observed coming from the explosion. However, these dramatic recordings did have limitations, the rapid "blooming" of the infrared (IR) screen that follows the explosion of a bomb can mask the actual point of impact, and it certainly masks the effect on the target.[231] In spite of this potential limitation, the LGB innovation appears to have been one of the most effective changes by CENTAF.

CENTAF persuaded ARCENT and MARCENT to adopt a final innovation by convincing them to accept videotapes of LGB attacks as a source of valid BDA. With this modification of existing procedures, the progress of the air attrition effort began to show dramatic progress.[232] ARCENT J-2 established rules that permitted accounting of LGB kills recorded on videotape (if verified by a ground liaison officer), A-10 kills, and all kills confirmed by imagery.[233] The contribution of all other aircraft reports were disregarded in this process, leading to emotional responses from CENTAF. ARCENT's rules were, in fact, no more than a model: a means to estimate progress. This model, however, was used to judge CENTAF performance, and therefore resulted in "ruffled feathers." Any model has limitations, but if ARCENT had not been persuaded to accept VTR and A-10 BDA, the 50 percent destruction might not have been perceived until D+100.[234]

CENTAF's adaptation to the realities of war reveals an unusually high degree of organizational flexibility. So many changes were implemented quickly, effectively, and simultaneously. These changes reflect favorably on the organization. One is challenged to find a military organization that was able to incorporate so many innovations in a similar 10-day period.

At this point it is possible to make some observations on patterns common to CENTAF's process of adaptation. First, observation and analysis must lead to the perception that

adaptation is desirable. The fog of war, however, impairs one's powers of observation and ability to correctly analyze. For this reason, the most important adaptations by Riyadh were the rapid establishment of alternate sources of information. The additional information provided by cockpit videotapes, informal connections to Washington, A-10 observations, and later, the use of the killer scouts allowed the commanders and staff in Riyadh to perceive battlefield realities more effectively. Feedback from ARCENT (the 99 percent estimate) immediately provided a strong perception that adaptation was required.

With the need to adapt apparent, CENTAF was able to make adjustments to increase effectiveness. Ideas came from a variety of sources, although three sources stand out: the network of junior officers, many Fighter Weapons School graduates, that linked the Black Hole, wing planning cells, and flying squadrons. The second source, a small group of FWS instructors, was brought to the TACC as troubleshooters. These individuals, free from the ATO process, worked on specific issues for the commanders. The third source was CENTAF's senior leaders. The general officers in Riyadh took an energetic and helpful part in working out optimal solutions to perceived problems.[235] General Horner clearly expected his headquarters staff to innovate, and he made this clear to them from the start of the war: "If you have a good idea about tactics or target selection or things of that nature, they are always welcome. . . . [There are] no bad ideas in here. . . . Everybody has experience in one form or another in tactical aviation and we need to talk to one another about it."[236] The flexible mentality and receptivity to new ideas as displayed by Generals Horner and Glosson were necessary for successful generation of new ideas and their aggressive implementation.

Three innovations (FOL operations, killer scouts, and Tank Plinking) reveal a common pattern noted by Fred L. Frostic in *Air Campaign against the Iraqi Army in the Kuwaiti Theater of Operations.*[237] Once innovative concepts were formulated, selected crews conducted a limited trial. If successful, the innovation was included into the next ATO. This pattern was practical for CENTAF because the crews were adequately trained and motivated to be able to handle the changes and because CENTAF commanders trusted their crews and

planners enough to relying on the initiative and ingenuity of those who would carry out the changes. The A-10 case differed only in that the wing committed all of its resources to the first attack on the Tawakalna Division instead of attempting a limited trial. The prudence of this course of action is clearly explained by the uncertainty the A-10 wing faced with this new and unfamiliar tasking.

The speed of these adaptations is surprising. Only two days were required for the A-10, F-16, and F-111 mission changes, and four days were required for the 363d wing to initiate large-scale operations from an FOL. Flexible aircraft and munitions facilitated the process.

There were, however, problems that could not be adequately solved. The first was BDA. The BDA process was broken, and all echelons within CENTAF were painfully aware of that fact. Despite the strong desire to correct the system, certain obstacles could not be overcome. The BDA system was designed to operate from the top-down, with imagery providing hard evidence of target conditions. This architecture was dependent on a very few collection platforms; it was physically impossible for those few systems to supply the volume of information required by the process. Had a bottom-up architecture been used, strike aircraft might have been properly equipped to provide the information (e.g., equipped with strike cameras) and procedures in place to properly use that information.[238] Although Riyadh forced through some elements of bottom-up BDA through cockpit VTR tapes, it was not enough to overcome the bureaucratic inertia existing across several independent organizations. In short BDA was mired in bureaucracy and fundamentally flawed in its peacetime top-down centralized framework. For the process to work, a massive technical solution was required, which still has not occurred as of this writing.

The second problem not adequately solved was that of target acquisition. Aircrews attacking the KTO saw hundreds of indistinct ground units and thousands of hard targets with little certainty regarding which were dead, alive, decoy, or real. Lack of continuity (which might have improved with better target information) led to thousands of individual pictures of the battle. When continuity was established for the daylight

missions through the killer scouts, uneven perceptions of the nature of the problem remained. The Iraqi Army's extensive deception efforts lessened CENTAF's blows, and this was not clearly understood within the command.

Attrition War
6–23 February 1991

We just need to keep up what we're doing. More of the same. The harder we hit them the sooner it's over. I think we have to just stick to that strategy.

—Lt Gen Charles A. Horner

After the tumultuous first week of February, CENTAF began to register positive progress towards the Republican Guard's destruction within the framework established by ARCENT. The innovations adopted at the beginning of the month were fine tuned throughout the middle of the month. As the ground war approached at the end of the month, CENTAF's intellectual and physical energies shifted south to prepare for the final phase of the campaign.

The tank plinking and killer scout missions built confidence among the CENTAF commanders. Videotapes of LGB attacks were proof of positive progress. General Horner jokingly established a nightly quota.[239] When the command reached his 100-tank goal on 11 February, Horner remarked, "I think we have to keep doing what we're doing . . . They seem to be getting very effective in finding and killing targets. It's just a question of time."[240] Although ARCENT BDA rules discounted F-16 results, the killer scouts improved the commander's vision and control of the battlefield. Due to the time spent over the Iraqi positions, the scout pilots had the best perception of the actual condition of the Republican Guard. Generals Glosson and Horner spoke with the killer scout pilots on the telephone, questioning them, and fine-tuning their targeting guidance.[241]

ARCENT briefing slides on 4 February estimated the Tawakalna Division at 59 percent strength, Hammurabi at 95 percent, and the Medinah Division at 99 percent.[242] Reflecting

CENTAF's changes, the figures stood at 48 percent, 92 percent, and 83 percent by 14 February.[243] After a reassessment conducted by DIA analysts in Washington using photographs of the entire division area, Tawakalna's estimated strength rose from 49 percent to 74 percent while that of other divisions decreased slightly to 88 percent and 74 percent.[244] In an attempt to adjust the BDA model to account for the discrepancy, ARCENT G-2 began to count only 33 percent of the A-10 claims and 50 percent of the F-111 LGB claims.[245] ARCENT's rationale for accepting A-10 claims at the exclusion of others reveals a lack of understanding of air operations. A-10 claims were accepted on the basis that they "fly in tandem, loiter longer, and A-10 pilots train in the close air support role."[246] The fact of the matter is that virtually all of CENTAF's aircraft flew in formation, the killer scouts were loitering two to three times longer than the A-10s, and the A-10s were performing interdiction, not CAS. The G-2's readjustment sent shock waves through the theater. Subordinate army echelons were distressed by the changes: "By the middle of February, division intelligence personnel had lost much credibility with the division command group because of recurring inexplicable changes in BDA."[247] CENTAF was understandably unhappy with the altered rules. General Horner had often expressed his frustration with rules established by ARCENT: "If you look at some of the videotapes of the F-111s . . . you're glad you're not one of the 'non-statistics' or one of the 'partially operational tanks' in Kuwait."[248] Members of the CENTAF staff took issue with the change, arguing that the DIA assessment was inaccurate because it was only able to detect catastrophic kills.[249] The CENTAF staff was concerned that the revised rules would cause undue targeting of ground units.

The BDA guidelines imposed by ARCENT G-2 led to dysfunctional behavior. On 12 February General Schwarzkopf proscribed further attacks of Iraqi units already below 50 percent.[250] Because A-10s and LGB missions were the only sorties producing sanctioned BDA, they were assigned priority targets, while other systems were flown against weakened units.

The A-10 wing was subsequently ordered deeper behind Iraqi lines to attack the Medinah Division and suffered two losses in the process. The Medinah Division straddled the Iraq-Kuwait border roughly 70 miles from friendly territory. The Medinah Division was more stoutly protected than most other divisions, and the A-10's first appearance evoked a strong reception.[251] Comfortable with their interdiction mission, the A-10 wing did not deem as necessary the wing-sized attack tactics used against the Tawakalna Division 17 days earlier. Pilots believed the Iraqi air defenses were a "known quantity"; the wing emphasis had been "creeping northward" throughout the month as crews became more comfortable with the environment.[252] As the tide of the wing's efforts reached the Medinah Division 15 February, a two-ship element went down with one pilot killed and the other captured; another aircraft (piloted by the wing commander) suffered major battle damage.[253] When queried about the day's losses, Col David Sawyer's response noted that the losses were due to constantly increasing risk in the wing's tasking and ended with "believe it or not, on the way home I flew over a flight of F-16s working a target approximately 15 miles north of the Saudi border! A-10's over the Republican Guard and F-16s in the southern KTO doesn't compute."[254]

Unfortunately, using the logic of ARCENT's BDA rules, the action did "compute." The A-10s were attempting to achieve the required RGFC 50 percent attrition to ARCENT's satisfaction. Now able to rely on the F-111s and F-15Es, General Horner pulled the A-10s back from the Republican Guard. In order to minimize further losses, he restricted them to the kill boxes adjacent to the Saudi border.[255]

F-111s then assumed the predominant role against the guards. Tallies of destroyed Iraqi tanks climbed steadily, confirmed by what CENTAF regarded as high-quality feedback. After viewing one evening's results, General Horner exclaimed that the F-111 videotapes should be required reading at the Army War College and the A-10 Weapons School.[256] F-16s continued to pound the Republican Guard throughout the day, guided by the 4th TFS killer scouts. The F-16 units pushed their jets, pilots, and support personnel harder as the month progressed, gradually increasing wing

sortie rates.[257] Some of the F-16 focus shifted towards interdicting LOCs, as the F-16 began to perform regular armed reconnaissance missions along roads and rivers, called road recce and river recce. River reconnaissance became an important task because the Iraqis compensated for the destruction of the Euphrates bridges with increased use of ferries, pontoon bridges, and earthen causeways. F-16s patrolled the Euphrates daily, identifying and attacking numerous improvised river crossing sites.[258]

Likewise, the heavy bombers were pushed to targets more suited to area bombing. In spite of the fact that the B-52s were not producing BDA, the CENTAF staff noted a certain ARCENT infatuation for B-52 strikes on ground units.[259] This may have been due to a perception that the bomber attacks were yielding greater psychological than physical effects. ARCENT apparently reduced its demand for B-52 strikes after the G-2 was shown a photograph of an artillery position that had been subjected to a three-ship B-52 attack. The bomb trains had walked directly through the dispersed position but appeared to have destroyed only one gun.[260] B-52s began to attack area targets such as logistics sites, a mission that capitalized on the B-52's large payload. The B-52s also began preparing the breaching sites along the border. Feints were conducted with heavy breaching operations conducted in front of the Egyptian Corps but quickly terminated when they became too successful—Iraqis were observed reinforcing the area in front of the Egyptians.

As the ground war approached, CENTAF's strikes shifted south in order to weaken the first echelon of the Iraqi Army, particularly those units in the vicinity of the breaching sites. CENTAF's intellectual energies were also able to move south. General Horner directed his staff to think about "how . . . to work a difficult close air support operation." Displaying his characteristic appreciation for the knowledge of those around him, he exhorted "nobody owns the bank as far as good ideas or brilliance around here. Think how we're going to work Fire Support Coordination Lines for a tank going 20 miles an hour."[261]

With attrition figures steadily rising, commanders were confident the goals would be reached before the ground war commenced. The attitudes of Generals Horner and

Schwarzkopf indicate the possibility that they considered the job already accomplished because they believed the BDA figures to be so contrived to be irrelevant and gradually gave up chasing the numbers.[262]

CENTAF's efforts against the Republican Guard were subjected to a final audit with the beginning of phase IV, the ground offensive.

Ground War
24–28 February 1991

The way home is through the RGFC.

—Lt Gen Frederick Franks

On 24 February 1991 (G day) the US-led coalition ground forces attacked along a 400-kilometer (km) front. Two powerful US Army Corps, the XVIII and the VII, thrust deeply into the Iraqi Army's west flank as the US Marine Corps (USMC) and Arab forces pushed directly into Kuwait. As ground forces pushed into Iraq, a steady flow of coalition fighters accompanied the leading ground elements providing continuous CAS coverage. The rules changed for the air war; crews were to accept risks they had been able to avoid before. General Glosson instructed his wing commanders that "effective immediately there will be no altitude restrictions or weapons delivery parameters dictated to the flight leads. . . . Flight lead control has always been and will continue to be, the key to the greatness of American airpower."[263] CENTAF crews supporting the coalition ground forces were electrified by this premission message from Riyadh.

> PLEASE PASS THE FOLLOWING MESSAGE TO ALL WING LEADERSHIP AND CREW MEMBERS ASAP:
>
> THE GROUND WAR HAS STARTED. OUR NUMBER ONE JOB IS SUPPORT OF THE GROUND FORCES. CLOSE AIR SUPPORT AND AIR INTERDICTION MISSIONS ARE NOT WEATHER CANCELED BY SOME DECISION MAKER REMOVED FROM THE SCENE. THE TIME HAS COME FOR EVERY FLIGHT LEAD TO MAKE EVERY REASONABLE EFFORT TO ATTACK THE TARGET AND GET HIS FLIGHT BACK HOME. OUR GROUND GUYS ARE DEPENDING ON EVERY SORTIE. FROM NOW ON, IT IS UP TO EVERY AVIATOR TO MAKE IT HAPPEN.[264]

Some ground units used the coalition fighters to locate enemy forces or pin down the next echelon.[265] If close air support was not required the fighters attacked secondary interdiction targets, often under the direction of the killer scouts. Within two days the two US corps had pivoted to the east, poised to smash into the Republican Guard and pocket the Iraqi forces remaining in Kuwait. As the US Army closed with the Republican Guard, the character of the battle had been shaped by CENTAF's month long duel with the Iraqi Army.

As the first troops crossed the Iraqi border, the Republican Guard heavy divisions were estimated by ARCENT to be down to 54 percent (Medinah), 55 percent (Tawakalna) and 77 percent (Hammurabi) strength.[266] CENTAF could have driven the figures lower with more time, but the commanders seemed to place less importance on the 50 percent figure as the ground war approached. Iraqi desertions made it clear that the Iraqi Army was disintegrating. Time for increased attrition was not available as political pressures to launch the ground war overrode military considerations.[267]

The US Army made quick work of the forward Iraqi echelons devastated by coalition air. On 26 February the 2d Armored Cavalry Regiment (ACR) of the VII US Corps met the elements of the Tawakalna Division. Moving east towards Kuwait, the cavalrymen overran Tawakalna observation posts and shortly thereafter encountered elements of the Tawakalna's two southern brigades mixed with remnants of other Iraqi armored units.[268] The southern elements of the Tawakalna Division were encountered in the same positions they had occupied throughout most of the air campaign, while the northern half of the division appears to have displaced west into blocking positions.[269] The ACR's engagement, later named the Battle of 73 Easting, was an intense multibattalion melee that resulted in heavy Iraqi losses at the cost of one US life.[270] The ACR's role subsided when the 1st Infantry Division conducted a passage of lines, pressing its advance into Kuwait, and completing the destruction of the Tawakalna Division's southernmost elements. The northern elements of the Tawakalna Division were subsequently engaged and overrun by the 3d Armored Division and 3d Brigade, 1st Armored Division.

The next day (27 February), the 1st Armored Division engaged the Medinah Division and an infantry brigade, possibly from the Adnan Division. After scattering the infantry, the 1st Armored Division deployed in a linear formation and hammered the Iraqi armored division in a head-on confrontation since called the Battle of Medinah Ridge. The 1st Armored Division claimed more than 300 Iraqi armored vehicles destroyed, marking the death of the Medinah Division.[271]

As the Medinah Division was being destroyed, the 24th Mechanized Infantry Division swept eastwards along the Euphrates racing to seal the Iraqi's escape route at Basrah. Trailing the 1st Armored Division by approximately 25 km, the 24th Mechanized Infantry Division encountered uncoordinated pockets of resistance but not the anticipated major contact with the Republican Guard light infantry divisions. The infantry comprising Iraqi's northernmost echelon, however, fled the battlefield as the Battle of Medinah Ridge was lost. Subsequently the 24th Mechanized Infantry Division was unable to close with those units. Much of these infantry divisions' heavy equipment appeared to have been abandoned

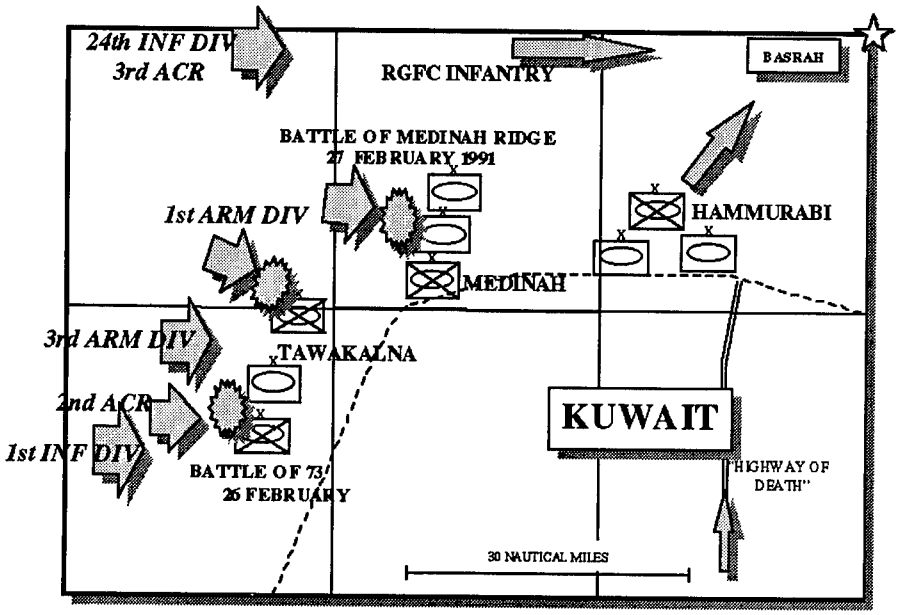


Figure 4. Ground Offensive and RGFC Actions

on the field of battle. The Republican Guard's remaining heavy division, the Hammurabi, appears to have used the Battle of Medinah Ridge as a rearguard action to escape to the northeast in the direction of Basrah.

When the president declared a unilateral cessation of hostilities on the morning of 28 February, elements of the Hammurabi Division, several Republican Guard infantry divisions, and remains of units able to flee from Kuwait were trapped in a small enclave southwest of Basrah. Exit from the Basrah pocket was severely restricted by damage to the bridges and causeway across the Euphrates. A successful defense of the pocket was improbable if the coalition forces chose to attack. A plan was in place to conduct an air assault north of Basrah, sealing any escape routes across the Euphrates. Furthermore, there is no evidence to indicate that the disorganized Iraqi units in the pocket would have fared any better than the rest of the army, particularly without the benefit of prepared defensive positions. An attack into Basrah, however, was not a low risk option for US forces due to the likelihood of costly urban combat.

The Hammurabi Division attempted to flee the Basrah pocket on 2 March by skirting the 24th Mechanized Infantry Division positions to cross the Euphrates at Rumaylah. In the process, however, shots were exchanged with the 24th Mechanized Infantry Division, and in the ensuing Battle of Rumaylah, the 24th Mechanized Infantry Division claimed 187 armored vehicles, 34 guns, 16 rocket launchers, and 400 wheeled vehicles destroyed. US casualties included one soldier wounded and one M-1 destroyed.[272] The Iraqis fled back towards Basrah and were not involved in any more engagements with the coalition. It can be assumed the remnants of the Republican Guard divisions reformed around Basrah and gradually filtered across the Euphrates over the next several weeks.

Major elements of the Republican Guard were destroyed as an effective military force. Remnants may have been lashed together to suppress internal unrest after the war, but the guard was no longer the most intimidating military force in the region.[273] The guard's potential as a strategic instrument of coercion was immeasurably diminished when two of the

Republican Guard's finest divisions were crushed in Desert Storm as the third fled. No longer referred to as Iraq's fearsome battle hardened elite, the guard was seen now as a technologically inferior third world force unable to effectively wage modern war.

Although General Powell would not be able to use "smoking tanks as kilometer posts all the way to Baghdad," he could use them almost all the way to Nasseriyah or Basrah had he wished. As the weeks after the war passed, attention inevitably turned to determining how many of Iraq's tanks were indeed smoking. The Central Intelligence Agency (CIA) analysts used reconnaissance photographs taken of the Basrah pocket days after the war to count the survivors. Photointerpreters counted 842 tanks, 1,412 personnel carriers, and 279 artillery pieces trapped against the Euphrates.[274] How much of Iraq's Army these vehicles represented is difficult to determine, as there is no agreed upon baseline. The CIA credited the Iraqis in the KTO with 2,655 tanks, 2,624 personnel carriers, and 889 artillery. The DIA, however, counted 3,475 tanks, 3,080 armored personnel carriers (APC), and 2,475 artillery in the KTO before the war.[275] If no Iraqi equipment escaped from the Basrah pocket before coalition reconnaissance photographed the remaining hardware, it may be concluded that the coalition destroyed between two-thirds and three-quarters of the tanks in the KTO. Similarly, the coalition may have killed two-thirds of Iraq's artillery or it might have been nine-tenths.[276] With a range of authoritative sources available, many positions are defensible; and few may be disproved. A consensus on how many of Iraq's tanks were killed in Desert Storm appears to be as difficult to establish now as it was in the midst of a war.

Appreciating that most of Iraq's military hardware was destroyed or captured during this famous victory, accusations and recriminations have rebounded between the services as each service sought to stake a claim in the postwar mechanized body count. At least two teams traveled to Kuwait to autopsy destroyed Iraqi tanks and determine the cause of death. Findings, however, were inconclusive for a variety of reasons: some vehicles had experienced multiple killing shots (possibly from land and air attack), many others were never

inspected because an indeterminate number of vehicles had already been removed and because many areas were inaccessible due to transportation limitations and the danger posed by unexploded munitions.

In an effort to use more subjective sources, each service, branch, and weapon system has been able to find an Iraqi prisoner debriefing that suggests that their weapon system, branch, or service was predominant. Each Iraqi's experience was certainly unique, and the coalition's air and land power was not spread homogeneously throughout the theater. It may therefore be possible to suggest that each system had a significant but distinct effect on the enemy, and the sum of these effects is more meaningful than their disaggregation.

CENTAF's precise effect on the Republican Guard cannot be determined, but an examination should consider what facts we know about the RGFC in relation to what was attempted. CENTAF used airpower in concert with CENTCOM psychological operations to break the guard's capability and will. The results were mixed. The bulk of at least two Republican Guard heavy divisions stood and fought VII Corps, unlike most of the non-Republican Guard units which quickly disintegrated at the approach of coalition ground units. Republican Guard units encountered by the XVIII Corps, however, were unable to fight as coherent units, and as noted by the 24th Mechanized Infantry Division commander: "They were shocked, they were horrified. They would attempt to resist, fire back with tank Saggers, small arms, and then mostly surrender."[277]

CENTAF attacked Iraqi LOCs and supply areas to isolate the Iraqi Army from its supplies and to prevent its retreat. The bridge cuts inhibited the Iraqi retreat across the Euphrates.[278] The air interdiction operation did not deprive Republican Guard divisions the supplies required to fight in one day of combat against US ground forces. This task was not the goal nor would it have been possible without forcing the Iraqis to consume their supplies; the Iraqi rounds fired in the Battle of 73 Easting may have well been the rounds carried into battle in August the previous year. Bridge interdiction reduced Iraqi traffic across the Euphrates, but use of ferries and pontoon bridges allowed some reduced amount of supplies across. The

depots south of the Euphrates would have been largely unaffected by the bridge effort, and they were subjected to B-52 attack. The depots, however, were so hardened and vast they were nearly invulnerable to air attack. Gen Barry R. McCaffrey, USA, described one area as the largest concentration of ammunition he had ever seen, spanning an area of 100 km by 80 km, including underground bunkers, hospitals, and command posts.[279] CENTAF planes were able to reduce substantially Iraqi access to their logistics sites by continuous attacks of logistics vehicles. The Iraqis were forced to shift from a large resupply efforts to very low-rate resupply using few vehicles to avoid coalition air attack.[280] This reaction limited Iraqi options.[281] Deprived of a robust logistics capability, the Iraqi forces were unable to wage a prolonged battle or a battle of maneuver.[282] Degraded logistics put the Iraqi Army on a very short tether.

By wreaked havoc on the Iraqi command, control, communications, and intelligence (C^3I) structure the air campaign further denied the Iraqis the option to wage a coherent defense. Coalition air strikes hit fixed Iraqi communications links and intimidated the Iraqis into not switching on their radios for fear they would be detected. Air supremacy completely denied Iraqi airborne reconnaissance.[283] Although the Tawakalna and Medinah divisions appeared to have received the order to defend to the west, the maneuver was executed poorly and units became entangled and confused by air attack.[284] The course of the battle suggests disrupted C^3I had a large impact; US forces generally knew where the Iraqis were but the Iraqis seldom knew where the coalition forces were.[285] A commander at 73 Easting attacking from the west encountered an Iraqi battalion oriented towards the south.[286] One group of Iraqi soldiers at 73 Easting, unaware of the presence of US forces reacted to an artillery barrage as they were under air attack by leaving their fighting vehicles and taking cover.[287] General McCaffrey's arrival in the Euphrates valley was a complete surprise to the Iraqis. One armored battalion commander captured by the division was not aware of the Americans 300 km in the Iraqi rear; when the division artillery shelled an Iraqi airfield, the base responded with AAA, unaware of the American's ground presence.[288] General

McCaffrey labeled the RGFC infantry units divisions only "in theory" and described the Iraqi operational level command and control as "shattered."[289]

At the tactical level, guard armor was no match for US equipment, nor were Iraq's top soldiers a match for the soldiers of the VII or XVIII Corps. Iraqi T-72s were vulnerable to coalition weapons, even many that were not expected to be effective against armor.[290] The American M-1A1, however, proved impervious to most of Iraq's weapons. Advantages in American sights and ballistics computers gave them a decisive edge at long range. At closer ranges individual American initiative and superior training paid off. US soldiers were at a peak when the ground war commenced, having adhered to a heavy training schedule during the air campaign. Iraqi soldiers, normally requiring extensive workup training, were unable to prepare for the ground war under steady air attack. Iraqi soldiers were, instead, trained by weeks of bombing to flee their crew-serviced weapons and seek shelter.

Iraq's respected long-range artillery that survived the air campaign was ineffective. Denied air surveillance by coalition air superiority, Iraqi artillery units lacked any meaningful targeting capability.[291] Intimidated by continuous air presence, the Iraqis never turned on their counterbattery radars.[292] There is evidence that some Iraqi artillery positions may not have been manned as US units approached.[293] Iraqi fires were described as "erratic" and "completely ineffective."[294] The units that were able to fire were dealt with swiftly. US units were able to use counterbattery radars continuously to silence Iraqi fires with powerful rocket barrages. Fixed in place by destruction of their prime movers, Iraqi artillerymen faced a dilemma: stay and die or abandon the equipment and live.[295]

Iraqi weapons systems were diminished by CENTAF attacks. That there was ground fighting, and in some cases very intense fighting suggests that the 50 percent attrition figure was not of primary importance. As Lt Gen Frederick Franks, VII Corps commander remarked, "50 percent didn't mean much to Capt. McMaster" (a company commander at 73 Easting). Airpower's value to the RGFC battle seems to reside in the options it took away from the enemy commander.

Constrained logistics meant he couldn't go far or fight long; damaged C^2 meant he couldn't coordinate his actions; airpower blinded his artillery and pinned his units, setting the Republican Guard for the coup de grâce to be administered by combined air and ground forces during phase IV.

The Keys to Innovation

This analysis has found that USAF preparations in the decade prior to Desert Storm did not adequately predict the tactics needed to operate against the Republican Guard, but CENTAF capitalized on the initiative and flexibility nurtured in Air Force personnel to overcome obstacles to innovation and make timely and effective changes to satisfy theater objectives. USAF operational and tactical doctrines as practiced by Air Force units prior to the Gulf War were not well suited to the task at hand due to their predominantly European orientation. USAF planners correctly identified many of the new conditions CENTAF faced and crafted a promising plan to defeat the Republican Guard. Some significant features of the planners' concept of operations, however, were lost in the transition from war on paper to reality. As the war approached, most of CENTAF's combat wings recognized the need to shift from low-altitude tactics and unevenly shifted to high-altitude operations. When air operations commenced against the Republican Guard, results quickly fell short of expectations. Without hesitation CENTAF initiated six innovations to improve results. Nearly simultaneously CENTAF instituted A-10 deep interdiction and reconnaissance, F-16 FOL operations, killer scouts, tank plinking, and the use of VTR tape as BDA. These innovations increased CENTAF's effectiveness and enabled it to satisfy the theater objectives.

The experience of the Gulf War appears to corroborate Michael Howard's assertion that "whatever doctrine the armed forces are working on now, they have got it wrong."[296] Neither side's doctrine was right: the USAF's air offensive against the Republican Guard looked entirely different than what had been envisioned in deep air attack doctrine. The objective changed from delay and disruption of a rapidly advancing ground force to destruction of a dug-in ground force, a task

enormously harder to achieve and to measure. Likewise, the tactics required in the Persian Gulf looked entirely different than those designed for deep air attack in Europe. Confronted with new realities of the Gulf War environment, CENTAF wings set aside the tactics in which they were trained and generated new ones.

Iraq's static defense was completely unsuited against an opponent who seized the initiative and was able and willing to deliver telling blows in depth. The flaws in Iraq's reliance on ground-based air defenses (which might have been suitable for deflecting most regional air forces) were quickly revealed with the collapse of Iraq's air defense system as the country was laid bare to heavy air attack. Unstoppable air strikes on an army that had enjoyed air superiority in its previous war left it no choice but to disperse and dig in deeper. When that Army attempted to change and seize the initiative at Khafji, unimpeded air attacks drove it back. Iraqi doctrine, in Howard's words, "was too badly wrong." The Iraqi Army was unable to influence the course of events. Deprived of options, it continued to decay under constant pressure from the air. Critically weakened by air attack, the house of cards collapsed when the coalition ground attack kicked in the door.

What sets CENTAF apart from other military organizations is the speed of its adaptation process. Time frames of successful wartime innovations are typically discussed in terms of months and years, CENTAF transformed ideas into reality in days. During the week between 27 January and 6 February, CENTAF changed the entire character of the air battle with the Republican Guard. By streamlining the feedback system (VTR generated BDA) the effects of tank plinking were detected immediately. Likewise, daytime killer scout operations provided another streamlined information conduit to the commander so effects of the changes could be quickly evaluated. These measures allowed CENTAF to realize it had found a winning combination. Constant surveillance of the Iraqi Army reduced its capability to react: killer scouts monitored all Iraqi movements during the day, while JSTARS watched the Iraqis at night. Although the theater time frame for phase III of the campaign was left open-ended, air objectives were essentially fulfilled by the time the ground

preparations were complete by D+38.[297] If CENTAF had not been able to modify significantly its operations, the desired attrition might not have been reached (or perceived) until D+100, adversely impacting the campaign timetable.[298]

CENTAF's innovations resulted in savings of time, material, and manpower in the effort to reduce the Republican Guard to 50 percent strength. With the understanding that perceived progress does not equal actual progress, use of VTR tapes improved perceived progress towards the 50 percent goal. This enhanced feedback certainly saved material and time that would have been expended to satisfy the slower imagery-dependent BDA process. A-10 deep interdiction saved time and resources by applying additional systems against the Republican Guard. The A-10's munitions (Maverick and 30-mm cannon) made the probability of success higher on each sortie. F-16 FOL operations saved time by increasing the daily output of sorties, while the killer scouts made many of these sorties more effective by directing them to the most suitable targets. Tank plinking reduced expenditures of ordnance by increasing the accuracy of each weapon delivered, in addition to conserving the resources required to carry that extra ordnance. The F-111, A-6, and F-15 tank plinkers also saved time by attacking multiple targets with a high chance of success. One tactical adaptation, however, increased time and munitions expenditures. The shift to high-altitude attacks increased time and expenditures in order to conserve manpower. The potential material and political costs of the heavy losses that would have occurred at low altitude are likely to have offset potential savings in other areas. The shift to high altitude appears to have been a prudent decision in spite of increased time and munitions required.

The adaptive process used by CENTAF appears to be well modeled by the OODA loop. All four steps were present in CENTAF's successful adaptations.

- Observation yielding information on the state of enemy forces and actions, friendly forces and actions, and the environment.

- Orientation resulting in the perception that change is desirable (born from either opportunity or necessity).
- Decision incorporating mental and institutional flexibility that promotes the development of new ideas and the resolve to try them.
- Action capitalizing on the organizational and technical abilities to implement the innovation.

Several conditions had a major impact on CENTAF's ability to adapt effectively to the requirements of the war.

Air Superiority. Air superiority created a permissive environment for innovative tactics. CENTAF had near total freedom of action above 10,000 ft in the KTO. This freedom of action gave the combat wings the ability to experiment in as a benign environment as possible in wartime. Nearly everybody came back, allowing discussion and refinement of new tactics. Low losses gave the CENTAF commanders a certain "cognitive freedom of action." Freed from undue concern about losses, CENTAF was able to focus on how to defeat the Republican Guard.

Open-Minded Attitudes of Senior Commanders. This interaction of new ideas and flexible attitudes nurtured the growth of new methods from all quadrants. General Horner admitted to not having all the answers and encouraged his staff to offer suggestions. Headquarters was responsive to the inputs of the wings. Interaction occurred between headquarters and the wings at several levels and the ATO, easily misunderstood as a one-way demand, was described by one Desert Storm wing commander as "a compromise between the wing and the fraggers . . . a negotiated product."[299] The tolerance for new ideas and flexible attitudes of commanders allowed subordinates to contribute to their fullest potential.

Faith in Motivated and Well-Trained Subordinates. This condition of faith in subordinates allowed units to find optimal solutions to complex problems in minimum time. Riyadh devised new roles for several CENTAF wings but never told them how to accomplish them. One wing commander said "Riyadh *never* determined tactics."[300] Wing and squadron commanders had a similar faith in their crews to be able to improvise procedures and integrate new systems without

guidance. Integral to this faith in subordinates were high expectations. One senior Black Hole planner noted that "[Gen] Glosson expected package and mission commanders to exercise tactical initiative, that is, to find their own tankers [when plans were changed at the last minute] or to make major in-flight adjustments."[301]

Personal Initiative. Personal initiative of the aircrews was cultivated on US training and tactics ranges in the classrooms at Nellis AFB and flight briefing rooms across the USAF was the bedrock of the adaptation process. The USAF's continuing commitment to training yielded immense dividends in the Gulf War. The USAF Fighter Weapons School fostered tactical excellence among its graduates, who then carried these exacting standards throughout the Air Force. The realistic, unscripted training conducted at Red Flag provided aircrews with the opportunity to solve complex tactical problems in the face of a live, reacting enemy. The personal initiative of the USAF aircrews was enhanced by their technical aptitudes. Aircrews displayed a striking capacity for integrating and optimizing the use of new systems on the battlefield without guidance.

This study does not suggest that adaptation in war is easy. The obstacles are formidable. If any of the elements of the adaptation process are missing or significantly impaired, adaptation is unlikely. Impaired observation, orientation, and action inhibited CENTAF's adaptation process. Obstacles to observation impaired adaptation by the night low-level interdiction wings and CENTAF headquarters. During Desert Storm, when most CENTAF wings transitioned from low- to high-altitude tactics, the night low-level community was unable to test (and observe) the utility of high-altitude attacks and were therefore reluctant to change. CENTAF's widespread underappreciation of Iraqi deception reveals the difficulty posed by an enemy attempting to hinder observation. Suffering from vision impaired by Iraqi countermeasures, Riyadh never appropriately addressed the problem posed by Iraqi decoys.

Inappropriate orientation contributed to the delayed shift to high altitude by the night low-level interdictors. The low flyers were slow to perceive the need or opportunity to change

tactics due to their "get as low and fast as possible and hide" culture.

Organizational friction was an impediment to implementing adaptations. The technologically intensive top-down intelligence process could not be completely overcome. Bottom-up BDA was accepted by ARCENT for only a few weapons systems and only if verified by an Army GLO. The competing demands on theater airpower prevented implementation of the CINC's desire to concentrate in order to devastate one division. CENTAF's tasks were many, and each drew off strength from the main goal.

Several significant problems were never overcome. Most stemmed from the objective of the air battle with the RGFC. CENTAF's task of attacking the Republican Guard included operations against morale, command and control, logistics, and artillery and armor. The effects of most of these actions were not easily quantifiable, nor did they capture US senior commanders' attention as the 50 percent figure did. The evidence suggests that the nonquantifiable efforts may have been more significant to the ground offensive than pure attrition of armor or artillery. If the enemy does not know which way to orient his tanks, or where to target his artillery, then they are all rendered potentially ineffective. If he cannot respond to ground maneuver because his logistics are restricted, or because he is under continuous aerial observation and attack, then his combat potential falls off dramatically. Means to measure these important areas were never institutionalized and their contributions were underappreciated. Frustration with the process used to measure 50 percent attrition eventually led to its diminution in importance to the American senior commanders. General Schwarzkopf gradually reverted to weight of CENTAF effort as his main measure of merit against the guards. A fundamental change to the measures of merit used to judge effectiveness seems to have been warranted but was never instituted.

Even the attrition goal proved to be devilishly hard to measure. The efforts spent chasing it may not have been justified. The problems created by an effort to destroy 50 percent of the hard targets in a large, dispersed, and mobile target array exceeded Riyadh's capabilities to guide strikes to

the appropriate place. Targeting defaulted to the wings as airpower with "airshaft accuracy" was sprinkled indiscriminately over 900 square-mile kill boxes. Some of the wing GLOs and intelligence personnel were able to procure targeting materials outside normal channels to aid in targeting, but this was not done uniformly. Killer scouts helped sort out some of the targeting problems but had limited success identifying individual aim points.

The other problem illuminated by the 50 percent figure was the inability of intelligence to measure progress accurately. The problem was beyond the intelligence system's technical or manpower capabilities. Staffs were never able to calculate actual BDA. At best ARCENT devised an imperfect model that never reconciled the contributions of several weapons systems.

The innovations used against the Republican Guard came from both the CENTAF staff in Riyadh and its combat wings. These innovations circulated throughout a network of connections between the staff and the units in the field. Commanders and tactics experts in Riyadh conceived A-10 deep interdiction, A-10 reconnaissance, F-16 FOL operations, and tank plinking. General Glosson then instructed his wings to carry out those new missions. Riyadh, however, refrained from informing wings on how to accomplish the new tasks. Wing and squadron commanders, operations officers, and weapons officers often decided how to implement the changes. Success, however, rode squarely on the shoulders of the mission planners, tacticians, and flight leaders.

The shift from low-altitude tactics to high altitude was accomplished at the unit level, as tactics were considered a matter best left for the wings to decide. In an effort to clarify how much risk was acceptable, individual units and wings instituted minimum weapons delivery altitudes, leading to a variety of standards throughout the command. The seeds of the killer scouts were sown by the 388th TFW (P) mission planners when they used wing assets to validate targets for follow-on formations. There is a degree of simultaneity in this innovation, as Riyadh was considering a similar concept when the wing brought up the matter. The concept was well received

in Riyadh and was quickly institutionalized with command-wide impact.

Several innovations were internal to the echelon that instituted them. The struggle to use VTR tape as BDA resided and was handled at the headquarters level. Likewise, integration of new systems such as the LANTIRN targeting pod were internal to the wings and tactics to optimize employment (such as F-15E buddy-lase tactics) were best decided at the wing.

In all cases and at all levels, networks of motivated individuals stepped forward to take personal initiative and solve the problems at hand as their ideas flowed freely throughout the organization.

Implications

CENTAF's struggle in the Persian Gulf War indicates wartime and peacetime imperatives.

The United States Air Force must sustain in peacetime its ability to adapt during war. The Air Force's central maxim states "flexibility is the key to airpower." The Gulf War validated this maxim and illuminated the need to perpetuate it. There are four avenues that must be pursued to ensure the organization is flexible enough to meet future demands. The first quality that must be sustained is the mental capability for flexibility. CENTAF personnel possessed the ability to solve unexpected situations quickly because they were trained to do so. The tough, realistic training accomplished at exercises such as Red Flag nurtured mental flexibility. Aggressive problem solving, like that encouraged at the USAF FWS must be perpetuated throughout the USAF. Hard training, without "school solutions" is the means that must be pursued.

The same requirement for mental flexibility applies towards joint training. Increased familiarity with sister component procedures and information available is necessary to lessen organizational friction. Increased awareness and communications between component staffs, beyond that conducted in formal meetings, may facilitate adaptation at the operational level. The alternative, comprehensive and prescriptive joint doctrine, is a two-edged sword. Strengthened joint doctrine has the potential to smooth out some

interservice frictions. Established BDA guidelines, for example, might have eliminated some of the frictions that arose from the ground component's evaluation of air operations. The risk of enhanced joint doctrine is that it may not be worth the price if it institutionalizes fixed procedures that result in school solutions.

Although mental agility can accomplish much, it must be supported by physical capacity. If a large portion of the force is based on single-purpose, specialized weapon systems, there is the danger that no mental flexibility may be able to compensate. High-quality, high-capacity, multirole systems best enable the Air Force to adapt to the unanticipated realities of war in the future. Physical limitations to intelligence systems aggravated the contentious dispute over BDA and restricted the availability of valuable targeting materials, underscoring the continuing requirement to improve intelligence collection and distribution. Enhanced physical capability, however, may not be able to solve the problems posed by an adversary determined to deny certain information to us, making some uncertainty in war inevitable.

Institutional capability for adaptation must be built into the organization. Frequent two-way communications between headquarters and the field allowed for a collective approach towards finding optimal solutions to tough problems. Innovations originated from both the top and the bottom. The system must allow for the incorporation of solutions from either direction. Several important innovations originated from a group of (tactical) experts at the headquarters; there seems to be cause for establishing a permanent cell within each numbered Air Force dedicated to adaptation and analysis. A group of officers with a wide education and critical minds should be trained to examine tactical and operational issues to determine what is working, what is not, and what can be improved. This cell should work directly for the air component commander in order to assist the planning and operations sections of the air operations center.

The most important quality that facilitates adaptation, the ultimate arbiter, resides in the attitude of the commander. Future commanders would be well advised to encourage individual initiative and creative solutions from their

subordinates. This flows from faith in one's subordinates, and encourages them to make decisions in the face of uncertainty. Faith is manifested in the decentralization of decision making. Such faith does not come easily. General Horner stated, "It's very difficult for military people to learn to let go. We want to be in control." Decentralization, however, is the "fundamental way you release the initiative of thousands of people."[302]

The final implication of this study suggests that in wartime, air component planners need to devise and articulate more meaningful objectives for air operations against enemy land forces. These objectives must closely reflect air's multifaceted effects on land forces. They should be expressed as degraded capabilities of the enemy force that will facilitate accomplishment of the theater objective in light of the overall theater campaign plan. Development of more comprehensive objectives should lead to the better understanding and measurement of airpower's contributions to a joint campaign. Objectives that better represent what airpower does may reduce the interservice frictions that sprang from the use of a single criterion. This broader approach can not only clarify airpower contributions but it can lead to a clearer picture of the state of the adversary. This may help us avoid hammering away at an enemy in pursuit of a fixed-attritional goal as his soldiers surrender to newsmen and passing helicopters. Broader criteria may also compensate for enemy tactical deception, because he will be hard-pressed to mask all indicators of the state of his forces. The Air Force needs to think about and identify means to measure air operations against land forces during peacetime because the press of war does not provide time for reflection and analysis.

Notes

1. The KTO includes Kuwait and Iraqi territory south of 31 degrees north latitude and east of 44 degrees, 30 minutes east longitude.

2. *Gulf War Air Power Survey (GWAPS)*, vol. 5, *A Statistical Compendium and Chronology* (Washington, D.C.: Government Printing Office [GPO], 1993), pt. 1: 468. *GWAPS* data lists 6,047 USAF air strikes on kill boxes AF7, AG7, and AE6 (main dispersal areas of the RGFC). Navy and Marine aircraft reported 316 air strikes while other coalition aircraft reported 90.

3. Harold R. Winton, "On Doctrine: Thinking about How to Think about War," lecture, School of Advanced Airpower Studies, Maxwell AFB, Ala., 26 August 1994.

4. The influence of political, social, economic, and technological changes on the conduct of war are well described in Michael Howard, *War in European History* (Oxford: Oxford University Press, 1976).

5. Sir Michael Howard, "Military Science in an Age of Peace," *Journal of the Royal United Services Institute for Defence Studies* 119 (March 1974): 4.

6. The Russian victory over Finland came after great initial setbacks to the Russians. The Russians exhibited little adaptation to the requirements of the environment and prevailed through sheer mass, at great cost. Richard W. Condon, *The Winter War: Russia against Finland* (New York: Ballantine Books, 1972).

7. Lt Gen John H. Cushman, "Challenge and Response at the Operational and Tactical Levels, 1914–1945," in *Military Effectiveness*, eds. Allan Millet and Williamson Murray (Boston: Unwin Hyman, 1988).

8. Stephen P. Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991).

9. USAF difficulties in Vietnam caused by its strategic nuclear focus is a theme of Earl H. Tilford Jr. in *Setup: What the Air Force Did in Vietnam and Why* (Maxwell AFB, Ala.: Air University Press, 1991).

10. Rosen, 22–39.

11. James H. Doolittle with Bernie Lay Jr., "Daylight Precision Bombing," *IMPACT: The Army Air Forces' Confidential Picture History of World War II*, n. d., bk. 6, xv.

12. Howard, "Military Science in an Age of Peace," 8.

13. B. H. Liddell Hart, *The Real War, 1914–1918* (Boston: Little, Brown and Co., 1930), 249–60.

14. The OODA loop is mentioned positively in the current Air Force Manual (AFM) 1-1, *Basic Aerospace Doctrine of the United States Air Force*, vol. 2, March 1992, 22 and was described as "the decision cycle" in an article published by Army Chief of Staff Gordon R. Sullivan. Gen Gordon R. Sullivan and Col James M. Dubik, "War in the Information Age," *Military Review*, April 1994.

15. John R. Boyd, briefing slides, subject: A Discourse on Winning and Losing, August 1987, Maxwell AFB, Ala.

16. Helmuth von Moltke, *Moltke on the Art of War: Selected Writings*, ed. and trans. Daniel J. Hughes and Harry Bell (Novato, Calif.: Presidio Press, 1993), 185.

17. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), bk. 1, chap. 6.

18. Rosen, 38.

19. Boyd, slide 16.

20. Cushman, 334.

21. Martin L. van Creveld, *Command in War* (Cambridge, Mass.: Harvard University Press, 1985), 232–60.

22. Maj Michael R. Macedonia, USA, "Information Technology in Desert Storm," *Military Review*, October 1992, 37–38.

23. Cushman, 334.

24. Clausewitz, bk. 1, chap. 3.

25. "Haig was supported by the conviction that his strategical opinion, based upon the ceaseless study of a lifetime, could not be wrong. He was, in fact, the incarnation of *Field Service Regulations* in the 1909 edition. He fought by a book of rules. His mind ran on rails." J. F. C. Fuller (*Daily Mail* 7-5-38) as quoted in Denis Winter, *Haig's Command: A Reassessment* (New York: Viking, 1991), 162–63.

26. Clausewitz, bk. 1, chap. 7.

27. Timothy T. Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, Leavenworth Papers 4 (Fort Leavenworth, Kans.: Combat Studies Institute [CSI], 1981), 56.

28. Lt Col Leonard D. G. Teixeira, "Linebacker II: A Strategic and Tactical Case Study" (Maxwell AFB, Ala.: Air War College, 1990), 7–26.

29. David M. Glantz, *Soviet Military Operational Art: In Pursuit of Deep Battle* (London: Frank Cass, 1991).

30. Michael D. Doubler, *Closing with the Enemy: How GIs Fought the War in Europe, 1944–1945* (Lawrence, Kans.: University of Kansas Press, 1994), 282.

31. Ibid., 281.

32. Ibid.

33. Department of Defense, *Final Report to Congress on the Conduct of the Persian Gulf War* (Washington, D.C.: GPO, 1993), 3–9; and Brig Gen Robert H. Scales Jr., USA, *Certain Victory: The US Army in the Gulf War* (Washington, D.C.: GPO, 1993), 44–45.

34. Richard Jupa and James Dingeman, "The Republican Guards: Loyal, Aggressive, Able," *Army* 41, no. 3 (March 1991): 57.

35. Ibid., 58, 61.

36. Stephen C. Pelletiere, *The Iran-Iraq War: Chaos in a Vacuum* (New York: Praeger, 1992), 93–109.

37. Stephen C. Pelletiere, Douglas V. Johnson II, and Leif R. Rosenberger, *Iraqi Power and U.S. Security in the Middle East* (Carlisle Barracks, Pa.: Strategic Studies Institute, 1990), 9–23.

38. Ibid.

39. Capt James M. Warford, USA, "The Tanks of Babylon: Main Battle Tanks of the Iraqi Army," *Armor*, November–December 1990. Warford, an instructor at the Armor Officer Advanced Course, noted the T-72 was first seen by the West when paraded by the Soviets in 1977. Iraqi gun and armor modifications to the T-55 "may have effectively brought this 32-year-old tank into the 1990s," 23. A postwar evaluation of the T-72 in *Military Technology* finds the entire armor design philosophy of the former Soviet Union "fundamentally flawed" with its emphasis of quantity and small size

over quality and sophistication. Enzo Bonsignore, "Tank Experience Raises Tank Survivability Issues," *Military Technology*, February 1992, 64–70.

40. National Training Center Handbook 100-91, *The Iraqi Army: Organization and Tactics*, Fort Irwin, Calif., 3 January 1991, 25–31.

41. Ibid., 15.

42. Jupa and Dingeman, 61–62.

43. Pelletiere, Johnson, and Rosenberger, 23–36.

44. It is likely that this battle shaped the thoughts of Iraqi armor commanders prior to the Desert Storm ground offensive. Capt Aaron Danis, "A Military Analysis of Iraqi Army Operations," *Armor*, November–December 1990, 14–15.

45. Col Wallace Franz, USA, Retired, "Defeating the Iraqis—Saddam's Troops Are Not Ready for a War of Maneuver," *Armor*, January–February 1991, 8–9.

46. *GWAPS*, vol. 1, *Planning and Command and Control* (Washington, D.C.: GPO, 1993), pt. 1:204.

47. Republican Guard positions were observed by the author from the air and on the ground during Operation Desert Storm.

48. Described by Maj Gen Barry R. McCaffrey in Senate testimony as: "A giant logistics complex . . . [with] 1300 or more places where there were 20 or more tons of ammunition and supplies—lots of underground bunkers that would go for a kilometer or so; [with] underground fuel storage areas." US Senate, *Operation Desert Shield/Desert Storm: Hearings before the Committee on Armed Services*, 102d Cong., 1st sess., 1991, 114.

49. H. Norman Schwarzkopf with Peter Petre, *It Doesn't Take a Hero* (New York: Bantam Books, 1992), 346. Schwarzkopf also believed that if a counterattack appeared too risky the Republican Guard might attempt to stay out of the battle by taking refuge inside the Iraqi border.

50. AFM 1-1, *Basic Aerospace Doctrine of the United States Air Force*, 16 March 1984, v. A more recent version of AFM 1-1 was issued after the Gulf War, but this study uses the 1984 version of AFM 1-1 because it was in effect during the war.

51. Ibid., 2-11, 2-13.

52. Ibid., 1-1, 2-13.

53. Ibid., 3-3.

54. War Department Field Manual (FM) 100-20, *Command and Employment of Air Power*, 21 July 1943, 16–17. This manual illuminates the difference in attack against lines of communication, versus small, well-dispersed targets near the front. Attacks on moving formations and lines of communications are emphasized in J. C. Slessor, *Air Power and Armies* (London: Oxford University Press, 1936), 92. The vulnerability of moving forces is also underscored in Col John A. Warden III, *The Air Campaign: Planning for Combat* (Washington, D.C.: Pergamon-Brassey's, 1989), 71–85.

55. AFM 2-1, *Tactical Air Operations—Counter Air, Close Air Support, and Air Interdiction*, 2 May 1969, 7-2. Surprisingly, this 26-year-old manual is still the Air Force's most current official statement of operational doctrine.

56. Ibid., 7-3, 7-4.

57. Tactical Air Command Pamphlet 50-26, Training and Doctrine Command Pamphlet 525-16, US Redcom Pamphlet 5245-4, *Joint Operational Concept: Joint Attack of the Second Echelon (J-SAK)*, 13 December 1982, 1-3.

58. Ibid., iii, 1-3.

59. Ibid., 1-2.

60. Gen Bernard W. Rogers, "Follow-On Forces Attack (FOFA): Myths and Realities," *NATO Review*, December 1974, 1.

61. Ibid.

62. Ibid., 2.

63. Lt Col Price T. Bingham, *Ground Maneuver and Air Interdiction in the Operational Art*, CADRE Paper no. AU-ARI-CP-89-2 (Maxwell AFB, Ala.: Air University Press, 1989).

64. Charles D. Lloyd, "A Technological Success Story: Joint Stars and Operation Desert Storm," *Air Power History* 38, no. 3 (Fall 1991): 27–35.

65. James Blackwell, "The Status of Follow-on Forces Attack Technologies," *Military Technology*, October 1988, 115–24. Glenn W. Goodman, "New Airborne Sensors Look Deep, Allow Army/USAF to Strike Deep," *Armed Forces Journal International*, January 1989, 84–87.

66. "Tactical doctrine applies basic and operational doctrine to military actions by describing the proper use of specific weapons systems to accomplish detailed objectives." AFM 1-1, 1984, vi.

67. These manuals (three dash series) are multicommand manuals (MCM) because they apply to several Air Force commands, normally including Air Combat Command (formerly TAC), United States Air Forces in Europe, and Pacific Air Forces.

68. MCM 3-1, *Mission Employment*, vol. 1, *Tactics, Tactical Employment, General Planning and Employment Considerations*, 11 November 1992, ii.

69. Ibid., 3-1, A 13-1.

70. MCM 3-1, *Tactical Doctrine*, vol. 5, *Tactical Employment—F-16*, 1 January 1995, i–ii.

71. All USAF wings that fought in Desert Storm had formal tasking for Europe except the 363d TFW from Shaw AFB, S.C. *GWAPS*, vol. 4, *Weapons, Tactics, and Training and Space Operations* (Washington, D.C.: GPO, 1993), pt. 1.

72. Gorilla formations are strike packages of 20–50 fighters compressed on the same route to maximize mutual support. They were widely believed to be necessary for survival in Europe. These observations are based on the author's participation as a flyer, mission commander, and battle staff member in more than 10 Red Flag exercises between 1984 and 1988.

73. Maj Larry Thompson, 363d TFW pilot, interviewed by author, 5 May 1995.

74. The author participated in two Red Flag exercises that included a "high-altitude day" (one of 10 flying days during a normal deployment) to practice high-altitude tactics. These high-altitude days were met with great resistance by the squadrons ordered to fly them; the consensus was that this was not "realistic training."

75. A sharp contrast is provided by the RAF Tornado: its performance was designed for low-altitude flight, its weapons delivery software was poorly suited for high-altitude attacks, and its premier weapon: the JP233 antirunway munition had to be delivered from extremely low altitude and high speed.

76. Diane T. Putney, "From Instant Thunder to Desert Storm: Developing the Gulf War Air Campaign's Phases," *Air Power History* 41, no. 3 (Fall 1994): 40–42.

77. Ibid., 42.

78. Schwarzkopf, 318–20.

79. Putney, 44.

80. Ibid., 45.

81. Ibid., 46.

82. Lt Col Roy Y. Sikes, "Targeting Iraqi Forces in the KTO," lecture, Air Command and Staff College, Maxwell AFB, Ala., 28 January 1994; Lt Col Roy Y. Sikes, Checkmate planner, telephone interview with the author, 16 May 1995; and Lt Col Mark B. "Buck" Rogers, Black Hole/GAT planner, interviewed by author, Maxwell AFB, Ala., 22 and 23 February 1995.

83. A sign was reported posted in the Black Hole: "We are not preparing the battlefield. We are destroying it."

84. Sikes interview; and Sikes lecture.

85. Sikes interview; and Putney, 45.

86. "Concept of Operations for Phases II & III—Attacks on Iraqi Forces in the Kuwait Theater of Operations (KTO)" (TS). Declassified by declassification and review team HRA, Maxwell AFB, Ala., 11 April 1995, 4.A.(3). Information extracted is unclassified; and Rogers interview.

87. Ibid.

88. Ibid., appendix C.

89. Lt Gen Charles A. Horner, transcripts of Dadaelian Dinner Speech, 11 September 1991; and *GWAPS*, vol. 1, pt. 1: 172.

90. Sikes lecture—Checkmate initially used 60–80 percent; and Sikes interview—90 percent attrition was also discussed as a possibility signifying the destruction of a ground unit.

91. *GWAPS*, vol. 1, pt. 1: 170; and Maj Michael J. Bodner and Maj William W. Bruner III, "Tank Plinking," *Air Force Magazine*, October 1993, 29.

92. *GWAPS*, vol. 1, pt. 1: 11, 186; The 2,400 sorties were not reached until 2 February, and 5,400 sorties were eventually reached on 19 February. *GWAPS*, vol. 5, pt. 1: 462–511.

93. Barry D. Watts, *The Foundations of US Air Doctrine: The Problem of Friction in War* (Maxwell AFB, Ala.: Air University Press, 1984), 43–95.

94. General Horner felt modeling was useful, but eyed the figures with caution. Before the war he advised Secretary of Defense Dick Cheney that "here's what the models show . . . I would suspect it's twice that or more." Horner, "Dadaelian Dinner Speech," Q+A, 3.

95. CENTAF Combat Operations and Combat Plans were independent of General Glosson's special planning cell referred to as the Black Hole. Combat Plans was put under Glosson's control in December.

96. Col Samuel J. Baptiste, "Headquarters United States Central Command Air Forces in the Gulf: Reflections on Combat Planning and the Air Tasking Order Process" (Maxwell AFB, Ala.: Air War College, May 1993), 11–20.

97. Col Samuel J. Baptiste, chief of KTO Plans, GAT cell, telephone interview with the author, 28 April 1994.

98. Rogers interview; and Baptiste interview.

99. *GWAPS*, vol. 1, pt. 2: 70.

100. Baptiste, "Headquarters United States Central Command Air Forces in the Gulf," 10.

101. Schwarzkopf, 318–20.

102. Three B-52s and 24 F-16s struck the Republican Guard during the first 24 hours of the campaign. *GWAPS*, vol. 5, pt. 1: 469.

103. Emotional adaptation to air raids is enhanced if there are relatively few near misses typical of a small raid. Irving L. Janis, *Air War and Emotional Stress: Psychological Studies of Bombing and Civilian Defense* (Westport, Conn.: Greenwood Press, 1976), 98–125.

104. There were three squadrons trained and equipped to serve as FACs available in the theater. The United States Marine Corps (USMC) operated OV-10 Broncos and F-18Ds over their area of responsibility in Southeast Kuwait, and the USAF's OA-10 FACs defaulted to supporting their own A-10 wing along the front lines. There was no operative plan for FACs over the breadth of the KTO, or over the RGFC as Desert Storm began.

105. *GWAPS*, vol. 5, pt. 1: 463–539. Statistics of strikes against the Republican Guard are derived from the *Statistical Compendium* of the *Gulf War Air Power Survey*. The format of the data makes all figures rough approximations. Data is presented as individual strikes, which are the numbers of targets reported attacked. Some missions may have reported more than one discrete target attacked per sortie. Strikes, therefore, have the potential to have a higher number than the number of sorties reported. It is also worth mentioning that sorties canceled will not show up as strikes, since they did not attack targets. Republican Guard figures are approximate because strikes are compiled by kill box. Kill boxes cover 900 square miles: orders of magnitude greater than an Iraqi division. This author has determined nearly all of the Republican Guard heavy divisions were concentrated in three kill boxes AF6, AG7, and AH7. These locations were derived from detailed ARCENT templates. Some of the Tawakalna Division positions were in a fourth kill box (AF7), but 10 of the division's 12 maneuver battalions were in AF6, as was all of the division's support

assets. *GWAPS* incorrectly reports part of the Tawakalna in AG6. AG6 contained the Jihad Corps, which was adjacent to the Tawakalna Division. Other units were in some kill boxes. AF6 contained an armored brigade of the 12th Armored Division, while AG7 and AH7 contained RGFC light infantry. These units may have absorbed some of the blows intended for the RGFC heavy divisions.

106. *GWAPS*, vol. 5, pt. 1: 463–539.

107. Ibid.

108. Capt William F. Andrews, F-16 pilot, unpublished war diary.

109. "I know we utilized all possible channels—both in the system and around it . . . it came down to a matter of who you knew or who could pull strings. . . . We were all *very* frustrated about the imagery and unbelievable dissemination problems." Capt Catherine Dunham, 10th Tactical Fighter Squadron (TFS) intelligence officer, letter to the author, subject: Target Intelligence Dissemination in the Gulf War, 18 November 1994.

110. Ed Wagamon, analyst, Intelligence and Threat Analysis Center, FSU division, telephone interview with author, 14 December 1994; and Alan D. Campen, *The First Information War: The Story of Communications, Computers, and Intelligence Systems in the Persian Gulf* (Fairfax, Va.: AFCEA International Press, 1992), 75–81.

111. Maj Edward J. Wright, USA, "The Topographic Challenge of Desert Shield and Desert Storm," *Military Review* 72, no. 3 (March 1992): 28–38.

112. 24th Infantry Division intelligence officer testified she knew "where the Iraqi divisions were . . . down to the battalion level, in six-digit grids. And when we fired artillery prep on them, they were there, and we hit them." US Senate, *Operation Desert Shield/Desert Storm*, 129; and Brig Gen John F. Stewart Jr., USA, *Operation Desert Storm, The Military Intelligence Story: A View from the G-2 3d US Army*, Riyadh, Saudi Arabia, 27 April 1991, 13. General Stewart, ARCENT G-2, claims US soldiers were often able to anticipate contact and open fire accurately at long range based on Iraqi division templates.

113. *GWAPS*, vol. 1, pt. 2: 286.

114. Quoted in ibid., 254.

115. Maj William Bruner, Black Hole planner, interviewed by author, Maxwell AFB, Ala., 21 April 1995; and Rogers interview. After the war several USAF aircrews, intelligence personnel, and planners were shocked by the existence of these target materials that might have made CENTAF's job easier.

116. According to one unit's after-action report (AAR): "Pilots were lucky to just get a verbal description of their target—quite often a target they had destroyed the day before or conversely a target photo 6–7 months old which had no reference points and which had on it nothing but a few dark spots." 138th TFS/IN AAR, "CENTAF/IN After-Action Report," (U) (Secret), 14-1. Information extracted is unclassified.

117. *GWAPS*, vol. 1, pt. 2: 302. To contrast, F-117 and F-111 wings cooperated and deconflicted aim points on Iraqi airfields when faced with

lack of precise targeting guidance from Riyadh, because excellent targeting graphics were available.

118. Maj Jim Hawkins, Black Hole B-52 planner, telephone interview with the author, 19 April 1995.

119. Ibid.

120. Strategic Air Command, "Desert Storm Bombing and Navigation Conference 22–24 April 1991 After-Action Report," 19 June 1991, pt. 1: Summary.

121. Nonspecific Red Flag training and even specific CENTAF/CENTCOM exercises such as Quick Force conducted through the 1980s often included high altitude join-up and ingress but normally included a descent to low altitude prior to entering the target area. Author's experience as a participant; and Thompson interview.

122. Brig Gen Ervin C. Sharpe, former commander of 354th Tactical Fighter Wing (TFW), interviewed by author, Maxwell AFB, Ala., 24 and 27 April 1995.

123. Sharpe interview. The desert environment was poorly suited for low altitude tactics. There was little terrain suitable for terrain masking, and the atmospheric conditions at low altitude often obscured targets that were visible from higher.

124. Sharpe interview; Thompson interview; and Bruner interview.

125. William L. Smallwood, *Strike Eagle: Flying the F-15E in the Gulf War* (Washington, D.C.: Brassey's, 1994), 21–44.

126. Sharpe interview.

127. A divisive struggle over altitudes is described in Smallwood, 21–44.

128. Author's conversations with multiple 363d TFW pilots.

129. Author's conversations with Royal Air Force (RAF) and French AF pilots at the AAFCE Gulf War debriefing, Florennes Air Base (AB), Belgium, April 1991.

130. RAF tornado pilot remarked to author at the AAFCE conference: "The Queen will have to pay me a lot more to fly low over an enemy airfield again."

131. Jack Broughton, *Going Downtown: The War against Hanoi and Washington* (New York: Orion Books, 1988), xv.

132. Brig Gen Buster C. Glosson, 14th Armored Division commander, Desert Storm campaign briefing to the pilots of the 363d TFW, Al Dhafra AB, United Arab Emirates (UAE), 10 January 1991.

133. Ibid.

134. Rear Adm J. C. Wylie, *Military Strategy: A General Theory of Power Control* (New Brunswick, N.J.: Rutgers University Press, 1967), 14–27.

135. Rogers interview. Specifically Major Rogers examining videotapes observed F-16 pilots conducting dive toss attacks and attacks with shallow dive angles from extremely long slant ranges, that might have been suitable for low altitude attacks but were ineffective from high altitudes.

136. This effect was soon detected by F-16 crews, because they were able to visually observe weapons impacts. B-52 detection was delayed until

good BDA became available weeks into the war. Author's experience as F-16 pilot and see Strategic Air Command "Conference"; and for B-52 problems, see *GWAPS*, vol. 1, pt. 1: 293.

137. The flight manual lacked gunsight settings for such long-range attacks: they had never been thought of. Maj Arden Dahl, A-10 pilot, telephone interview with author, Maxwell AFB, Ala., 25 April 1995.

138. "CENTAF TACC/NCO Log, January–February 1991" (U), 30 January 1991, 21. (Secret) Information extracted is unclassified.

139. "There is no available imagery from the attacks on the Republican Guard, but we do know their lines of communication have been damaged." (U) 24 January 1991, 1930 hrs, 17th Air Division (P) Historian, "CENTAF TACC/ NCO Log." (Secret) Information extracted is unclassified.

140. Lt Gen Charles A. Horner, "Transcripted Comments from CENTAF TACC January–February 1991" (U), 2 February 1991. (Secret) Information extracted is unclassified. "It's obvious that the national systems can't support the way we need to be supported. They're superb against fixed infrastructure type facilities but they're not very accurate against forces in the field."

141. "CENTAF TACC/NCO Log" (U), 21 January 1991. (Secret) Information extracted is unclassified.

142. "The USAF maxim is 'train like your going to fight.' Well, we never did." 9th Tactical Intelligence Squadron AAR. "CENTAF/IN After-Action Report (U) Observation B. (Secret) Information extracted is unclassified.

143. Lt Col Kevin W. Smith, USAF, *Cockpit Video: A Low Cost BDA Source* (Maxwell AFB, Ala.: Air University Press, December 1993), 11. The difficulty of evaluating mission reports is related in *GWAPS*, vol. 1, pt. 2: 32–39.

144. Stewart, 19.

145. Smith, 4–7; and Stewart, 17–21.

146. Smith, 19–28. The 363d TFW adopted a wide variety of solutions from manually adjusting aim points to typing a variety of corrections into their F-16 fire control computers. Lack of a viable combat weapons assesment program precluded an accurate, uniform solution. Based on the author's observations.

147. In early February the 363d TFW GLO examined several intelligence photos of Iraqi armor with the author. The isolated lines of vehicles held no meaning because they could not be integrated into a larger framework of where they were or what missions had flown there.

148. Videotape was used initially against strategic targets. Lt Col David A. Deptula, "Lessons Learned: The Desert Storm Air Campaign," lecture, Center for Strategic and International Studies, Washington, D.C., April 1991, 13.

149. Smith, xiii–xiv; Deptula lecture, 12–13; and Bruner interview.

150. Deptula lecture, 13. Glosson sent a C-21 to collect daily wing VTR summaries.

151. "If units are to be tasked to provide their own BDA they should be given the appropriate materials and trained imagery analysts to do the job properly." Lieutenant Warn, "Battle Damage Assessment from LANTIRN Videos." (U) CENTAF/IN AAR. (Secret) Information extracted is unclassified; Lieutenant Warn, "LANTIRN Targeting Pod Imagery Interpretation." (U) CENTAF/IN AAR. (Confidential) Information extracted is unclassified; and Smith, 19–29.

152. Deptula wrote, "Got BDA from Checkmate—Not CENTAF or CENTCOM." Lt Col David A. Deptula, "Wartime Significant Events Outline," 2–3 March 1991.

153. Brig Gen Raymond P. Hout, 363d TFW (P) commander during Desert Storm, telephone interview with author, 5 May 1995.

154. The author routinely coordinated 363d TFW activities with several other wings as a mission commander and chief, 363d Wing Mission Planning Cell.

155. Col Richard B. H. Lewis, interviewed by author, Fort Bliss, Texas, 5 May 1995; and Rogers interview.

156. Numerous conversations were recorded in the "CENTAF TACC/CC/DO Log" and "CENTAF TACC/NCO Log." (U) (Secret). Information extracted is unclassified.

157. Building on Army theory, the Iraqis were already maximizing dispersion and protection. The only other option versus area fire was counterbattery fire, which had been denied when the coalition air forces achieved air superiority over the KTO. "Tactical Responses to Concentrated Artillery," CSI Report 13 (Fort Leavenworth, Kans.: CSI, n.d.).

158. William L. Smallwood, *Warthog: Flying the A-10 in the Gulf War* (Washington, D.C.: Brassey's, 1993), 123–24. This constitutes a change from the day prior, when General Horner, with General Glosson and Colonel Deptula, sketched out a rough plan for the air war that envisioned using "penetrators [F-16, F-18, F-15E] and heavy bombers" against the RGFC, and "attack aircraft" (A-10, AV-8) against other KTO units. Lt Gen Charles A. Horner, "Air Ops Summary of Air War," 261100Z February 1991. On 27 January, General Glosson told the A-10 commanders they would have five to six days to prepare for the mission. He decreased planning time to only two days, possibly in response to other feedback.

159. Maj Michael W. Isherwood, A-10 mission planner and A-10 pilot, telephone interview with the author, 17 April 1995; and Smallwood, 37–41.

160. Isherwood interview.

161. Smallwood, *Warthog*, 123–27.

162. Sharpe interview; and Smallwood, *Warthog*, 124.

163. Dunham letter; and Smallwood, *Warthog*, 124. "They [A-10 intelligence personnel] had a backdoor route. . . . One of the intel guys just came from an assignment with the RF-4 unit that was over there. He called a friend in the unit and told him what they needed. They worked out the transportation and got what they needed."

164. Sharpe interview; and Dunham letter. Mission effectiveness increased with improved planning materials: When the Tawakalna's air defenses attempted to oppose the wing's first flights, pilots were able to identify and immediately attack the division's air defense locations. In contrast, most missions lacking these materials often did not know where to look to monitor air defense reactions and counterattack.

165. Dahl interview.

166. Horner, "Transcripted Comments" (U), 30 January 1991. (Secret) Information extracted is unclassified. "We did get one report about the Tawakalna that said the A-10s rolled in, but no one was at home; that they weren't even shooting back any more. I hope that means they are finished. We have no way of knowing."

167. Col Ervin C. Sharpe, commander of 354th TFW and Col David A. Sawyer, commander of 23d TFW, to commander, 14th Air Division (P), letter, subject: A-10 and Iraqi Tactics, 3 February 1991. (Secret) Information extracted is unclassified.

168. This tactic noted in the "CENTAF TACC/NCO Log" and observed by the author in an attack on a position in the vicinity of the Tawakalna Division. The tactic was executed inexpertly, in that the fire was lit too late (with the unit under observation), and too far from any previous bomb impacts to be effective. In fact this vehicle became the flight's primary target until it was destroyed.

169. Sharpe interview.

170. Lewis interview; Rogers interview; and Baptiste interview.

171. Col Richard B. H. Lewis, "JFACC Problems Associated with Battlefield Preparation in Desert Storm," *Airpower Journal* 8, no. 1 (Spring 1994): 9.

172. Ibid.

173. *GWAPS*, vol. 5, pt. 1: 462–511.

174. Smallwood, *Warthog*, 137–40.

175. Ibid.

176. Sharpe and Sawyer letter.

177. "Tactical Responses to Concentrated Artillery."

178. William F. Andrews, F-16 unpublished war diary, another F-16 pilot, from the 388th TFW was only aware of attacking decoys once; and Maj Jay Lindell, killer scout pilot, interviewed by author, Maxwell AFB, Ala., 20 April 1995.

179. The CENTAF/DO stated after the war: "They would hide in the sand, put the tanks in the sand, push berms up around it, thinking they would hide; you can't hide from infrared." Maj Gen John A. Corder, Oral History Transcript: "Desert Storm: An Overview of Air Operations," (U) 7 August and 4 September 1991, 58. (Secret) Information extracted is unclassified.

180. Lt Col William G. Welch, "Notes from the BCE: Observations on Joint Combat Operations at Echelons above Corps," *Field Artillery*, June 1992, 18; Wagamon interview—In contrast an Army Intelligence Agency

analyst involved in mapping Iraqi Army positions commented that "the national pastime in Iraq must be decoy making"; and Maj Philip A. Oppenheimer, 4th TFS flight commander and killer scout pilot, telephone interview with the author, 23 May 1995. An F-16 killer scout commented that "the Iraqis are masters of deception." Several Army units noted heavy deception efforts within occupied Iraqi garrison areas, based on multiple conversations with author.

181. Corder transcript (U), 39. (Secret) Information extracted is unclassified. "We would lose track of units for three or four days when they were moving."

182. Many Army units were able to successfully engage Iraqi units from intelligence templates is evidence that the units moved little.

183. Sharpe and Sawyer letter. In addition to coping with the decoy problem, the other main point of the letter was that the A-10s felt their efforts were being diluted by the tactical air control system (a system designed to provide responsive CAS), which was diverting them from planned interdiction missions to "immediate" priority CAS targets, even though there were no ground forces in contact. Sharpe interview.

184. "CENTAF TACC/NCO Log" (U), 31. (Secret) Information extracted is unclassified.

185. Horner, "Transcripted Comments" (U), 21. (Secret) Information extracted is unclassified. Horner's comments frequently pushed the Republican Guard to the forefront. Even during the battle of Khafji, Horner exhorted, "Please keep your eye on the Republican Guard. Right now, it is sort of the key to this campaign."

186. Horner, "Transcripted Comments" (U), 16. (Secret) Information extracted is unclassified.

187. *GWAPS*, vol. 5, pt. 1: 462–511.

188. Ibid., 467.

189. Horner, "Transcripted Comments" (U), 11. (Secret) Information extracted is unclassified.

190. Lt Col Mark A. Welsh, "Day of the Killer Scouts," *Air Force Magazine* 76, no. 4 (April 1993): 66–70. Andrews's diary, 2-7-91: "We're not dropping ordnance of choice here—you have to shack the target with Mk-82 and the wingmen have to look for AAA since their CBU won't hurt tanks"; 2-10-91: "he held us up for 20 minutes, then against a tank unit—all misses—Dismal! I got down amongst them with my Mk-82 popcorn bombs—risking my a-- to get better accuracy all for nought! We're here for tonnage!! [to make the slides in Riyadh look good]."

191. Lewis, "JFACC," 10; Lewis interview; and Hout interview.

192. Rogers interview.

193. Two wings, the 363d and 388th TFWs, had three F-16 squadrons. Two of the 388th squadrons were equipped with LANTIRN pods for night operations. The 363d wing had three squadrons of non-LANTIRN (day) F-16Cs.

194. Hout interview.

195. 17th Air Division (P), TACC Log (U), 3 February 1991. (Secret) Information extracted is unclassified.

196. From the author's experience, when two sorties were flown to one area, familiarity with the area was definitely increased. The author, however, serving as chief of mission planning at times was not aware any pressure to send formations to the same targets, and some opportunities may have been missed.

197. Col Gary North, 363d TFW (P) planner and mission director, telephone interview with author, 19 April 1985.

198. Ibid.

199. Hout interview. The wing commander believed the 363d would be able to fly a full schedule from the second day.

200. 10th TFS, "Desert Shield/Desert Storm After-Action Report," 9 May 1991, OPS-5.

201. Welsh, 67.

202. Maj Scott Goodfellow, 388th TFW (P) weapons officer and killer scout pilot, telephone interview with author, 28 August 1995.

203. Welsh, 67.

204. Ibid.

205. Ibid., 68; and Lewis interview. The name was a creation of General Glosson's staff to avoid the Vietnam-era name of Fast FAC, even though the concept was the same as fighter-controlled strikes over southern sections of North Vietnam and the Ho Chi Minh Trail.

206. Oppenheimer interview.

207. Welsh, 69.

208. Ibid.

209. Ibid.

210. Ibid., 70.

211. Lt Gen Buster C. Glosson, CENTAF director of plans, memorandum to CENTCOM J-3 Plans, subject: Theater Campaign Strategy Assessment (U), 14 February 1991. (Secret) Information extracted is unclassified.

212. Maj Jay Lindell, chief, Wing Standardization Evaluation, 388th TFW (P), Al Minhad AB, UAE, interviewed by author, Maxwell AFB, Ala., 20 April 1995; and Oppenheimer, interview.

213. Sharpe and Sawyer letter.

214. Goodfellow interview.

215. Deptula, "Wartime Significant Events Outline," 2. Colonel Deptula noted immediately after the war: "frustration over no BDA against RG. Therefore need pictures of tanks dying."

216. Lewis interview.

217. Night Camel was conducted versus the VII Corps as they began their movement from the coast inland in December and January. Although F-111s were able to detect the US Army vehicles, they did not simulate laser-guided bomb attacks against them. At the time, unguided CBU-87 was believed to be the best weapon for the job. During the war, the old fire

control computer in the F-111 was found not to be well suited for CBU-87 attacks.

218. "CENTAF TACC/CC/DO Log" (U), 1–5 February 1991. (Secret) Information extracted is unclassified.

219. Bodner and Bruner; and Bruner interview.

220. Bodner and Bruner, 30.

221. Fred L. Frostic, *Air Campaign against the Iraqi Army in the Kuwaiti Theater of Operations*, Project Air Force (Santa Monica, Calif.: RAND, 1994).

222. 48th TFW (P), "Operation Desert Storm: 48th TFW (P) Taif, Saudi Arabia," USAFE Desert Storm History Inputs, 26.

223. Maj John Taylor, F-111F pilot, telephone interview with the author, 5 June 1995; and Maj William Hopmier, 335th TFS weapons officer, Operation Desert Storm, interviewed by the author, Maxwell AFB, Ala., 21 April 1995. Hopmier believed the F-15Es may have been better able to discriminate valid targets with their superb radar.

224. *GWAPS*, vol. 5, pt. 1: tables 188–89. USN A-6s delivered 149 PGM strikes against Iraqi ground units. Navy expenditure of LGBs in Desert Storm was 623 versus 8,456 USAF LGBs.

225. When it deployed to the desert, the F-15E weapons system was brand new and not cleared for many weapons loads. Clearance by engineers (called Seek Eagle) is required to ensure safe carriage, and separation of ordnance will be possible under a range of conditions.

226. Hopmier interview.

227. Ibid.

228. Ibid.

229. Smallwood, *Warthog*, 177–83.

230. Hopmier interview. Adaptation in combat revealed much more flexibility than what is normally permitted in peacetime. Commanders bringing the F-15E on line had been very conservative in tactics development and training.

231. During one controlled weapons system evaluation, the author observed a Maverick missile explosion in a targeting pod display, convinced the target had been destroyed when pieces of metal were seen flying from the fireball. Ground inspection, however, revealed the missile hit a few feet from the targeted tank, which was still in operable condition (the debris had been a fender).

232. Lewis, "JFACC," 12–13.

233. Ibid.

234. Ibid., 9.

235. Exemplifying the energetic approach toward problem solving, General Horner worked out optimal timing for killer scout missions on a scratch pad with Lt Col Phillips. 17th Air Division (P), "CENTAF TACC Log" (U), 3 February 1991. (Secret) Information extracted is unclassified.

236. Horner, "Transcripted Comments" (U), 3. (Secret) Information extracted is unclassified.

237. Frostic.

238. In Vietnam there was enough time (years) to identify the need and procure the hardware.

239. Lt Gen Charles A. Horner, Reuter Transcript Report, "Address to Business Executives for National Security Education Fund," 8 May 1991, B8.

240. Horner, "Transcripted Comments," 37. (Secret) Information extracted is unclassified.

241. Oppenheimer interview.

242. COMUSARCENT Briefing Slides, "Unit BDA: Theater Echelon" (U), 4 February 1991. (Secret) Information extracted is unclassified.

243. Ibid.

244. Lewis, "JFACC," 13.

245. Ibid.; and Stewart, 20.

246. Stewart, 20.

247. Col Steven A. Epkins, USA, "A Division G2's Perspective on Operations Desert Shield and Desert Storm" (Carlisle Barracks, Pa.: Army War College, 15 April 1992), 34.

248. Horner, "Transcripted Comments" (U), 32. (Secret) Information extracted is unclassified.

249. Lewis, "JFACC," 13.

250. Ibid., 12.

251. Oppenheimer interview. A killer scout with frequent responsibility for the Medinah's kill box noted that other divisional air defense units would cease-fire when targeted. "The Medinah was different: its gunners wouldn't quit and it had vigorous AAA protection throughout."

252. Sharpe interview; and Dahl interview.

253. A-10 combat recap, Sharpe interview; and Dahl interview.

254. Statement of General Horner before the Senate, *Operation Desert Shield/Desert Storm*, 276; and Smallwood, *Warthog*, 182.

255. Sharpe interview.

256. "CENTAF TACC/CC/DO Log" (U), February 1991. (Secret) Information extracted is unclassified.

257. *GWAPS*, vol. 5, pt. 1: 462–511.

258. The F-16s were not to attack permanent bridges, which were best left for LGB attacks. Instead the F-16s were instructed to record and report the locations of any permanent bridges observed in use. Based on author's experience as chief of 363d wing mission planning cell.

259. Lewis interview; and Baptiste interview.

260. Lewis interview.

261. Horner, "Transcripted Comments" (U), 30. (Secret) Information extracted is unclassified.

262. Baptiste interview. According to Colonel Baptiste, Horner laughingly dismissed attrition figures routinely during February TACC briefings because he realized they didn't reflect reality. Schwarzkopf began to use air strikes as a primary measure of merit (Horner called it farmer

logic) when problems with BDA appeared insurmountable; and Horner, Reuter Transcript Report, B8–9.

263. CENTAF Message (U), 241600Z February 1991. (Secret) Information extracted is unclassified.

264. TACC CC/DO Log (U), 24 February 1991. (Secret) Information extracted is unclassified.

265. Maj Michael W. Isherwood, "Noise or Music? Orchestrating Fixed-Wing Air in the Close-in Battle," *Field Artillery*, October 1994, 9.

266. COMUSARCENT slides, Unit BDA (U), 23 February 1991. (Secret) Information extracted is unclassified.

267. Schwarzkopf, 441–42.

268. 1st Lt John Hillen, "2d Armored Cavalry: The Campaign to Liberate Kuwait," *Armor*, July–August 1991, 10–11; and Lt Col Douglas A. Macgregor, "Closing with the Enemy," *Military Review*, February 1993, 65.

269. Lt Richard M. Bohannon, "Dragon's Roar: 1-37 Armor in the Battle of 73 Easting," *Armor*, May–June 1992, 13.

270. The VII Corps historian recorded 108 armored fighting vehicles destroyed, Lt Col Peter S. Kinsvatter, "VII Corps Goes to War: Ground Offensive," *Military Review*, February 1992, 35.

271. Richard M. Swain, in *Lucky War: Third Army in Desert Storm* (Fort Leavenworth, Kans.: Command and General Staff College Press, 1994), 264, reported 186 Iraqi tanks, 127 armored personnel carriers, and 38 artillery pieces destroyed by the 1st Armored Division on 27 February; and Lt Gen Ronald H. Griffith, in "Mission Accomplished—In Full," US Naval Institute *Proceedings*, August 1993, 63, stated his division destroyed "more than 160 armored systems and two defending brigades of the . . . Medinah Division" in two hours.

272. Maj Jason K. Kamiya, USA, *A History of the 24th Mechanized Infantry Division Combat Team during Operation Desert Storm: "The Attack to Free Kuwait" (January through March 1991)*, (Fort Stewart, Ga.: 1991), 37, 55.

273. Those quick to condemn the United States for allowing the fragmented units in the Basrah pocket to survive on the grounds that they were subsequently used against the revolts in the north and south may have forgotten that the Iraqis had substantial forces not committed to the KTO including four Republican Guard infantry divisions intended to "perform internal security duties." *GWAPS*, vol. 1, pt. 1: 203–4.

274. Michael R. Gordon and Bernard E. Trainor, *The General's War: The Inside Story of the Conflict in the Gulf* (Boston: Little, Brown and Co., 1995), 430.

275. *GWAPS*, vol. 1, pt. 1: 203.

276. Dividing which of the surviving hardware came from the Republican Guard is an even tougher problem. A guess may be made if it is assumed that only the Republican Guard were equipped with T-72s. In that case, 375 of the tanks were identified as T-72s, CIA estimated the guard started with 786, and the coalition destroyed 53 percent. ARCENT, credited

the guard with 988, leading to the estimate that the coalition destroyed 62 percent. There is evidence that the original assumption (only the guard was equipped with T-72s) is incorrect. At least one USMC armored unit reported encountering at least a battalion of T-72s in south Kuwait where there were no reported guard units. SSgt Jeffrey R. Dacus, "Bravo Company Goes to War," *Armor*, September–October 1991.

277. McCaffrey, testimony before the US Senate, 114.

278. Author was a prisoner of the Iraqis from 27 February to 6 March. His captors were unable to cross the Euphrates in Basrah due to the incredible traffic problems in the vicinity of a damaged bridge the evening of 28 February. They were able to cross with great difficulty on 1 March.

279. McCaffrey, testimony before the US Senate, 114

280. Oppenheimer interview.

281. ARCENT anticipated four possible Iraqi reactions: mobile counterattack, mobile defense, static defense of key terrain, or static defense in place. The Iraqis appear to have been unable to execute any but the last.

282. McCaffrey, testimony before the US Senate, 166. The coalition logistics units, enjoying complete freedom of action due to US air supremacy were hard-pressed to sustain the US Army's maneuver into the Iraqi rear. The 24th Infantry Division (Mechanized), covering the greatest amount of ground, projected 3,500 tons of supplies would be required from G-Day to G+4. This quantity required 80 840-foot trailers and 75 5,000-gallon water tankers.

283. Capt T. Bell, "Analysis of the Enemy Threat to the Division's Future Battle," *24th Mechanized Infantry Division Combat Team: Historical Reference Book* (Fort Stewart, Ga.: April 1991).

284. Vince Crawley, "Ghost Troop's Battle of 73 Easting," *Armor*, May–June 1991, 10; and Macgregor, 66.

285. 24th Infantry Division intelligence officer testified she knew "where the Iraqi divisions were . . . down to the battalion level, in six-digit grids. And when we fired artillery prep on them, they were there, and we hit them." US Senate, 129; General Stewart, ARCENT G-2, claims US soldiers were often able to anticipate contact and open fire accurately at long range based on Iraqi division templates. Stewart, 13; Crawley, 8; and Capt A. A. Puryear and Lt Gerald R. Haywood II, "Ar Rumaylah Airfield Succumbs to Hasty Attack," *Armor*, September–October 1991, 20.

286. Col Gregory Fontenot, "Fright Night: Task Force 2/34 Armor," *Military Review*, January 1993, 47.

287. Bohannon, 14.

288. McCaffrey, testimony before the US Senate, 148.

289. Ibid.

290. Maj Robert Bowman, interviewed by author, 16 May 1995, Maxwell AFB, Ala. One Apache battalion of the 1st Armored Division discovered that the Iraqi tanks were vulnerable to 30-mm fire. Subsequently that unit emphasized 30 mm and achieved the most kills in the aviation brigade.

291. Capt Richard A. Lacquement, Capt Joseph V. Pacileo, and Capt Paul A. Gallo, "Targeting during Desert Storm," *Field Artillery*, February 1992, 37; Col Robert H. Scales Jr., "Accuracy Defeated Range in Artillery Duel," *International Defense Review*, May 1991, 478. "In this century, more than 90 percent of all distant fires were observed from the air."

292. Scales, "Accuracy Defeated Range," 478. "Curiously, the problem at hand was not so much how to silence his guns, but rather how to induce them to fire or to switch on his radars and radios so that US targeting systems could locate him precisely."

293. Scales, "Accuracy Defeated Range," 478. One US artillery battalion commander observed five of six Iraqi guns destroyed by US artillery but few bodies around the position.

294. Lacquement, 37; and Hillen, 11.

295. Scales, "Accuracy Defeated Range," 481; and Lacquement, 35.

296. Howard, "Military Science in an Age of Peace," 7.

297. Schwarzkopf, 434 and 443.

298. Lewis, "JFACC," 9.

299. Sharpe interview.

300. Ibid.

301. *GWAPS*, vol. 1, pt. 2: 224.

302. Lt Gen Charles A. Horner, "New Age Warfare," *The War in the Air, 1914–1994: The Proceedings of a Conference Held by the Royal Australian Air Force in Canberra, March 1994*, ed. Alan Stephens (Canberra: RAAF Air Power Studies Centre, 1994), 327.

Appendix A

Primary USAF Units That Participated

F-16: 212 Aircraft (1 February)

4th Tactical Fighter Wing (TFW) (P) Seymour Johnson AFB, N.C. Deployed to Al Karj Air Base (AB), Saudi Arabia

157th Tactical Fighter Squadron (TFS) McEntire Air National Guard Base (ANGB), S.C.

138th TFS Hancock Field ANGB, N.Y.

363d TFW (P) Shaw AFB, S.C. Deployed to Al Dhafra AB, United Arab Emirates (UAE)

17th TFS Shaw AFB

33d TFS Shaw AFB

10th TFS Hahn AB, Germany

388th TFW (P) Hill AFB, Utah. Deployed to Al Minhad AB, UAE

4th TFS Hill AFB	killer scouts.
421st TFS Hill AFB	LANTIRN equipped
69th TFS Moody AFB, Ga.	LANTIRN equipped

401st TFW (P) Deployed to Doha, Quatar

614th TFS Torrejon AB, Spain

A-10A: 144 Aircraft (1 February)

23d TFW (P) England AFB, La. and 354th TFW (P) Myrtle Beach, S.C.

23d TASS Davis-Monthan AFB, Ariz.	OA-10 FACs

74th TFS England AFB, La.

76th TFS England AFB, La.

353d TFS Myrtle Beach, S.C.

355th TFS Myrtle Beach, S.C.

511th TFS New Orleans, La.

706th TFS Alconbury AB, England

F-111F: 64 Aircraft (1 February)

48th TFW (P) Lakenheath AB, United Kingdom. Deployed to Taif AB, Saudi Arabia

- 492d TFS Lakenheath AB
- 493d TFS Lakenheath AB
- 494th TFS Lakenheath AB
- 495th TFS Lakenheath AB

F-15E: 48 Aircraft (1 February)

4th TFW (P) Seymour Johnson AFB, N.C. Deployed to Al Karj AB, Saudi Arabia

- 336th TFS Seymour Johnson AFB
- 335th TFS Seymour Johnson AFB

B-52: 36 Aircraft (1 February)

1708th BMW (P)	location unavailable
4300th BMW (P)	location unavailable
811th BMW (P)	location unavailable
806th BW (P)	deployed to Fairford AB, England

Appendix B

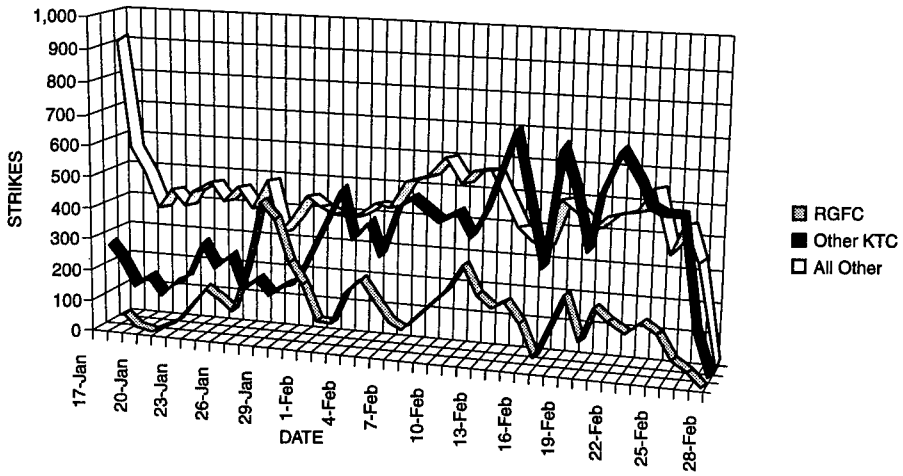
Chronology

Date	Event
1987	Republican Guard Forces Command (RGFC) expands to three heavy divisions, one infantry, one Special Forces brigade, later expanded by three infantry divisions for Kuwait invasion.
1988	RGFC spearheads final offensives into Iran.
8-3	Iraq invades Kuwait; RGFC divisions spearhead the attack.
8-8	Schwarzkopf asks for Air Staff assistance in campaign plan.
8-10	Warden briefs Schwarzkopf.
8-13	Warden briefs Powell—Powell demands Iraqi armor as target.
	Checkmate begins planning operations versus Kuwait theater of operations.
8-17	Final Instant Thunder brief to Schwarzkopf. Glosson assigned to campaign planning.
8-?	Late August the RGFC divisions pull back to Iraqi/Kuwait border/exchange positions with infantry and assume reserve position.
12-30/31	Night Camel Exercise F-111s observe VII Corps armor with infrared systems.
1-16	Air campaign begins.
1-27	A-10s directed to plan RGFC attacks.
1-29	A-10 attacks on the Tawakalna Division. Bomb damage assessment (BDA) labeled "nonexistent" by Lt Col Richard B. H. Lewis, United States Central Command Air Forces. Schwarzkopf criticized J-2, "vehicles had to be on their backs for J-2 to assess a kill."
1-31	US Army Central Command (ARCENT) assesses RGFC at 99 percent strength.

2-1	Theater reconnaissance of Tawakalna Division inconclusive. A-10s conduct visual recce.
2-3	388th Fighter Wing (FW) "frustrating missions" versus RGFC lead to request for Fast FACs.
2-4	363d FW forward operating location operations begin. Colonel Lewis researches ARCENT BDA criteria. First killer scout missions to increase F-1 effectiveness.
2-5	First tank plinking.
2-12	Commander in chief directs bombing stop versus units less than 50 percent.
2-15	BDA rules changed based on the Defense Intelligence Agency survey of the Tawakalna Division. A-10s lost over Medinah Division, A-10s pulled back.
2-24	Ground offensive begins.
2-26	Battle of 73d Easting Tawakalna Division destroyed.
2-27	Fire support coordination line moves north of the RGFC. Battle of Medinah Ridge, Medinah Division destroyed.
2-28	Hostilities ended with remainder of RGFC in Basrah pocket.

Appendix C

Location of Air Strikes during Desert Storm

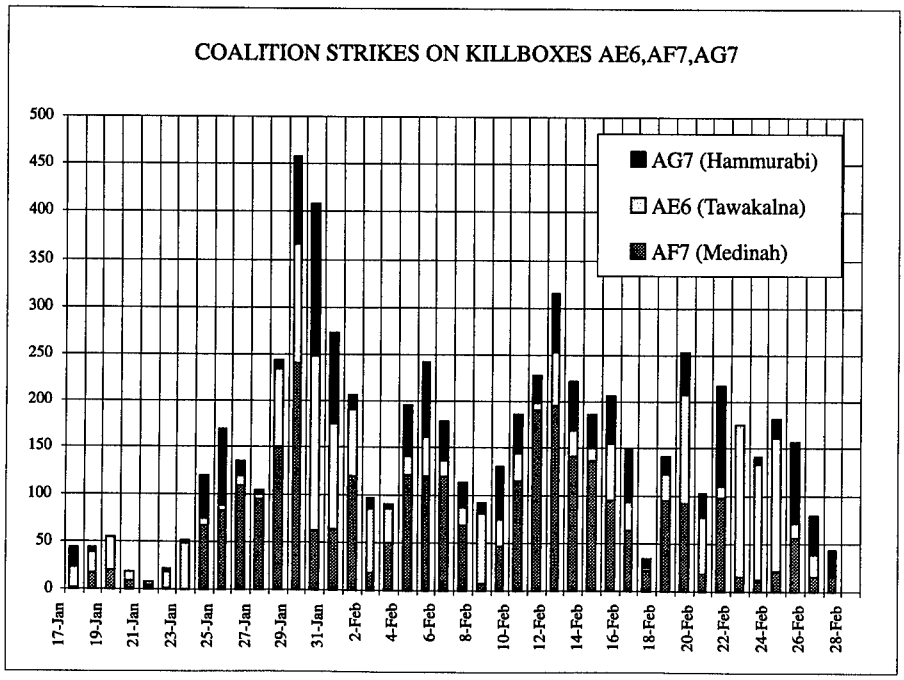


Source: *Gulf War Air Power Survey (GWAPS)*, vol. 5, *A Statistical Compendium and Chronology* (Washington, D.C.: Government Printing Office, 1993), pt. 1: 462–511.

This chart represents coalition air strikes as reported by the *Gulf War Air Power Survey (GWAPS)*. The RGFC line depicts the number strikes against kill boxes AE6, AF7, and AG7. The "Other KTO" line charts all other reported air strikes in the KTO. The "All Other" line tracks air-to-ground strikes outside the KTO, including missions against Scuds, counterair, interdiction, and strategic targets.

Appendix D

Distribution of Strikes against RGFC Heavy Divisions



Source: *GWAPS*, vol. 5, pt. 1: 462–511.

This chart depicts coalition air strikes as reported by the *Gulf War Air Power Survey (GWAPS)* against kill boxes AE6, AF7, and AG7. These three kill boxes contained the three RGFC heavy divisions. The first week saw few strikes on the RGFC units. The greatest weight of effort fell on the RGFC the last days of January. Air strikes never reached the 600 per day level used in the planning of Phase III.

Appendix E

Iraqi Prisoner of War Comments

These conflicting accounts were used to support conflicting claims in the aftermath of Desert Storm.

Airpower: "One Iraqi prisoner, a division commander, put it bluntly. 'Why did your men give up?' his interrogator asked. 'You know,' he replied sullenly. 'I don't know. Why?' the interrogator persisted. 'It was the *airplanes*!' he responded." (Source: USAF Report, "Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf War.")

A-10: "The single most recognizable, and feared, aircraft at low level was the A-10/Thunderbolt II. This black-colored jet was seen as deadly accurate, rarely missing its target. Seen conducting bombing raids three or four times a day, the A-10 was a seemingly ubiquitous threat. Although the actual bomb run was terrifying, the aircraft's loitering around the target area prior to target acquisition caused as much, if not, more anxiety since the Iraqi soldiers were unsure of the chosen target."—36-year-old Iraqi captain (Source: A-10 Combat Recap).

Tank Plinking: "During the Iran War, my tank was my friend because I could sleep in it and know I was safe . . . none of my troops would get near a tank at night because they kept blowing up."—Iraqi general (Source: "Reaching Globally, Reaching Powerfully.")

B-52: "One troop commander, interrogated after the war, stated he surrendered because of B-52 strikes. 'But your position was *never* attacked by B-52s,' the interrogator exclaimed. 'That is true,' he stated 'but I had seen one that *had* been attacked.'" (Source: "Reaching Globally, Reaching Powerfully.")

USAF versus Artillery: "[An] Iraqi division commander on the front lines when asked by interrogators 'why didn't you use your artillery?' He said, 'It was 100% destroyed by air. . . there was a division behind me and I asked for their artillery and it was sent forward, and, it was 100% destroyed enroute to my

position.'" (Source: General Horner, "Dadaelian Dinner Speech.")

US Army versus artillery as paraphrased by Colonel Scales, USA: "A prisoner of war whose artillery unit who opposed VII Corps . . . revealed that his 64 gun battalion group lost seven pieces during the air phase and 46 to MLRS raids. . . . One captured battalion commander stated that his unit fired only once during the battle, and within moments, artillery bomblets devastated his position. A third of his soldiers fled the position and left most of his guns destroyed and the rest of his soldiers dead." (Source: Col Robert H. Scales Jr., "Accuracy Defeated Range in Artillery Duel," *International Defense Review*, May 1991.)

M1A1 Abrams: "On 17 January, I started with 39 tanks (T-72M1). After 38 days of aerial attacks, I had 32, but in less than 20 minutes with the M1A1, I had zero. . . ."—An Iraqi battalion commander captured by 2d ACR as told to Colonel Holder, 2d ACR on 16 April 1991.

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