Theater Missile Defense

Reflections for the Future

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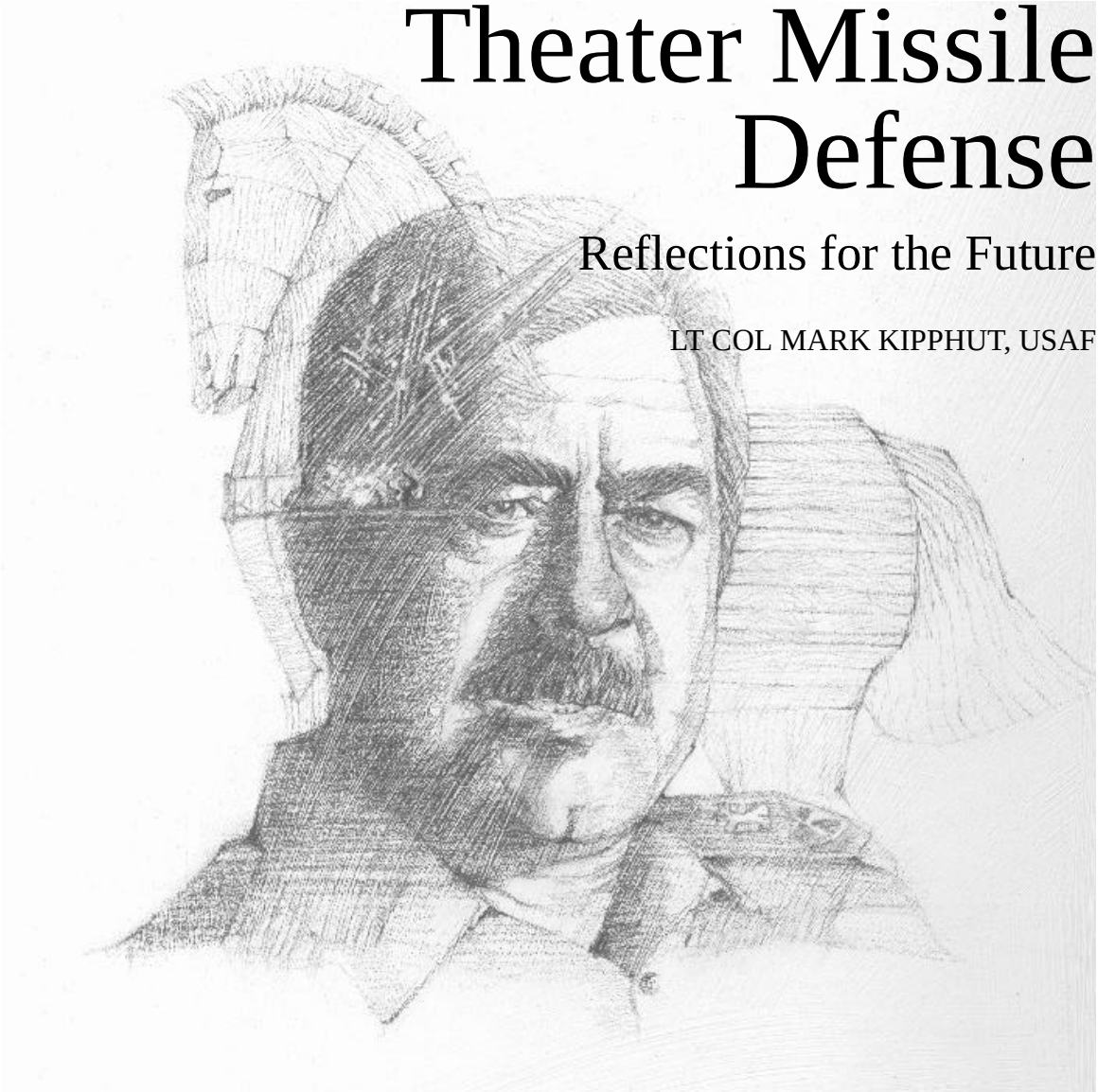


AS A RESULT OF Gulf War efforts countering Saddam Hussein's short-range ballistic missiles (SRBM), theater missile defense (TMD) has emerged as a leading doctrinal issue. Our inability to halt Scud attacks spurred a virtual cottage industry. Pundits and prognosticators of all shapes and sizes are offering insights into how we should best counter this "new" threat. The two distinctive TMD lessons that emerged from the Gulf War were (1) that missiles will play a significant role in future wars, and (2) that locating, targeting, and destroying mobile missile transporter-erector-launchers (TEL) is both time and resource intensive. Yet before the United States Air Force (USAF) develops new TMD doctrine, tactics, techniques, and procedures, it would serve us well to first reflect on the past.

Background

The Gulf War was not the first time airpower was required to counter enemy cruise or ballistic missile attacks. During World War II, Operation Crossbow, the Allied attempt to counter German V-1 and V-2 operations became the dominant focus shaping airpower employment during the critical spring and summer months of 1944. Unfortunately, Gulf planners did not learn Crossbow's lessons, because, as this article shows, most of the challenges faced in World War II resurfaced during efforts to suppress Scuds during the Gulf War.

Two factors inhibited Gulf War air planners from properly anticipating or countering the Iraqi Scud menace. First, Air Force officers are poor students of history. Our intellectual foundation tends to be based on Jominian reductionism. Rather than properly studying history to gain a rich appreciation of the subtleties of war, we ransack the history record in search of principles that guarantee success. This "cookie-cutter" approach typically leads to dogmatic application, not strong doctrinal thought.[1]

Before the USAF develops new TMD doctrine, tactics, techniques, and procedures, it would serve us well to first reflect on the past.

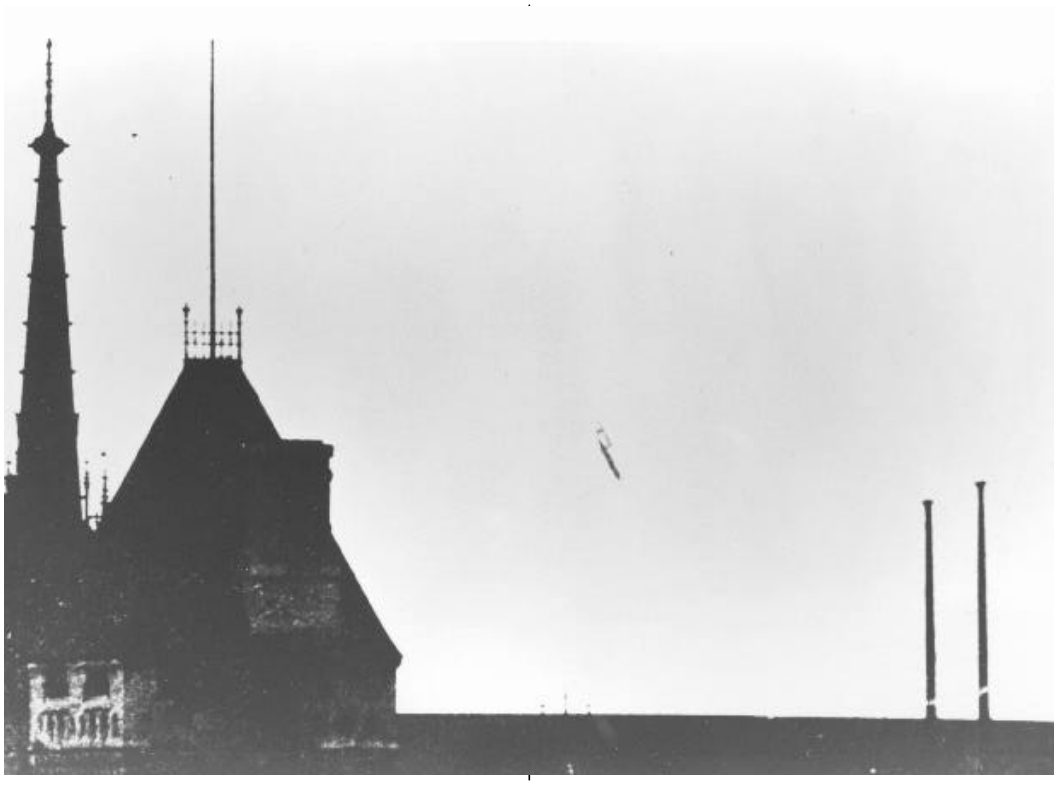
To avoid this pitfall, the Air Force must reject its biases toward using history to discover the indisputable laws of war and instead adopt a Clausewitzian view that requires that history be properly studied to gain an appreciation of the physical and psychological factors governing conflict. This approach instructs us how to think, not how to act. For Clausewitz it was not a matter of *"knowing* that," which is important, but of *"knowing how to act,"* which is critical![2] The examination of history, therefore, yields no specific formula, no single guide for action; instead, it educates the warrior to find his way through the jungle of chance and uncertainty that characterizes the combat environment.

The second inhibiting factor is the Air Force doctrinal bias for air superiority based on neutralizing manned fixed-wing aircraft. Airmen often proclaim that, first and foremost, the enemy's air forces must be defeated by air supremacy—*a war cannot be won without it*.[3] This belief suffers from "mirror-image" analysis. Because America relies on fixed-wing aircraft as the primary means of waging air war, then these must be the only "things" that are really important. *This is dogma,* not doctrine. It ignores the trend within the third world, where ballistic missiles play an important role.[4] The initial drafts of the latest Air Force doctrine are reexamining the restrictive definition of air superiority, but changing doctrine requires more than just new words; we must refocus our thinking![5]

Just seven days after D day, a V-1 launched from France hit a railroad bridge in London. Thus, a new era in warfare was born—the employment of missiles against civilian and military targets. Iraqi use of Scuds during Desert Storm continued this trend.[6] Adolf Hitler and Saddam Hussein had similar purposes for launching their missiles. Each wanted to incite civilian terror to erode public support for the war effort and to provoke a reaction from his enemy that could fundamentally alter the war. Despite inaccuracy and small warheads, ballistic missiles can leverage an opponent and contribute to breaking the enemy's will to fight.

Hussein learned this during the savage Iran-Iraq war. In response to Iranian missile attacks against Baghdad, he ordered the launch of almost 200 missiles at Iranian cities, primarily Tehran.[7] The Iraqi missile attacks caused little destruction, but each warhead had a psychological and political impact—the strikes boosting Iraqi morale while causing almost 30 percent of Tehran's population to flee the city. The threat of rocketing the Iranian capital with missiles capable of carrying chemical warheads is cited as a primary reason why Iran accepted a disadvantageous peace agreement.

Despite the role ballistic missiles played in ending the Iran-Iraq war, coalition commanders and their staffs did not appropriately anticipate the impact that Scud attacks would have on their plans. They grossly underestimated political



A V-1 ends its flight. Airpower failed to achieve its objective of "limiting the intensity" of either the V-1 or V-2 once German launch operations began.

pressures and their impact on resource allocations as a result of the attacks on Israel. In both World War II and the Gulf War, airpower was the principal means employed to stop enemy missiles, and in each case the results were at best inconclusive, and at worst, absolute failures.[8]

Crossbow Campaign

Originally, Hitler had set the end of December 1943 as the target date for the start of the V-1 and V-2 assault.[9] However, the effects of Allied air attacks and German developmental problems delayed the first attacks until D day. The German objective was to attack the United Kingdom with approximately 94,000 tons of high explosives per month and by 1945 German planners estimated they could strike southern England with one million tons of explosives per year. *This would have equaled 60 percent of the total Allied Combined Bomber Offensive (CBO) tonnage dropped during 1944, the best year of the CBO!*

If achieved, this objective would certainly have altered the war, especially if one considers the small geographic nature of southern England. Gen Dwight D. Eisenhower concluded that

> if the Germans had succeeded in perfecting and using these new weapons six months earlier, *our invasion of Europe would have been exceedingly difficult, perhaps impossible* . . . if the Portsmouth-Southhampton area had been one of the principal targets, *OVERLORD might have been written off* (emphasis added).[10]

Ultimately, due in part to Crossbow and other Allied operations, the Germans did not achieve their primary goals. Nevertheless, V-weapon suppression efforts had a tremendous impact on Allied air planning. Crossbow affected not only

the conduct of the CBO, but also strained the resources supporting Operation Overlord.

The Gulf War was not the first time airpower was required to counter enemy cruise or ballistic missile attacks.

Despite the Allies' best efforts, the Germans launched approximately 15,500 V-1 and V-2 missiles between June 1944 and March 1945, forcing Eisenhower to direct that Crossbow take priority over all other Allied air operations, including those in support of the Normandy beachhead and the CBO.[11] By the end of the war, suppression of V-weapons accounted for more than 69,000 strike sorties and almost 137,000 tons of munitions. Clearly, the Germans had created a major diversion, and if this threat was not neutralized quickly, the continued diversion of scarce airpower resources away from the Normandy lodgment and CBO could have jeopardized the entire Allied war strategy.

Allied Intelligence and Warning

By late 1942, the frequency of reports concerning new German "secret weapons" was increasing; and in early 1943, the British government received "unambiguous warning" of German intentions to attack Britain using unmanned missiles, possibly with chemical, biological, or nuclear weapons. In response, Prime Minister Winston Churchill tasked a special panel to direct all V-weapon intelligence activities and to recommend countermeasures. In November 1943, based on the committee's recommendations, the British War Cabinet directed an intensification of countermeasure efforts.

Crossbow began in earnest in December 1943, and eventually included all Allied offensive and defensive V-weapon countermeasures.[12] It was also in December that the British finally revealed to their American counterparts the full magnitude of the threat. Before then American aircraft had flown missions against V-weapon targets without fully understanding why. This delay slowed the full coordination of Allied efforts to suppress the threat.

Once all the critical details were disclosed, American leadership, both military and civilian, rapidly realized the potential impact of V-weapons employment. A conclusive estimate of German capabilities and intentions was sent to Gen Henry ("Hap") Arnold and Gen George Marshall by Eisenhower in December 1943. It claimed that "the equivalent of at least a 2,000-ton bombing attack [could be achieved] in a period of 24 hours."[13] This compares favorably with German planning that called for a maximum of just over 3,000 tons per day by mid-1944.[14]

Crossbow Planning

The objectives of Crossbow were to "delay the beginning of attacks and to limit their intensity once begun."[15] Overall, the height of the campaign was from August 1943 until August 1944, as the Allies first attempted to delay the introduction of V-weapons and then to suppress their use. Ironically, formally coordinated countermeasure plans were not developed and approved until after August 1944, when the threat had diminished.

The Allies established a combined planning cell to determine the best strategy for reducing missile capabilities. This organization, dominated by British officers, directed Anglo-American operations against all elements of German long-range missile programs, including research facilities, manufacturing plants, storage sites, launch sites, and airborne intercept operations until July 1944. Throughout Crossbow, the British approach focused on the physical destruction of the launch sites, while the American approach was to destroy the broader V-weapons support infrastructure, focusing on production capabilities, logistical support facilities, and the electric grids supporting the launch sites. These disagreements were never fully resolved; in fact, there was no single target set whose destruction could have halted German missile operations. Crossbow's success in delaying the introduction of V-weapons came from the cumulative effects of repeated operations against all elements of the "system."

Crossbow offensive operations can be divided into two phases: Crossbow I, April 1943 to early June 1944; and Crossbow II, mid-June 1944 to

May 1945. The first phase consisted of the initial identification of the V-weapons target set, primarily by aerial reconnaissance, and attacks against German-based research facilities plus the operational launch and support facilities being built in France. The second phase was more active, and arguably more critical, because it attempted to stop missile operations once strikes against England and other targets started. This phase broadened the focus of bombing to include supply sites, supporting infrastructure, and production facilities. In the end, the entire enemy V-weapon "system" was attacked—research and development facilities, manufacturing plants, transportation nodes, supporting electric grids, storage areas, and launch sites.

Crossbow Results

While the Allies succeeded in destroying or neutralizing all permanent V-weapon sites, the Germans displayed a capability to continue launch operations by limiting the signature of new, modified firing sites that utilized small, simplified launchers protected by extensive camouflage, concealment, and deception (CC&D) techniques. The United States Strategic Bombing Survey (USSBS) concluded that air attack against the entire V-weapon "system" slowed the introduction of the V-1 and V-2 by three to six months.[16] Therefore, Crossbow achieved one of its stated objectives: *"delaying the beginning of the attacks."* This allowed the Allies to execute Overlord before the full impact of Hitler's "secret" weapons could be realized. Both General Eisenhower and General Bradley make this point in their autobiographies.[17] *Based on this judgment, Crossbow I can be labeled a qualified "success"; however, without question Crossbow II must be labeled a dismal failure.* Airpower failed to achieve its objective of "limiting the intensity" of either the V-1 or V-2 once German launch operations began.[18] Despite the application of thousands of sorties against over 250 targets during the critical summer months of 1944, the Germans averaged just over 80 launches per day. German sources contend that they never failed to launch due to direct intervention by Allied airpower or a shortage in weapons.[19] On the other hand, Allied leaders devoted a significant effort to suppressing the threat at the expense of other critical missions.[20]

Crossbow Sortie Allocation

Crossbow operations between August 1943 and April 1945 required 68,913 strike sorties delivering 136,789 tons of munitions. They involved both strategic and tactical sorties.[21]

Strategic Air Forces. Overall, strategic air forces flew 53 percent of all Crossbow sorties (36,795) and delivered 84 percent of all tonnage (114,790). This equates to 5.6 percent of all sorties and 6.8 percent of all tonnage delivered between 1939 and 1945. Between August 1943 and August 1944, Crossbow consumed 14 percent of all Allied strategic sorties and 16 percent of total tonnage.

Tactical Air Forces. Tactical air forces flew 47 percent of all Crossbow sorties (32,091) while delivering only 16 percent of the total tonnage (21,999). From August 1943 to August 1944, tactical air forces devoted 17 percent of total sortie generation and 13 percent of total tonnage to Crossbow operations. Likewise, the RAF Fighter Command flew an additional 4,600 sorties, or 79 percent of all its offensive sortie generation, following the elimination of the strategic air threat to the United Kingdom, aimed at suppressing V-2 launch operations. Finally, Crossbow consumed 40 percent of reconnaissance sorties after 1943.

Crossbow Observations

The four major lessons airmen should derive from Crossbow are:

- Attacking an enemy's missile infrastructure can be effective as a long-term strategy, but such an approach is unlikely to have an immediate impact on stopping launch operations.
- Effective attacks against small, mobile targets employing CC&D efforts requires real-time reconnaissance support; otherwise, targets are going to be difficult to find, if not impossible to attack.

- Planning requires comprehensive intelligence support that extends well beyond simply focusing on the technical capabilities of an enemy system. The corollary is that operational plans must fully take into account enemy actions and reactions.
- Political pressure can directly determine resource allocation.

Throughout Crossbow an extensive debate erupted over the best methods of neutralizing the threat. The British believed the destruction of the launch sites by heavy bombers would provide the best means to an end, while American airmen held the destruction of the supporting infrastructure by heavy or medium bombers would complement fighter-bomber attacks against V-1 sites.[22] These differences were never fully resolved, and only after extensive efforts failed to slow V-1 launch rates was the American approach finally accepted and implemented.[23]

The lack of a unified approach also wasted time and resources. For example, even after Allied intelligence confirmed that the fixed V-1 and V-2 sites were neutralized in July 1944, political pressure by the British government required Gen Carl Spaatz to continue to send heavy bombers against them. Precious resources were used to attack militarily insignificant targets while the legitimate needs of the CBO and the battle in Northern France went unsatisfied.

Overall, while air attacks did delay the introduction of V-weapons, it did not seriously hinder or halt launch operations once they were initiated. It appears that the better approach would have been to adopt a strategy closer to American recommendations, augmented by additional defensive operations.[24] Postwar analysis shows that the greatest impact on German efforts came from the indirect effects that bombing had on disrupting V-weapon production and distribution. Silencing V-weapons eventually required ground forces to overrun the launch sites. Against this backdrop, the focus shifts ahead nearly 50 years to examine the challenges posed by Iraqi ballistic missiles.

The Great Scud Chase

By the time the United Nations authorized the coalition to "use all necessary means" to evict Iraqi forces from Kuwait, Hussein had few strategic options remaining.[25] One was Scud missile attacks against Israel to undermine the integrity of the coalition and to intimidate Saudi Arabia. Within 24 hours of the opening of Desert Storm, Iraq launched the first of at least 88 Scuds at Israel and the Arabian Peninsula.[26] Just as in Crossbow, the coalition responded by diverting precious resources away from other areas to counter Scuds. Hussein, like Hitler, created a significant diversion.

Approximately 4,750 anti-Scud sorties were planned, including the change or addition of 553 sorties.[27] Daily Scud-hunting sorties numbered between 75 and 160, or about 5 percent of planned daily sorties. Overall, counter-Scud efforts represented between 2 and 5 percent of all 55,075 offensive fixed-wing sorties generated by coalition airmen, 4 percent of all scheduled sorties, and 11.5 percent of all new sorties added to the daily air tasking order.[28] The anti-Scud strategy had essentially three parts: (1) preplanned attacks against production, storage, and fixed sites; (2) 24-hour patrols to disrupt prelaunch activities; and (3) 24-hour patrols to attack launch sites after they fired their missiles.[29]

Contrary to the postwar assessments of several authors, the existence and extent of Iraq's ballistic missile programs were fairly well understood.[30] Although, in retrospect, some US prewar technical estimates were less than 100 percent accurate, the general capabilities of Iraqi missile programs were well documented.[31] Additionally, Iraqi employment practices during its war with Iran were well understood by the US intelligence community and the academic world.[32] Had planners, both in Washington and in-theater, fully appreciated airpower's limitations during Crossbow and better understood Hussein's employment of ballistic missiles in the Iran-Iraq war, there would have been fewer surprises.

Coalition Intelligence and Warning

By 1990, Iraq had three mobile Scud or Scud-based variants in its inventory: the Soviet-supplied 160-mile-range SS-1 (Scud), plus two indigenous Scud variants, the 325-mile Al-Husayn and the 400-mile Al-Hijarah.[33] All were inaccurate and could only strike cities or other large-area targets. As a result, Iraqi Scuds were judged to be more of a psychological than a military threat.

Although the absolute number of Scud missile airframes available to the Iraqis was unknown, the Defense Intelligence Agency (DIA) had estimated that the Soviet Union delivered at least 600 missiles.[34] Postwar disclosures showed Baghdad had purchased around 800 missiles, many of which had been utilized to build Iraqi extended-range Scuds.[35] All Iraqi variants could be launched from either fixed sites or mobile launchers.[36]

The Iraqis used well-known Soviet doctrine for the deployment and employment of their SRBMs.[37] Iraqi missile crews required 60 to 90 minutes to set up and launch a missile from a presurveyed site. Based on Soviet and Middle Eastern models, it was believed that the Iraqis would launch from concealed locations and minimize their exposure while moving to and from launch locations. This included launching under the cover of darkness or weather.

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In an attempt to improve its capability to threaten Israel, Iraq constructed five fixed launching complexes in its western desert near the Jordanian border. These contained 28 launch positions, allowing the Al-Husayn missile to hit all major Israeli cities, nuclear facilities in the Negev desert, and Syria. The existence of these fixed launch sites led many planners to believe they had found their trump card: if these sites were destroyed, the threat to Israel would be diminished.[38] This was shortsighted because it minimized the role of mobile Scud operations and discounted a demonstrated Iraqi capability during the Iran-Iraq war.

In retrospect, the role the fixed sites played in Iraqi strategy is unclear. Iraq had the ability to target Israel using mobile launchers, and although the use of fixed sites may marginally improve accuracy, Scud missiles remained an area weapon. Therefore, there is a possibility that the fixed sites were an elaborate deception effort. Certainly the Iraqis, probably through their relationship with the Soviets, *the masters of modern deception*, considered using replicas to draw off enemy combat power.

Postwar analysis shows that the Iraqis also relied on other types of deception. They employed elaborate high-fidelity decoys to complicate targeting and protect TELs. This also confused the battle damage assessment process.[39] Planners should have anticipated Iraqi use of CC&D given the close Baghdad-Moscow relationship and Soviet doctrinal emphasis on active and passive deception techniques to protect high-value targets.[40]

The number of Scud TELs in service at the time of the war remains a source of contention. The uncertainty over this issue is often cited as the reason *why* coalition forces could not stop launches.[41] Prewar estimates and postwar analysis do not differ greatly. The lowest prewar count was 12, while the upper estimate was 22.[42] Postwar analysis places the number at 36 (33 operational), a number supported by the *Gulf War Air Power Survey (GWAPS)*, the air warfare survey commissioned by the USAF.[43] It was also believed before the war that Hussein's "missile-men" had presurveyed a number of launch sites within Iraq and Kuwait to support launch operations against Saudi Arabia and Israel.

Throughout the fall of 1990, estimates of the size and capabilities of the Iraqi SRBM force were under continual refinement as more infor-

mation became available. DIA established a special Scud Cell at its Washington-based Joint Intelligence Center. This group identified (1) the prewar dispersal of missiles from their garrisons; (2) the likelihood that Iraqis would use darkness or poor weather to mask employment; and (3) expected employment strategies, including attacks against Israel. The culmination of this effort came in December 1990, when the cell provided Central Command (CENTCOM) and its air component, CENTAF, a full appraisal of the Iraqi Scud force, including the expected launch sequences, existence of presurveyed launch points in the western Iraqi desert, use of dispersed logistical support, and the correct size of the mobile launcher force.[44]

Hussein stumbled onto a Clausewitzian approach, attacking Israel to provoke an Israeli counterstrike by overflying either Saudi Arabia or Jordan, or both. He reckoned Arab coalition members could never accept alignment with Israel against another Arab state; thus, by striking at Israel, he indirectly targeted coalition unity.[45]

Despite knowing this, US military authorities throughout the Gulf were surprised by the amount of political pressure generated by the attacks. Many senior leaders admit they underestimated the Scud's impact because of its notorious inaccuracy and small warhead.[46] Gen H. Norman Schwarzkopf regarded the missiles as "militarily irrelevant." His most senior airman and joint force air component commander (JFACC), Lt Gen Charles Horner, thought the missiles were "lousy weapons." His chief planner, Brig Gen Buster Glosson, believed they were "not militarily significant."[47] It was only after significant pressure was imposed from Washington that the commander in chief (CINC) of CENTCOM "got the message" and redirected his forces to attempt to stop, or at least try to suppress, missile launches.[48]

Counter-Scud Planning

To understand how coalition counter-Scud operations were conducted, it is necessary to first consider how the air campaign plans were derived and integrated into the CINC's joint campaign. In August 1990, President George Bush specified US national objectives as:

- Immediate, complete, and unconditional withdrawal of all Iraqi forces from Kuwait;
- Restoration of Kuwait's legitimate government;
- Security and stability of Saudi Arabia and the Persian Gulf; and
- Safety and protection of American citizens abroad.[49]

As the third policy objective implied, the president determined early on that, in addition to the restoration of Kuwait, US forces would eliminate Hussein's capability to continue to threaten the region. Implied was the destruction of Iraqi ballistic missiles and any program to mate them with weapon of mass destruction (WMD) warheads. This objective was central to all subsequent political and military strategies adopted throughout Desert Storm.

To achieve the president's objectives, General Schwarzkopf, in concert with Secretary of Defense Dick Cheney, identified five primary operational objectives:

- Neutralize the Iraqi national command and control system;
- Eject Iraqi armed forces from Kuwait;
- Destroy the Republican Guard;
- Destroy Iraqi ballistic missile and nuclear, biological, and chemical (NBC) capability; and
- Assist in the restoration of the legitimate government of Kuwait.[50]

From these objectives, General Schwarzkopf refined his mission statement to include the need to "as early as possible, destroy Iraq's ballistic missile and NBC capabilities."[51] He established the following as the focus for CENTCOM Operations Order 91-001, 17 January 1991, which directed combined military operations during Desert Storm:

- Attack Iraqi politico-military leadership and command and control;
- Gain and maintain air superiority;
- Sever Iraqi supply lines;
- Destroy nuclear, biological and chemical production, storage, and delivery capabilities;
- Destroy Republican Guard forces in the Kuwait theater; and
- Liberate Kuwait City. [52]

This demonstrates that General Schwarzkopf had little latitude concerning the reduction of Iraqi missile capabilities. Scuds, along with Iraq's NBC program, were to be destroyed. By accomplishing this, it was assumed that the regional threat posed by Hussein would be eliminated and the "security and stability of Saudi Arabia and the Persian Gulf" would be maintained. General Schwarzkopf relied on airpower, under the direction of General Horner, to achieve this objective. General Horner, in turn, directed his staff to eliminate Iraqi Scud capabilities as quickly as possible during the opening phase of the air campaign.

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General Horner envisioned three counter-Scud objectives: (1) keep Israel out of the war; (2) destroy Iraq's Scud-associated production facilities; and (3) find and destroy Scud TELs that threatened the Arabian Peninsula. Initially, only a few missions were planned against the western launch sites and a limited number of other missile production and support facilities. The following target sets were to "reduce [the] offensive threat to regional states and friendly forces":

- Fixed Scud launchers,
- Ballistic missile support bases,
- Known surveyed launch sites for mobile launchers,
- Hardened aircraft shelters possibly hiding mobile launchers, and
- SRBM research, development, and production facilities.[53]

However, when the war started and Iraq began launching missiles, counter-Scud efforts rapidly expanded and eventually consumed the daily sortie-generation equivalent of a fighter wing.[54]

Iraq's ballistic missile program was considered critical; however, due to assumptions made in Washington, and later retained bmade in Washington, and later retained by theater planners, initial efforts focused solely on attacking the fixed sites in western Iraq and SRBM production and storage facilities.[55] The hope was to neutralize the short-term threat to Israel and to eliminate the long-term threat to the region.[56] The theater commanders and staffs recognized that the potential impact of the Iraqi mobile launcher targeting problem was too difficult to solve and that despite best efforts some TELs would escape to launch their missiles.[57] Reflecting the views of Generals Schwarzkopf and Horner, planners regarded Iraqi Scuds as "nuisance weapons." They believed the best strategy was for the coalition and Israel to absorb the attacks. In their view, to attempt to locate and destroy mobile TELs was sortie-intensive and counterproductive.[58] Therefore, a prewar search-and-destroy scheme for finding and attacking mobile Scuds was not devised.[59] Only after Scuds were launched at Israel did the theater develop a counter-TEL strategy.[60]

The low priority initially placed on counter-Scud efforts is reflected by the growth in the total number of SRBM targets. In August 1990, 24 were identified, but by mid-January the number grew to 121.[61] Postwar analysis concluded that by July 1992 there were at least 154 SRBM-asso-

While on the surface it appears the counter-Scud operations enjoyed some success in achieving their objectives, closer examination reveals several major shortcomings. A defeated Scud (above) and Scud damage (below, left and right).

ciated targets located within Iraq, a 583 percent growth from August 1990.[62] This was the largest growth in any single strategic target category and it reflected the same phenomena as existed in Crossbow, when total targets grew from under 10 to over 100.

Counter-Scud Operations

In the opening hours of Desert Storm, counter-Scud efforts progressed as planned; however, within hours of the first air attacks, Hussein initiated launches against Israel. These attacks revealed the true face of the threat—mobile launchers capable of moving quickly from hidden sites, firing, then hiding again before an air attack could be mounted.[63] However, despite his best efforts, Hussein could not provoke an aggressive Israeli response. Tremendous political pressure was applied to Washington by Jerusalem, forcing significant diversions of air resources from other missions. General Horner remarked that the greatest pressure placed upon him during the war was to stop, or reduce, Scud launches.

During the course of Desert Storm, the coalition scheduled and flew 1,460 strikes against Scud-related targets.[64] Fifty percent were directed against fixed launching sites or other "structures" (e.g., aircraft shelters, overpasses, etc.) suspected of hiding TELs.[65] Of the remaining strikes, 30 percent were directed against infrastructure or production facilities with only 15 percent conducted against exposed TELs.

By the third day of the air war, coalition "hunter-killer" aircraft remained continuously airborne over suspected launch areas. Theoretically, these combat air patrols (CAP) could rapidly react to either airborne or ground-based queuing or targeting, although in practice this proved almost impossible. Counter-Scud sorties and strikes exceeded those generated for suppression of enemy air defense missions, destruction of military-associated production facilities, and the severing of the lines of communications from Iraq to Kuwait.[66] Only attacks against air bases and ground forces required a greater effort.

Multiple strategies were used to deter launches. Aircraft flew along roads believed to support Scud movements and dropped bombs at predetermined intervals to disrupt movement or launch preparations. As the air war progressed, highway overpasses, culverts, bridges, and other suspected Scud hiding places were attacked using precision guided munitions, mainly laser-guided bombs. Entire areas were targeted with CBU-89 area denial mines to hamper the TELs' mobility and deny them use of suspected assembly and launching areas. A key element in this strategy was the employment of British and US special operations forces who provided vital targeting information for attacks on suspected Scud missile sites.[67]

Counter-Scud Results

To judge the overall effectiveness of Gulf War counter-Scud efforts, we should return to the original objectives of the campaign: to destroy ballistic missile production facilities and their infrastructure, to reduce the postwar long-term regional threat, to destroy Iraqi launch capabilities, and to maintain Israel's neutrality and minimize the impact on Gulf states.[68] While on the surface it appears that the counter-Scud operations enjoyed some success in achieving these objectives, closer examination reveals several major shortcomings.

First, postwar inspections showed that Iraq's long-term ballistic missile program was not destroyed. Second, there is no technical evidence that a single TEL was actually destroyed during the war, despite the claims of some 100 "kills" by aircrews and special forces.[69] Finally, fixed sites were neutralized, but it can be argued that these strikes were ineffective since the Iraqis relied exclusively on mobile launchers for employment. The exact impact of coalition operations against mobile systems is more problematic. Iraqi launch operations never stopped and only diminished somewhat over time, although during the last week of the war launch operations increased in tempo.[70] At best, it can be said that counter-Scud efforts only maintained "pressure" on Iraqi missile operations and that Scud CAP operations apparently were successful at harassing but never halting Iraqi launch operations.

The harsh reality is that airpower did not stop

Scud employment. This failure can be attributed to multiple reasons, but the root causes can be traced to three primary planning issues.[71] First was the low priority that planners placed on Scud suppression and the resulting failure to anticipate the political pressure generated by attacks on Israeli cities. Second was the false assumption that Iraq could significantly threaten Israel only from fixed sites. Finally, planners assumed that if required to find and destroy mobile Scuds, intelligence would provide adequate queuing for aircraft and that Iraqi CC&D would not complicate targeting.

The first failure was predictable. The neutralization of Scuds was a low prewar priority for CENTCOM. This is reflected by senior leader comments and by how CENTCOM portrayed the SRBM threat in prewar exercises. Only seven Scud-associated facilities made CENTAF's July 1990 exercise Internal Look target list (of a total of 218), while none were on CENTCOM's target list (of a total of 293).[72] Later, during the early months of Desert Shield, the Scud threat was perceived as a distraction, and Scud attack facilities played only a minor role in the development of targeting strategies. The focus was on neutralizing fixed sites and destroying Scud garrisons, storage, and production facilities.[73] No real thought was given to dealing with the mobile launchers, except to keep a few fighter-bombers on strip alert to attack launch preparations based on queuing by national or theater sensors. Planners assumed, incorrectly, that intelligence would provide one to three hours' warning of launch preparations, which would allow coalition forces to locate and attack the launch site.[74] This is a classic case of "wishing away" the threat. In December 1990, DIA provided guidance that (1) mobile Iraqi missile crews were dispersed and would not require more than 60 minutes to launch a missile, (2) the intelligence indicators that air planners were relying upon to identify and target launch sites would not exist, (3) the Iraqis were prepared to use presurveyed sites and were taking steps to enhance survivability, and (4) attacking mobile launch operations would be very difficult, if not impossible.[75]

The second mistake was more damaging because it assumed away a proven enemy capability. During the Iran-Iraq war, Hussein demonstrated time and time again that he could hit Tehran with missiles launched from Iraqi territory.[76] The distances from Iraqi border areas are the same as those from the western desert to Israeli cities, and therefore it should have been apparent that Iraqi mobile launchers could be utilized to conduct operations against Israel. Instead, airmen became focused on the fixed sites. This, coupled with undervaluing the mobile threat, resulted in the failure to consider the need for round-the-clock Scud CAPs.[77]

Finally, the final fundamental planning error was made when planners assumed decoys and other CC&D efforts would not greatly complicate targeting, thereby disregarding well-known *maskirovka* practices.[78] This ignored evidence gathered during prewar Air Force and Navy tests designed to determine the degree of difficulty aircrews would face in finding and destroying highly mobile targets. During Desert Storm, over 80 percent of the Scud launches occurred at night, and the lack of success in locating TELs during prelaunch and postlaunch operations reiterated the findings from Touted Gleem.[79] This test aptly demonstrated the difficulty US aircraft, such as the F-15E, would have in finding a field-deployed TEL.

These critical planning assumptions proved incorrect. Because of the earlier miscalculation of the nature of the Iraqi threat, General Horner had to divert significant numbers of sorties as well as other resources away from their planned missions to attempt to suppress the Scud threat. This diversion of resources, although not hindering the accomplishment of other missions due to the plethora of available aircraft, did fail to clearly and decisively accomplish any goals established for counter-Scud efforts. It can be argued that the Scud was Hussein's most effective weapon. It drew off significant numbers of sorties from other missions and provided him with his only real offensive potential.[80]

Future Considerations

Due to the growing proliferation of SRBMs, future Air Force leaders will face more challenges than their predecessors. Technological enhance-

ments, combined with increased employment sophistication, will make future counterballistic and cruise missile operations more difficult and will likely require even more resources. Hitler and Hussein effectively tied up hundreds of aircraft and thousands of sorties with small numbers of launchers and missiles while retaining the capability to threaten allied unity and strategy. Ballistic missiles offer smaller, resource-constrained states a cost-effective alternative to fielding large manned air forces. The Department of Defense's (DOD) final report on the Gulf War was clear on this point:

> Locating and destroying mobile missiles proved very difficult and required substantially more resources than planned. *This could be a more serious problem in the future against an enemy with more accurate missiles or one who uses* weapons of mass destruction *(emphasis added).*[81]

It is imperative that DOD and the Air Force intensify efforts to develop doctrine, tactics, techniques, and procedures for neutralizing enemy ballistic missiles. Our aerospace control doctrinal concepts and definitions need to be expanded to include both the enemy's aviation and missile assets. Countering ballistic missile operations must become integral to our planning efforts and exercise scenarios. Dedicated TMD exercises such as the Roving Sands series are a step forward, but greater emphasis must be placed on indoctrinating TMD principles and mind-set throughout US forces.[82] By examining and comparing World War II and Gulf War countermissile efforts, future planners can glean the following insights.

First, planners must not allow themselves to become doctrinally constrained when developing air campaign concepts. Even after the full implications of German and Iraqi missile programs were known, theater leadership did not fully appreciate the magnitude of the threat until *after* enemy attacks began.[83] Initial countermeasures in both wars mimicked our approaches to neutralizing traditional air force structures; that is, they focused on destroying fixed installations, including production facilities, launch locations, and support infrastructure. Little thought was given to suppressing mobile launchers. Furthermore, General Schwarzkopf's reluctance to employ special forces to enter Iraq to monitor Scud deployments significantly undercut his abilities to influence later enemy operations.

Second, countering enemy ballistic missiles is time- and resource-intensive. Future joint force commanders must recognize that gaining control of the battlespace requires the elimination of both aircraft and missiles. Future missile suppression efforts will be as resource-intensive as past operations, perhaps more so. Roving Sands '95 demonstrated this tactic when ballistic missile attacks consumed 17 percent of all air efforts over the first five days. Despite this level of effort, friendly forces succeeded in reducing the enemy missile infrastructure by only 40 percent.[84]

Third, the Air Force must continue to widen its concept of air superiority to include remotely piloted vehicles and cruise and ballistic missiles. The Air Force must revise the belief, as articulated by some theorists, that without air superiority, "victory" is not possible.[85] When Hitler unleashed his missile assault, the Allies had mastery of the European skies, yet his forces launched over 15,000 missiles. Almost 50 years later, Iraq launched Scuds after losing air supremacy. Neither the Germans nor the Iraqis controlled the air, yet if the Germans had disrupted Overlord operations or the Iraqis had succeeded in hitting an Israeli city with a chemical warhead, either conflict would have changed fundamentally.

Aerospace control infers denying enemy aviation and missile forces effective use of the environment, yet Air Force doctrine continues to focus on countering enemy air forces as the primary method of achieving aerospace control. To eliminate this deficiency, Air Force doctrine must be broadened to incorporate TMD as contributing to aerospace control, especially given the increasing role of ballistic missiles in the world today. The latest draft of Air Force doctrine is addressing this shortfall by expanding the definition of air and space control to include ballistic and cruise missiles. But the same draft goes on to state that

> offensive operations are most effective when conducted against theater missiles *before they are launched* (emphasis added) . . . preemptive destruction of known missiles and launch facilities

> may greatly limit subsequent theater missile attacks against friendly forces.[86]

This makes one wonder if the author is aware of the findings for either Crossbow or counter-Scud operations. Although advances in mating sensor and computer technology have reduced, if not eliminated, much of the enemy's ability to hide ballistic missile TELs, the complete and rapid neutralization of enemy missile forces remains unlikely. Prelaunch suppression of individual mobile launchers will remain a difficult challenge until the advent of long-dwell, all-weather sensors that can monitor a force once it disperses. Until then, alas, most planners will probably continue to rely upon the path of doctrinal dogma: *If it's easiest to destroy aircraft on the ground, then the same must be true for ballistic missiles*.

Fourth, planners must be aware that political pressures will force resource diversions after a threat fully materializes. A *"kitchen* sink *mentality"* develops to achieve immediate results. Enhancements in telecommunications and real-time news reporting will increase the pressures placed on theater commanders to halt enemy missile launches. This pressure will be greatest when civilian populations are at risk or the integrity of a political coalition is threatened. Israel demonstrated restraint, but only after the US maintained a 24-hour Scud CAP and the Israelis were allowed to nominate counter-Scud targets. Imagine the impact counter-Scud efforts would have had on mission accomplishment if the US had gone to war sooner. Fewer available combat, especially PGM-capable, aircraft; the predictable expansion of the target base; and the strains due to unanticipated mission requirements could have doomed the war effort.

Fifth, planning assumptions matter. Faulty assumptions will corrupt planning and can undermine a strategy. While developing the initial offensive air plans for Desert Storm, planners made several flawed assumptions about Iraqi Scud capabilities. Unfortunately, these were never adjusted, and they continued to provide the basis for TMD planning throughout Desert Shield and Desert Storm.[87] A critical mistake was made by not adjusting to new intelligence. During the six months preceding the war, new or updated intelligence regarding Iraqi SRBM capabilities was almost ignored. The result was that we were caught off guard when Hussein initiated an asymmetrical response to coalition air operations, forcing fundamental changes to the Desert Storm air execution.

If the Air Force is to remain the leader in air and space power, it must require its members to become better students of history.

Sixth, the application of airpower must support the attainment of operational and national objectives, not attempt to validate Air Force doctrine. Although this point may seem trivial, past experiences show airmen can allow preconceived views of airpower employment to override specific instruction from higher command authorities. Despite direction to the contrary, warriors in both wars resisted pursuing aggressive counter-SRBM strategies until ordered because they regarded these weapons as having little military consequence. Resistance reinforces the perception that airpower is more interested in justifying its own doctrine and independence than winning the war.

The political process will generate pressure to shift operational emphasis if tactical efforts are perceived to be either ineffective or not contributing to "ending the war." The media-generated drama played out each time a Scud was launched is an example of what the future portends. Planners must remain intellectually agile enough to respond to a wide range of contingencies while developing the mental toughness to maintain focus on proper mission execution. Our natural tendency is to resist change, but only by developing the ability to embrace change will the military retain its relevance. Only through rigorous planning can we learn to better anticipate friendly as well as enemy reactions to our actions. Preparation and deliberate planning before a crisis occurs are essential keys in maintaining a decisive edge—acquiring lessons from history or conduct-

ing doctrinal reflection after the crisis starts is fruitless.

Finally, future ballistic missile suppression operations will require dedicated, joint efforts to be effective. Joint doctrine acknowledges this, and Joint Pub 3-01.5, *Doctrine for Joint Theater Missile Defense (JTMD)*, highlights the requirement for effective JTMD operations to integrate both offensive and defensive approaches. This is similar in many respects to current counterair concepts to neutralize enemy fixed-wing airpower.[88] Intelligence integration using space-based, airborne, and surface-based systems is critical. Fundamentally, successful TMD requires a "family of systems" approach combined with joint war-fighting techniques. Airborne Scud CAPs remain the best response to enemy missile launch operations. Computer integration and logic-processing enhancements provide great promise for enhancing launch-point estimations and queuing for terminal attack operations. Finally, simulations and exercises remain critical in testing the synchronization between sensor and shooter links. Centralized command and control is also critical to integrate surface and air attacks against mobile launcher locations. Operational staffs must understand how to integrate airpower with operational fires to counter enemy SRBMs. Proven joint war-fighting concepts such as joint suppression of enemy air defenses (J-SEAD) provide excellent models for future planners.

Conclusions

The conduct of war is an intellectual process. Fighting battles and linking success to achieve operational objectives remains more art than science.[89] There are no absolute governing principles in war. Warfare is too complex, too nonlinear, to describe using a series of standardized doctrinal checklists. As Clausewitz observed over 175 years ago, the practice of war is an art requiring intellectual mastery, not mindless observance of a series of principles or application of formulae.[90] Military action produces not a single enemy reaction, but dynamic interactions. Because war is a mixture of physical and psychological activities, a universal theory of war that attempts to provide strict guidelines is unattainable. Ultimately, the study of the theory of war "is meant to educate the mind of the future commander, or, more accurately, to guide him in his self-education, not accompany him to the battlefield, just as a wise teacher guides and stimulates the student's intellectual development but is careful not to lead him by the hand for the rest of his life."[91] Therefore, the best path to understanding the future lies in mastering the past. If the Air Force is to remain the leader in air and space power, it must require its members to become better students of history. While not yielding specific doctrinal templates, history does provide fertile ground for developing judgment. If Air Force leadership and doctrine are to remain reliable and relevant to the future, our understanding of history must prove equally as sound. □

Notes

1. An example of this approach was articulated by Col John Warden, USAF, Retired, a leading airpower theorist, in "The Enemy as a System." *Airpower Journal* 9, no. 1 (Spring 1995): 41–45.

2. Michael Howard, *Clausewitz* (Oxford: Oxford University Press, 1983), 32.

3. This position has been articulated by several theorists, including John Warden. The fundamental underpinnings are found in Air Force Manual 1-1, *Basic Aerospace Doctrine of the United States Air Force*, vol. 1 (Washington, D.C.: Government Printing Office, 1992), 10–11.

4. Many states already incorporate ballistic missiles in their inventories: China, Egypt, India, Iran, Iraq, Israel, Libya, North Korea, Pakistan, Russia, Saudi Arabia, Syria, and Yemen. By 2000, over 20 states are projected to either have SRBMs or have the capability to produce them. Also, despite the reduction of Iraq's ballistic missile program, Baghdad is still assessed to possess a limited number of ballistic missiles. John Harvey, "Regional Ballistic Missiles and Advanced Strike Aircraft— Comparing Military Effectiveness," *International Security* 17, no. 2 (Fall 1992): 41; Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey (GWAPS) Report*, vol. 2, pt. 2, *Effects and Effectiveness* (Washington, D.C.: Government Printing Office, 1993), 321; Secretary of Defense, *Annual Report to the President and Congress* (Washington, D.C.: Government Printing Office, January 1994),

51–56; and Robert M. Soofer, "Joint Theater Missile Defense Strategy," *Joint Forces Quarterly*, Autumn 1995, 71.

5. Air Force Doctrine Document-1(AFDD-1), draft, "Air Force Basic Doctrine," Air University, Maxwell AFB, Ala., 5 August 1995, 11. The authors correctly are expanding the definition of offensive counterair (OCA) to incorporate all enemy air and missile power, including fixed- and rotary-wing aircraft, unmanned aerial vehicles, cruise missiles, air defenses, and ballistic missiles.

6. Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 3, *Argument to V-E Day, 1944–1945* (1948; new imprint, Washington, D.C.: Office of Air Force History, 1983), 84.

7. *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, D.C.: Government Printing Office, 1992), 1.

8. In both Crossbow and Desert Storm, planners employed both offensive and defensive missile countermeasures, although this paper only addresses offensive operations taken against enemy missiles.

9. The "V" designation originally meant *Versuchmuster* (experimental type), but was later interpreted as *Vergeltungswaffe* (vengeance weapon) by German propaganda services.

10. Gen Dwight D. Eisenhower, *Crusade* (New York: Doubleday, 1948), 260.

11. Craven and Cate, 527; and Richard Davis, *Carl A. Spaatz and the Air War in Europe* (Washington, D.C.: Smithsonian Institution Press, 1992), 428.

12. The focus of this article is on offensive countermeasures, but the Allies also poured a tremendous amount of resources into defensive measures; by the height of the V-1 assault, some 2,000 barrage balloons, 400 batteries of antiaircraft artillery, and 22 squadrons were deployed to defend London. Jozef Garlinski, *Hitler's Last Weapons* (New York: Time Books, 1978), 162.

13. Headquarters, European Theater of Operations, G-2, memorandum to the chief of staff, United States Army, providing all known details on German V-weapon programs, 13 December 1943, 4.

14. United States Strategic Bombing Survey (USSBS), Military Analysis Division, *V-Weapon (CROSSBOW) Campaign* (Washington, D.C.: Military Analysis Division, 1945), 4.

15. Ibid., 2.

16. Ibid.

17. Eisenhower, 260; and Gen Omar Bradley, *A General's Life* (New York: Simon & Schuster, 1983), 238.

18. USSBS, *V-Weapons (CROSSBOW) Campaign*, 2

19. Phillip Henshall, *Hitler's Rocket Sites* (New York: St. Martin's Press, 1985), 187.

20. Walter J. Boyne, *Clash of Wings: World War II in the Air* (New York: Simon & Schuster, 1994), 338.

21. USSBS, *V-Weapon (CROSSBOW) Campaign*, 25–29.

22. The British and Americans agreed that the "large" sites required attack by heavy bombers to be effective.

23. The acceptance of the American approach came too late. By the time it was implemented, Allied ground forces had already broken out of the Normandy beachhead and were threatening German V-1 launch areas.

24. Defensive operations were increasingly effective and by mid-August were successful in shooting down 74 percent of all V-1s crossing the coast. This improved to 83 percent by September. F. H. Hinsley, *British Intelligence in the Second World War*, abridged edition (London: Her Majesty's Stationary Office, 1984), 567.

25. *Conduct of the Persian Gulf War*, 21.

26. *Gulf War Air Power Survey (GWAPS) Report: Summary Report* (Washington, D.C.: Government Printing Office, 1993), 87. After the war, Iraq claimed it launched 93 modified Scuds to UN authorities documenting and destroying Iraqi ballistic missile, nuclear, chemical, and biological weapons programs.

27. "The Great Scud Chase" is a phrase immortalized by Gen Merrill McPeak, former Air Force chief of staff, at a news conference on 15 March 1991.

28. *GWAPS*, vol. 1, pt. 2, *Command and Control*, 216–45.

29. Ibid., 247.

30. An example is found in *GWAPS: Summary Report*, 123–24.

31. Thomas Christie and William Barlow, *DESERT STORM* Scud Campaign *(Washington, D.C.: Institute for Defense Analyses* [IDA]), I-13.

32. The best description of Iraqi and Iranian ballistic missile capabilities and employment practices was first published in 1990 in Anthony Cordesman and Abraham Wagner's *The Lessons* of Modern War, vol. 2, *The Iran-Iraq War* (San Francisco: Westview Press, 1990). This book accompanied many CENTCOM and CENTAF staff officers to the gulf throughout the summer and fall of 1990. Unfortunately, most apparently did not read this book since it very accurately described what would become the cornerstone for Iraqi strategy and tactics.

33. A third, longer-range variant, the 430-mile Al-Abbas, was not used during the war. *Conduct of the Persian Gulf War*, 13–14.

34. *GWAPS*, vol. 1, pt. 1, *Planning*, 210–11.

35. Richard Hallion, *Storm over Iraq: Air Power and the Gulf War* (Washington, D.C.: Smithsonian Institution Press, 1992), 178. In many cases,it required two or three basic Scud airframes to make a single Iraqi extended-range modified Scud missile. After the war, the UN Special Commission team responsible for the elimination of Iraq's weapons of mass destruction and ballistic missile programs verified the destruction of around 140 missiles. Altogether, the missiles destroyed by the UN, those fired during the Gulf War and the Iran-Iraq war, and those utilized to create extended-range Scud variants account for 570–640 Scud-B airframes. Due to the uncertainty in determining exactly how many Scud airframes the Iraqis had received, speculation continues that Iraq retains some 100–200 Scud-B airframes. *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 321.

36. Ibid., 320.

37. The *GWAPS* concluded Iraqi Scud strategies remained uncertain in the months prior to the war. However, review of the Gulf War Collection, Air Force Historical Research Agency (AFHRA), Maxwell Air Force Base, Alabama, reveals multiple assessments were made by a variety of national and theater intelligence agencies concerning Iraqi basing and employment philosophies, including launching procedures and time requirements. Virtually all the assessments, especially those by Defense Intelligence Agency (DIA), stated there was little uncertainty that Hussein would employ ballistic missiles against regional population centers, including Israel, if coalition military action was taken to liberate Kuwait. The threat was taken so seriously that much of the discussion focused upon an Iraqi preemptive option.

38. General Horner predicted to Secretary of Defense Dick Cheney in December 1990 that the air campaign would "preclude" Iraqi missile attacks. *GWAPS*, vol. 2, pt. 1, *Operations*, 182.

39. Air Force Intelligence Agency (AFIA/INID), *Denial and Deception Digest*, 91-02, 12 February 1991; and Christie and Barlow, I-18. Air Force Historical Research Agency (AFHRA), Gulf War Collection.

40. During the war, allied aircrews claimed some 80 mobile launcher kills, yet the postconflict *Gulf War Air Power Survey (GWAPS*) concluded there was no evidence the coalition destroyed any mobile launchers and most, if not all, of the kills were actually against high-fidelity decoys or other vehicles bearing a similar signature. *GWAPS: Summary Report*, 83–90.

41. For the two best examples of critics of the intelligence community who contend the underestimation of the number of mobile launchers constituted an intelligence "failure," see Hallion, 179; and James A. Winnefeld, Preston Niblack, and Dana J. Johnson's *A League of Airmen: US Air Power in the Gulf War* (Santa Monica, Calif.: RAND, 1994), 132. These authors contend the number of launchers possessed by the Iraqis was closer to 225, but neither presents any evidence to support this contention.

42. In addition to the initial estimates sanctioned by the US intelligence community, several rumors were circulating around Washington during August 1990 suggesting Iraq might possess several hundred, if not thousands, of mobile launchers. This highlights the dif-

ficulty planners can face during crisis periods in acquiring accurate and reliable information. Author's interview with several members of Checkmate and the Black Hole, 25–29 March 1996 and 15 May 1996.

43. Sources used include data acquired by the UN inspection teams, intelligence collected during the war, and defector reporting. The *GWAPS* concluded the Iraqis started the war with a total mobile launcher inventory in the high twenties to mid-thirties. Ibid., ix, *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 320–22, and *GWAPS: Summary Report*, 87.

44. These estimates are contained in the AFHRA, Gulf War Collection, CIS-37–CIS-44.

45. Michael Gordon and Bernard Trainor, *The General's War: The Inside Story of the Conflict in the Gulf* (New York: Little, Brown and Company, 1995), 228–33.

46. *GWAPS*, vol. 1, pt. 1, *Planning*, 103.

47. Ibid., 103–4; and Gordon and Trainor, 229.

48. Colin Powell with Joseph E. Persico, *My American Journey* (New York: Random House, 1995), 510–11.

49. *Conduct of the Persian Gulf War*, 19.

50. Ibid., 73.

51. Ibid.

52. Ibid., 74.

53. *GWAPS*, vol. 1, pt. 1, *Planning*, 165–66.

54. James Coyne, *Air Power in the Gulf* (Arlington, Va.: Air Force Association, 1992), 55.

55. Planners made the mistaken assumption during the construction of Instant Thunder, the predecessor to the Desert Storm air campaign, that if the fixed Scud sites were neutralized,the threat to Israel would be diminished. Theater planners later recognized the potential role mobile launchers could play but believed the resources necessary to reduce this threat would exceed expected gains. AFHRA, Gulf War Collection, Maxwell AFB, Ala., File CHSH-5 (Instant Thunder briefing), 8; and author's interviews with former Black Hole planners, 15 May 1996.

56. *GWAPS: Summary Report*, 43.

57. *GWAPS*, vol. 1, pt. 1, *Planning*, 166.

58. AFHRA, Gulf War Collection, 17August 1990 CENTCOM/CENTAF briefing to CJCS on the nature and capabilities of the Iraqi ballistic missile threat.

59. Ibid.; *GWAPS: Summary Report*, 43.

60. The degree to which Washington worried about Scuds more than theater leadership became evident in October when Joint Chiefs of Staff planners, at the insistence of Secretary Cheney, considered placing ground forces in suspected Scud launching areas that threatened Israel. Although discarded, this concept resurfaced in December. *GWAPS*, vol. 1, pt. 1, *Planning*, 103.

61. Ibid., 214.

62. Ibid., 219.

63. Hallion, 186.

64. *GWAPS: Summary Report*, 65.

65. *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 330.

66. *Conduct of the Persian Gulf War*, 159.

67. Douglas C. Waller, *The Commandos* (New York: Simon & Schuster, 1994), 346–51.

68. These are the measures employed by GWAPS to judge overall effectiveness. *GWAPS: Summary Report*, 78–90.

69. Despite the lack of technical evidence, based on the number of attacks and analysis of postwar intelligence, it is likely a limited number of TELs were destroyed. *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 340. Coalition crews reported destroying about 80 TELs and special forces another 20. Most reports probably reflected the results of a highly effective Iraqi CC&D effort and attacks against misfortunate Iraqi fuel tanker trucks that possessed "Scud-like" signatures. *GWAPS: Summary Report*, 83.

70. *GWAPS: Summary Report*, 88; and Waller, 346–48.

71. *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 321–23.

72. *GWAPS: Summary Report*, 32.

73. AFHRA, Gulf War Collection, File CHSH-5, INSTANT THUNDER briefing to president.

74. *GWAPS: Summary Report*, 79.

75. AFHRA, Gulf War Collection, DIA message to USCINCCENT responding to CENTCOM's request for information (RFI) concerning Iraqi Scud capabilities and operations, 7 December 1990.

76. According to Iranian sources, 71 percent of the modified Scuds launched by Iraq during the "War of the Cities" fell on Tehran. *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 319.

77. Black Hole planners claimed they began to recognize the threat presented by mobile launchers, but considered the resource implications for utilizing Scud CAPs at the start of the air campaign as too high in comparison with anticipated results. Author's interview with Black Hole planners, 15 May 1996; and *GWAPS: Summary Report*, 43.

78. *Maskirovka* is the Soviet-developed practice of using the aggregate measures of camouflage, concealment, masking, and deception to mislead and complicate adversary efforts to understand and counter friendly plans and capabilities. The Iraqis adopted a series of active and passive protection efforts, combined with an aggressive security program, to complicate the adversary's efforts to effectively target Iraqi military capabilities. Planners did not expect decoys to exist in such large numbers, nor did they expect the level of fidelity the Iraqis created. *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 54–55; *GWAPS: Summary Report*, 79; and author's interviews with Checkmate and Black Hole planners, 25–29 March 1996 and 15 May 1996.

79. A prewar test, code-named Touted Gleem, demonstrated conclusively that F-111F, F-15E, and LANTIRN-equipped F-16 fighters had less than a 50 percent chance of acquiring the Scud TEL even when the aircrews had precise target coordinates. TELs proved "virtually impossible to find" if the missile was not erect. This trend continued during the war when on 42 separate occasions, pilots visually observed a launch, yet in only eight cases were aircrews able to maintain visual to allow them to employ weapons. *GWAPS*, vol. 2, pt. 2, *Effects and Effectiveness*, 335.

80. *GWAPS*, vol. 1, pt. 2, *Command and Control*, 190.

81. *Conduct of the Persian Gulf War*, 188.

82. Roving Sands is an annual Joint Staff-directed exercise focused on theater ballistic missile defense operations, including operations designed to offensively explore ways to neutralize enemy ballistic capabilities.

83. As late as February 1944, General Spaatz was convinced the V-weapons associated construction was a German hoax designed to cause panic and drain resources. Richard Davis, *Carl A. Spaatz and the Air War in Europe* (Washington, D.C.: Smithsonian Institution Press, 1992), 426–32.

84. Ronald R. Fogleman, "Theater Ballistic Missile Defense," *Joint Forces Quarterly*, Autumn 1995, 75–79.

85. This is one of John Warden's central themes in *The Air Campaign: Planning for Combat* (Washington, D.C.: National Defense University Press, 1988). To disprove this theory, my faculty advisor was fond of saying, "Gee, I wish they would have told that to Ho Chi Minh."

86. AFDD-1, 12.

87. Ibid., 321–22.

88. Joint Pub 3-01.5 is composed of four integrated operations: passive missile defense, friendly efforts to minimize the effects of enemy missiles; active missile defense, intercept operations; attack operations, offensive efforts to neutralize enemy launch capabilities; and command, control, communications: computers, and intelligence capabilities to coordinate all friendly JTMD efforts. Joint Pub 3-01.5, *Doctrine for Joint Theater Missile Defense* (Washington, D.C.: Government Printing Office, 30 March 1994).

89. Both Hitler and Hussein used ballistic missiles in an attempt to achieve their strategic aims; however, each executed poor employment strategy. Hitler failed because he focused on the wrong targets; had he attacked the English ports supporting the invasion instead of London, he could have disrupted the invasion. Hussein never at-

tempted to launch a mass attack to maximize the shock effect of missiles. Had he struck Tel Aviv with a massed Scud attack, Israel probably would have had to respond militarily.

90. Peter Paret, *Clausewitz and the State* (Oxford: Clarendon Press, 1976), 371.

91. Ibid.

Prejudice against innovation is a typical characteristic of an Officer Corps which has grown up in a well-tried and proven system.

—Field Marshal Erwin Rommel