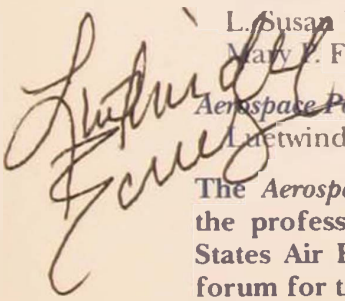
AEROSPACE POWER JOURNAL

Spring 2000



The *Aerospace Power Journal*, published quarterly, is the professional flagship publication of the United States Air Force. It is designed to serve as an open forum for the presentation and stimulation of innovative thinking on military doctrine, strategy, tactics, force structure, readiness, and other matters of national defense. The views and opinions expressed or implied in the *Journal* are those of the authors and should not be construed as carrying the official sanction of the Department of Defense, the Air Force, Air Education and Training Command, Air University, or other agencies or departments of the US government.

http://www.af.mil

http://www.aetc.randolph.af.mil

http://www.au.af.mil

http://www.cadre.maxwell.af.mil

AEROSPACE POWER JOURNAL

Spring 2000 Volume XIV, No. 1 AFRP 10-1

FEATURES

DEPARTMENTS

Lt Col Eric Ash, Editor

Just What Is Air *Force*?

IT IS INTERESTING to ponder the meaning of air *force* and what it will be in the future. As I recall from physics lessons at the Air Force Academy many years ago, force equals mass multiplied by acceleration *(F = ma)*. This familiar equation, which reflects the physical elements of force, also applies nicely to air *force*—one with effective, integrated air and space assets in the form of leading-edge technologies, smoothly operating organizations, and professional people. Our Air Force involves the synergy of mass and acceleration.

Mass, in terms of an air force, logically means our assets and the ability to bring those assets together appropriately. Mass is people, aircraft, missiles, and satellites. It is supporting infrastructure such as communications and transportation systems that quickly move information, equipment, and people worldwide. The article by Lt Gen Norton Schwartz and Col Robert Stephan proposes an air-minded perspective of how mass can be applied in an urban environment. Maj Gen Roger Brady's story of building expeditionary units in Kosovo pertains to the massing of forces where and when they are needed. The Air Force is currently studying mass, a time-honored principle of war, to rethink its specific application for modern aerospace power. Certainly, as the recent Balkans conflicts exhibited, mass or "concentrating combat power at a decisive time and place" (and, we might add, with near impunity) proved critical to NATO's success.

Acceleration is also a key to Air *Force* success. Our dynamic force constantly accelerates as the blistering pace of development in technologies, thinking, and organizing keeps the Air Force way out front. The Air Force continues to be a technological frontier with innovations in air, space, and information domains. Col Douglas Beason argues for better recognition of some of the technologists behind that process. Maj Chip Thompson explores the accelerating field of unmanned aerial vehicles, and the articles by Maj Howard Belote and Lt Col Cynthia McKinley pertain to one of the most rapidly accelerating domains in the Air Force—space.

An Air *Force* with energy, strength, and power second to none in the world is the product of the synergy between *mass* and *acceleration.* It is not something that just happened by chance. It was designed and created by people, and Air Force leadership continues to study future organizational and technological possibilities to produce the most economical and productive mix possible of people and machines to support national security. People give our Air Force direction, just as *F = ma* involves direction. *APJ* hopes to continue to be a part of that vector with contributions to the thinking behind the force. □

Don't Go Downtown without Us

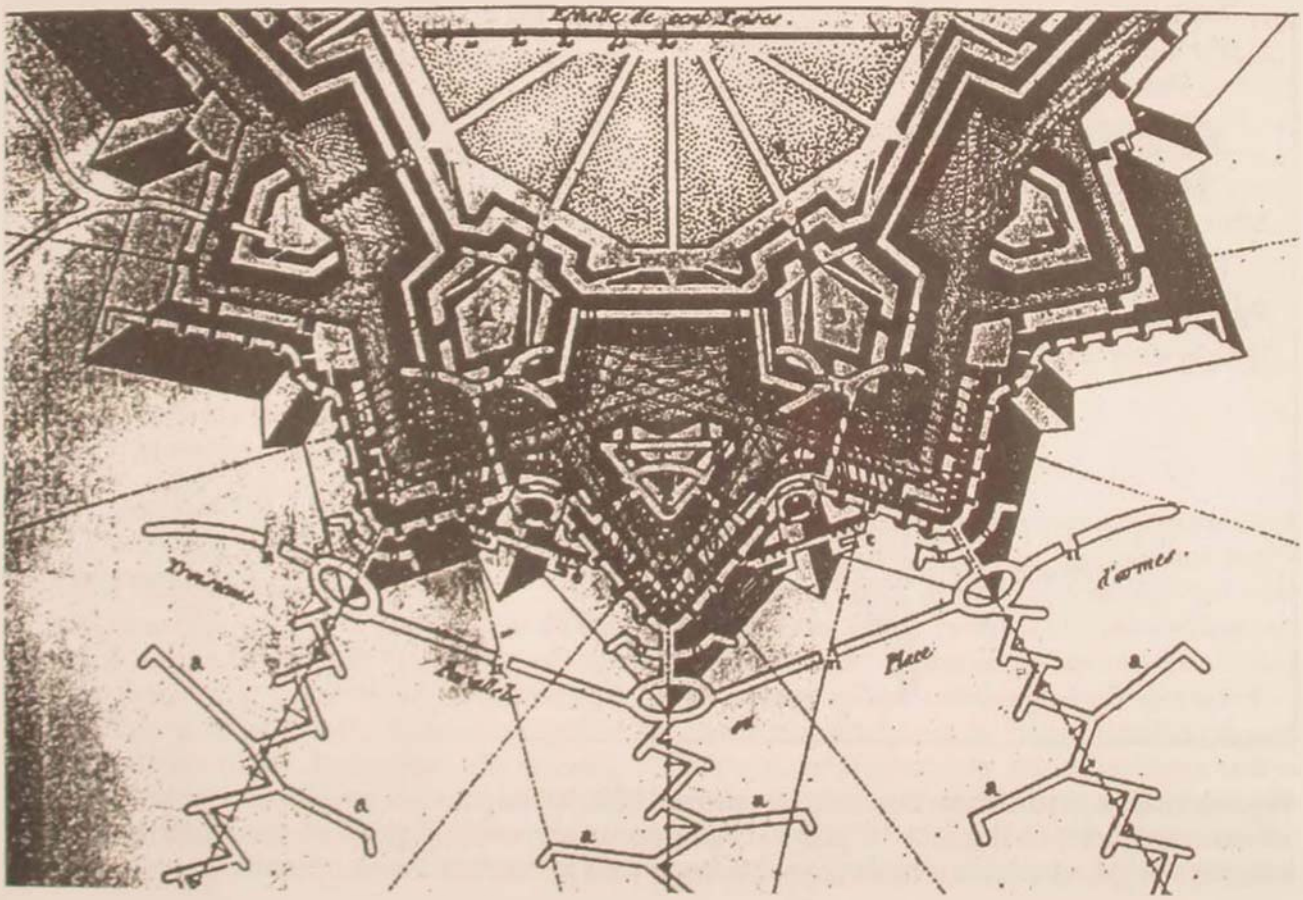
The Role of Aerospace Power in Joint Urban Operations

Lt Gen Norton A. Schwartz, USAF

Col Robert B. Stephan, USAF

FOR MANY PEOPLE, the term *urban operations* brings to mind the specters of Mogadishu, Hue City, and Stalingrad, where vicious, house-to-house infantry fighting was the order of the day. However, it is a mistake to view all urban operations through this bloody lens. Such operations, in fact, fall all along the spectrum of military operations—from humanitarian relief to peace support to major theater war (MTW). Aerospace power can play a major role in helping the joint force achieve its objectives with less risk in many scenarios across this operational continuum.

For good reason, analyzing, defining, and developing an urban-focused operational capability within our armed forces has received heightened emphasis as of late. This emphasis has manifested itself in a number of key national security documents, national policy



findings, war-gaming initiatives, independent analytical studies, and operational "lessons learned" reports.

Surprisingly, this recent focus on the "urban dimension" of military operations tends to obscure the fact that, from a historical perspective, urban operations are not a new phenomenon for the Air Force or our sister services. In fact, joint aerospace power in various forms has contributed significantly to successfully executed urban operations in many recent conflicts and contingencies (fig. 1).

As these cases illustrate, aerospace power—as a specialized subset of the joint force commander's (JFC) overall "tool box"—has consistently offered a unique set of options to increase the effectiveness of a full-spectrum joint campaign plan, while minimizing the risk to committed forces in this highly complex and uncertain environment.

The Operational Challenge

Policy makers, defense analysts, and academicians generally agree that military operations in urban environments are fraught with challenges, including complex, overlapping environmental, infrastructure, and population concerns. To meet these challenges effectively, commanders must develop plans and determine capabilities and resources appropriate to the urban arena, based on analysis of many interrelated factors, such as

- US interests and objectives
- Nature of the adversarial threat in terms of size, type, and organization
- Geopolitical and physical environments of the scenario at hand
- Domestic opinion

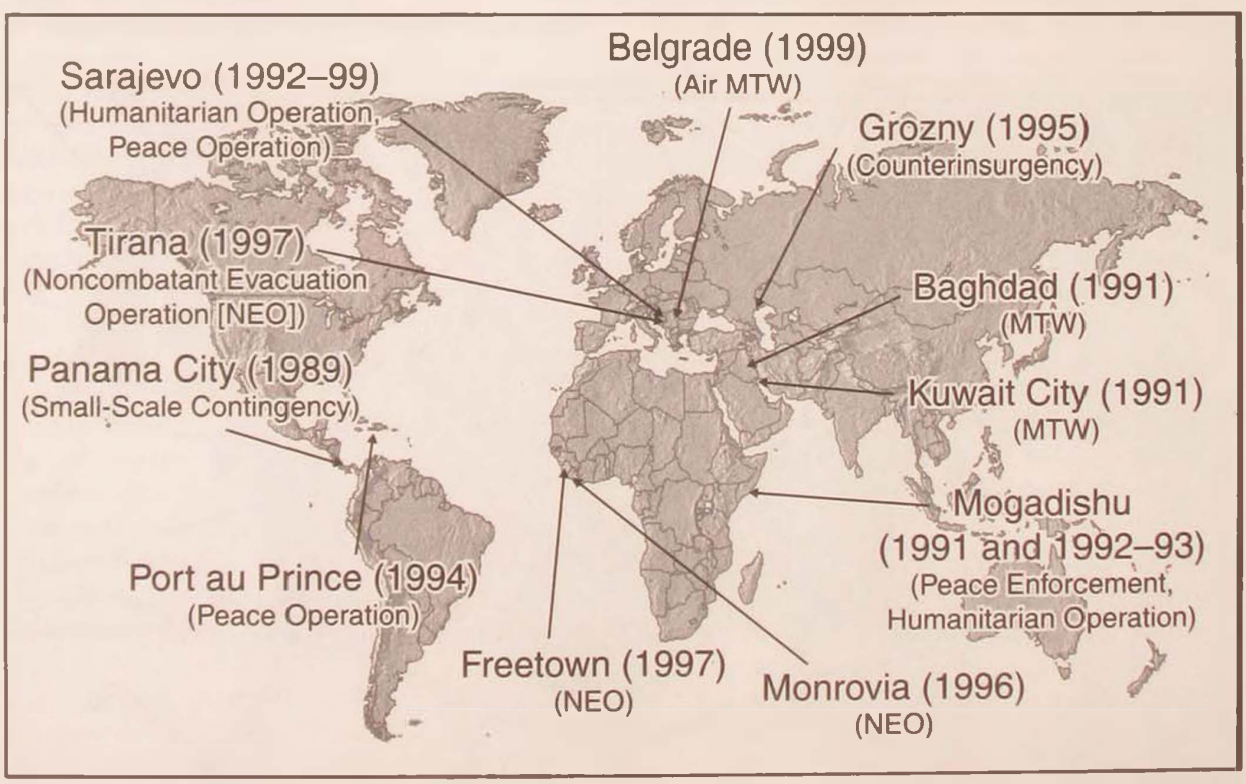


Figure 1. Selected Urban Operations since 1989. Military forces have been involved in many urban operations in the last 10 years. This graphic shows only a few of the better-known examples. Aerospace forces have played a large part in each of these operations.

- International/coalition support
- Availability and applicability of the resources at hand

Given the range of possible political and military scenarios we may face in an urban setting, policy makers and commanders must acknowledge the fact that no single recipe for success exists—not in terms of force structure, operational capability, or what one particular agency or service might bring to the table. A "one-size-fits-all" approach to urban operations—in terms of strategic-, operational-, and tactical-level considerations—is a recipe for failure. In essence the "urban fight" is, first and foremost, a "joint fight."

Competing Views of the Urban Environment

The classic view of urban operations is that urban environments afford our adversaries distinct asymmetrical advantages that negate traditional US military strengths in the areas of firepower and technology. Proponents of this view see urban operations as extremely manpower intensive, with a focus on seizing and occupying urban terrain, close-quarters infantry combat, and "low-tech" solutions to urban battle-space management. The aerospace aspects of joint military power are largely relegated to a support role in this construct.

Some "high-end" scenarios may warrant the political risks and human costs inherent in this approach. However, since most conflicts in urban areas fall short of this mark, this traditional school of thought offers our national political leadership no realistic, actionable military options.

A competing school of thought views the city as a "system of systems" made up of various key nodes that are normally archived and susceptible to detailed effects-based targeting analysis across three dimensions. By making these key nodes the operational foci of the joint campaign, we can apply our asymmetrical, joint strengths against the adversary's key centers of gravity without having to close with him in predictably costly force-on-force confrontations. By using this approach, one may control an adversary without necessarily introducing a large ground-combat force, thus minimizing casualties while achieving the desired effect.

This school, we believe, is more flexible, in that it advocates applying a combination of air, ground, and maritime solutions appropriate to the situation. Instead of a territorial, house-to-house orientation, this school looks to shape and control an adversary's behavior by achieving operational effects that may not include controlling territory at all. In the end, this approach offers the JFC a greater number of achievable, operational-level courses of action in the urban environments we are most likely to face.

Developing a Concept of Operations for Urban Operations

Most urban operations will include five components, to a greater or lesser degree (fig. 2). Rather than viewing these components as linear or sequential stages in an urban operation, one should regard them as interdependent, continuous, and frequently overlapping processes comprising a fluid joint campaign plan. As the campaign unfolds over time, the JFC will likely shift the weight of effort among the components to meet the requirements of the specific situation.

Battle-Space Analysis

Arguably the most important component of our concept of operations, battle-space analysis encompasses preparing intelligence concerning the battle space and maintaining operational-level situational awareness during all phases of the campaign—all intended to allow friendly forces to better predict, shape, control, or respond to the adversary's intentions and/or actions. Battle-space analysis allows the JFC to capitalize on information superiority to identify the adversary's key nodes,

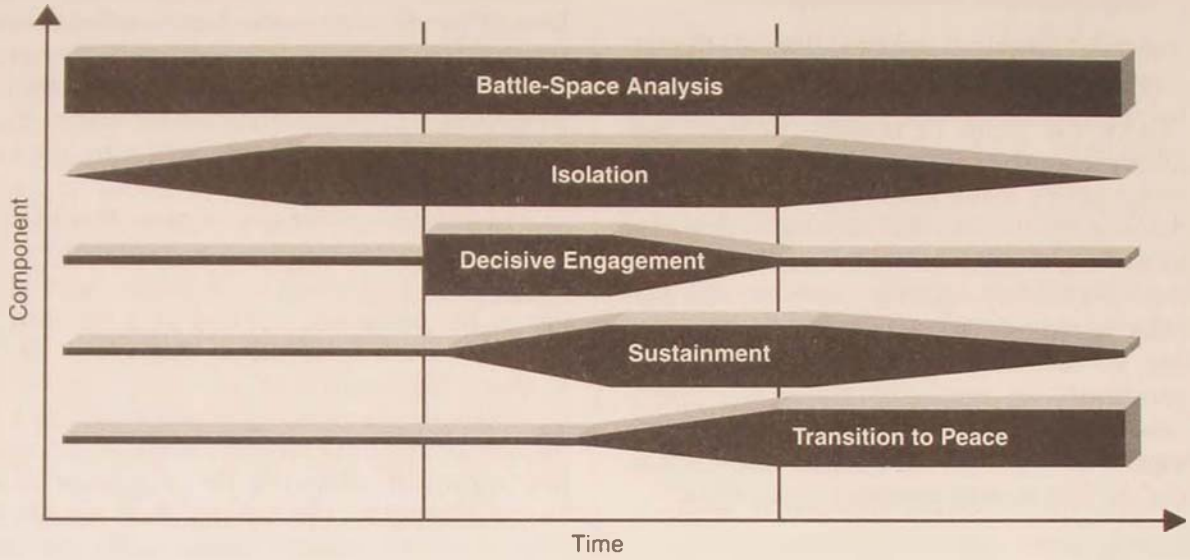


Figure 2. Hypothetical Concept of Operations

systems, and choke points central to his ability to shoot, move, and communicate across three dimensions.

Aerospace power allows the JFC to better "see" the urban battle space through a combination of space-based systems and manned and unmanned aerial platforms. These systems provide imagery, signals intelligence, and a capability to fuse multisource data into an overall common operational picture. In conjunction with archived data and ground-based human intelligence, these air and space systems enable more complete situational awareness in an urban setting. Overhead collection systems—including satellites, as well as the U-2, Predator, E-2C Hawkeye, and OH-58 aircraft, to name a few—also contribute significantly to nodal analysis, campaign planning, decision support, and rapid targeting processes.

True overhead, three-dimensional urban battle-space analysis may become possible in the future through the advent of ground-penetrating radars incorporating a mix of ground-deployed transmitters and air- and space-based receivers. This technology—currently being developed by the Air Force Research Lab—could potentially enable detection and mapping of underground urban command posts, munitions storage sites, and so forth.

Overhead intelligence, surveillance, and reconnaissance (ISR) systems also allow the joint team to seize the initiative once hostilities begin. The moving-vehicle identification, tracking, and targeting capability provided by a wide array of sensors on overhead platforms—such as the joint surveillance, target attack radar system (JSTARS) aircraft and the AC-130 gunship—is a perfect case in point. Another system with tremendous potential in this area is the CL-327 Guardian unmanned aerial vehicle (UAV), a tactical platform designed to pass real-time, color, electro-optical, and infrared video directly to orbiting aircraft and ground stations, providing both end users with a continuous picture of the urban battle space.

With advancing technology, airborne and space-based ISR systems may also play a key future role with respect to protecting friendly forces in the urban environment. Examples include development of overhead counter-sniper and counterfire detection and targeting capabilities, as well as overhead electronic identification and tracking of friendly ground forces.

Aerospace systems—such as national satellite networks, as well as airborne warning and control system and P-3 Orion aircraft—also provide the dynamic command and control (C^2) the JFC needs to exploit superior battlespace awareness and conduct high-tempo management of engaged forces. Robust overhead C^2, combined with real-time, three-dimensional intelligence, allows the JFC to operate effectively inside the adversary's decision-and-action cycle—a key to full-spectrum dominance during subsequent urban combat operations.

Isolation

The second component in a joint urban operation, isolation involves physically and psychologically separating an adversary from his urban support base, limiting his mobility and communication, and negating his ability to acquire useful intelligence on friendly operations. Isolation activities shape our adversary's perceptions and behavior and limit his options before hostilities begin.

Isolation also implies physical protection of the urban population from adversary attack and exploitation, as well as the unintentional collateral effects of urban combat. Isolation requires an active, scenario-dependent combination of physical, political, electronic, informational, psychological, and civil affairs measures.

Aerospace power can play a critical role in helping establish informational, physical, and psychological isolation over an adversary—thereby helping shape his perceptions and behavior. Aerospace power can also help in the formulation of population and infrastructure protection options vital to minimizing noncombatant casualties and physical destruction in an urban conflict setting. Airborne information operations such as jamming communications, broadcasting on public channels through the EC-130 aircraft, dropping leaflets, or intimidating an adversary through combat air-presence flights highlight aerospace contributions in this realm. Looking to the future, we have yet to fully explore additional concepts and technologies involving the use of nonlethal weapons from the air. This is a logical next step in capitalizing on recent advances in weapons accuracy—adding a range of nonlethal effects that may have tremendous urban application, particularly in the area of crowd control.

PANAMA

Operation Just Cause, the US invasion of Panama in 1989, was at the time the largest and most complex air operation conducted by joint US aerospace forces since the Vietnam era. The initial joint forced-entry operation and follow-on search for Gen Manuel Noriega and his cronies involved extensive urban combat and civil pacification operations. Aerospace forces played a critical role in protecting US citizens and defeating Panamanian Defense Force (PDF) elements seeking refuge in urban areas. Parallel joint aerospace operations were key to the success of the JFC's campaign plans.

- The initial assault included 140 aircraft of 16 different types, participating in more than 250 sorties in built-up areas.
- AC-130s conducted precision strike operations and supported the urban operations of special forces throughout the country. AC-130s also destroyed the 15-building *Commandancia* complex in downtown Panama City, crippling the single most important node in the PDF national defense and C^2 systems.
- MC-130, C-130, C-141, and C-5 crews conducted strategic airdrop and air-land operations directly from the continental United States into built-up areas in and around the Torrijos-Tocumen and Rio Hato airfields.
- EC-130s jammed commercial broadcast stations and PDF radio nets.
- Army MH-47/MH-60s provided critical vertical mobility for ground forces.
- Aerospace power neutralized PDF units in their urban sanctuary and interdicted key reinforcing units at numerous choke points throughout the city.

Decisive Engagement

The decisive-engagement component involves gaining the initiative by applying friendly strengths against the key nodes, sys-

Soldiers of the 6th Armored Division dodge sniper fire in the capture of Oberdorla, Germany, during World War II.

tems, and choke points identified during the JFC's battle-space analysis. The ultimate goal here is to weaken or destroy the adversary's cohesion, organization, C^2, lines of communication, and psychological balance so as to shape, modify, or control his behavior in line with the JFC's campaign plan. Continuously reassessing previous battle-space analysis and maintaining situational awareness are clear prerequisites to friendly success during decisive engagement.

Aerospace power plays an absolutely pivotal role in the decisive-engagement component of an urban operation. Aerospace forces can bring overwhelming precision firepower to bear, achieving devastating operational- and tactical-level effects against key adversary nodes. Future generations of "smart weapons" will allow even more precise effects against high-value targets with an extremely favorable asset-to-target ratio—minimizing both the exposure of friendly forces to hostile fire and the destructive effects against noncombatants and civilian infrastructure.

The joint community is making great strides in the ability of standoff weapons to achieve very precise effects in the urban environment. The joint air-to-surface standoff missile, with a range of over one hundred miles and the capability of penetrating adverse weather, boasts extreme targeting precision. With this weapon, commanders can now literally choose the location of impact on a given urban target structure. In the near future, the standard air-delivered munition will be the joint direct-attack munition (JDAM). This "launch-and-leave" weapon, guided by the Global Positioning System, allows an aircraft to attack multiple urban targets in adverse weather. The JDAM also features selectable impact azimuth and direction, allowing it to transit an "urban canyon" and engage with great precision. Improvements in weapons fuzing also have significant urban applications. For example, the hard-target smart fuze will allow our current inventory of GBU-27s and -28s to penetrate a structure and detonate after passing through a predetermined number of open spaces, enabling precision vertical targeting by floor.

Employing these current- and future-generation weapons, tactical strike aircraft can provide key support for ground-force operations during preplanned urban strike or close air support operations. The A-10 Warthog, AV-8 Harrier, and AH-64 Apache can all provide precise and devastating fire support to degrade the adversary and prevent him from reinforcing. In the future, tactical strike aircraft will be even more closely tied to unmanned sensor assets over the urban battlefield. The Air Force Research Lab is currently exploring concepts and technology that will allow aerial sensors to illuminate and magnify urban targets for strike aircraft using standard designator-class lasers. In a parallel effort, the Air Force UAV Battlelab is experimenting with concepts that will allow sensors on board the

US troops on ground patrol in Mogadishu in the early 1990s. High-tech surveillance resources promise to supplant this type of hazardous activity.

Predator UAV to overlay real-time video onto highly accurate satellite imagery. The geolocation data derived from this combination will enable highly accurate urban targeting with precision-guided munitions.

In the mobility arena, tactical lift forces—both fixed-wing and helicopters—provide the vertical maneuver that allows the pinpoint introduction of ground forces in the urban environment in support of the overall campaign plan. Examples include fixed-wing airborne insertion and rotary-wing troop insertion via MH-53, CV-22, CH-47, and MH-60 aircraft.

Sustainment

Sustaining the momentum achieved in decisive-engagement operations is of critical importance to the JFC. Prerequisites for success are continuous, real-time analysis of the battle space; operational effects achieved against key nodes and systems; and adversary responses. Sustainment activities may also include introducing additional forces, providing logistic support to committed forces, and capitalizing on successes by pursuing cascading effects against the enemy's remaining key nodes and systems.

In concert with ground-force operations, joint aerospace strike and mobility assets work in tandem to sustain friendly momentum, enable maneuver, and protect friendly forces in the urban environment. They can eliminate pockets of enemy resistance and resupply friendly forces on the ground, while denying our adversary this capability. Robust overhead C^2 and continuous data transfer from airborne sensors to strike assets enable

BOSNIA

The Bosnia case study represents the "crown jewel" example for highlighting the outcome-determining potential of airpower in an urban environment. US joint urban aerospace operations supporting United Nations (UN) and North Atlantic Treaty Organization (NATO) efforts in Bosnia provided humanitarian airdrops, relief flights and evacuations, enforcement of the UN-mandated no-fly zone, enforcement of the heavy-weapons exclusion zone around Sarajevo, and critical oversight of Sarajevo and the surrounding region.

- One hundred sixty thousand metric tons of humanitarian assistance were air-dropped or airlifted to isolated urban areas, accounting for 85 percent of international relief into Sarajevo.
- The credible threat of NATO air strikes compelled the Bosnian Serbs to withdraw three hundred heavy weapons from Sarajevo in February 1994, with another 290 transferred to UN control.
- F-16s shot down four Serb Galeb/Jastreb fighters while enforcing the UN no-fly zone in February 1994, shaping Serb behavior and confirming allied air supremacy.
- Operation Deliberate Force, conducted in the summer of 1995, illustrates the successful combination of integrated battle-space awareness, rapid information processing and sharing, and long-range precision strike. About 75 percent of the targets struck were in urban terrain. Nearly 99.5 percent of aerial munitions used were precision-guided, producing almost no collateral damage. Operational effects achieved by the air strikes seriously altered the Bosnian Serbs' military superiority in relation to their Muslim opponents and weakened the Serbs' willingness to continue the fight, ultimately delivering them to the Dayton peace negotiations.
- After Dayton, U-2s and surveillance satellites monitored treaty compliance, helped locate mass burial sites, and delineated permanent lines separating the former warring factions. JSTARS provided oversight for NATO ground operations, tracked Serbian maneuver forces, and monitored zones-of-separation activities.
- NATO fighters and attack helicopters currently provide continuous air presence over disputed areas, help quell spontaneous civil disturbances, and enforce level treaty compliance and boundary-line integrity.

friendly forces to press the attack and achieve cascading second- and third-order effects while adversary forces are still trying to assess the damage that has been done to them.

Transition to Peace

The final component of our operational concept refers to a variety of long-term, peace-shaping operations that ultimately mark the termination of urban violence or armed conflict. These may include facilitating the introduction of international peacekeeping or humanitarian relief organizations, setting conditions for a change of regime, destroying stockpiles of conventional or unconventional weapons, monitoring the activities of rival warring factions, and so forth. Additional fea-

A street scene in Stenay, Meuse, France, on 11 November 1918, showing Company A, 353d Infantry, passing the church at 10:58 with two minutes to fight in World War I.

tures of the transition to peace involve a managed transition to a replacement military force or civilian authority, the reestablishment of critical services and infrastructure, and follow-on consequence-management operations.

Aerospace systems and platforms can serve many critical functions during the transition to peace. Long-endurance UAVs, manned ISR platforms, and continuous-coverage satellites can provide sustained oversight of the urban conflict zone. They can also provide the sensor-to-shooter data required to support long-term "air constabulary" operations. A wide range of air-to-air and air-to-ground aerospace assets is available to provide the combat punch necessary to enforce adversary compliance with peace accords, if required. In recent years, these duties have included enforcing no-fly zones, verifying adversary truce lines, and responding to weapons-cantonment violations in built-up areas.

The strategic and tactical lift capabilities provided by joint aerospace forces are integral to postconflict urban peacekeeping, humanitarian relief, infrastructure and services restoration, and consequence management. Examples include C-17, C-5, C-130, CH-47, and UH-60 operations supporting food distribution, medical evacuation, movement of international observers, and resupply operations.

An Integral Part of the Joint Team

Aerospace power offers JFCs invaluable punch in the urban fight and has contributed substantially to recent joint urban operations at the strategic, operational, and tactical levels. Looking into the future, we must continue to define and develop appropriate applications for aerospace power in the joint urban campaign. Next-generation air- and space-based "eyes and ears," enhanced overhead C^2, robust mobility, and precision strike weapons will allow us to help close significant "capability gaps" we now face in the urban environment. Through these advances, aerospace power will continue to offer a greatly expanded range of options to help shape, control, or defeat an adversary in an urban setting.

Aerospace power is integral to any concept that offers an effective military strategy while minimizing risk in an urban environment. Whether in the context of achieving direct, precision effects against key adversary nodes; decisively enabling high-tempo, parallel joint-force operations; or providing real-time, three-dimensional, actionable ISR to the JFC, aerospace power is a key lever in the joint-force urban campaign.

Failure to bring the advantages inherent in joint aerospace power to bear against our adversaries in the urban environment puts operational success seriously at risk. A full complement of joint military power—including aerospace in all its forms—is the key to achieving our national objectives in this most challenging of all operational environments. To sum it up, "Don't go downtown without us!" □

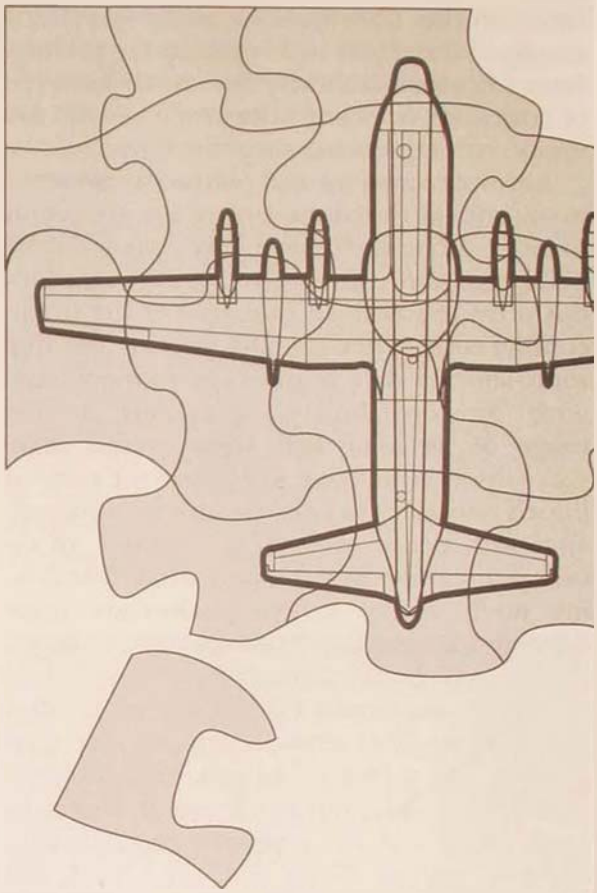
So many men are lost in the attacks on villages that I have vowed never to undertake them.

—Frederick the Great

Building and Commanding Expeditionary Units

Lessons from Kosovo

Maj Gen Roger A. Brady, USAF



THE RECENT AIR CAMPAIGN over Serbia and Kosovo has provided the latest chapter in the story of the deployment, employment, and redeployment of expeditionary aerospace forces (EAF). Although it reconfirmed many lessons learned in other efforts, this experience included some new challenges from which we should learn as we mature our expeditionary concepts and prepare for the next inevitable conflict. Obviously, the lessons learned from this conflict will be multifaceted—covering the entire spectrum of logistical support, force application, and political intrigue—and voluminous. However, this article looks at a small but important piece of the EAF puzzle—the creation and control of expeditionary units during a crisis. It addresses how and why the expeditionary force was organized for Operation Allied Force, responsibilities of an expeditionary-unit commander, lessons learned, and implications for the future.

I should acknowledge at the outset that this was certainly not the first large-scale deployment of expeditionary air forces. The United States Air Force and the Army Air Corps before it have a rich history in the use of expeditionary airpower. In the decade since our deployments to Southwest Asia began, our expeditionary concept has reflected what might be called the Central Command model. In this construct, forces deploy to an already established wing structure at a well-developed main operating base from which we conduct operations. Operations Northern Watch and Southern Watch in Iraq are similar in that regard. The experience of forces deployed to Aviano Air Base, Italy, to support operations in Bosnia is much the same. In contrast, Allied Force provided a wider range of expeditionary experiences. As we formed the units of the 16th Aerospace Expeditionary Task Force (ASETF), aircraft were deployed to existing main operating bases, contingency bases, allied air bases, and one international airport.

Organization

Organizing the units of the 16th ASETF was an iterative process, as was the buildup of forces in the theater. The forces initially deployed were attached to three air expeditionary wings (AEW) (fig. 1). Aircraft at Aviano AB, Italy, were assigned to the 31st AEW. All other aircraft south of the Alps but not at Aviano were attached to the 16th AEW (headquartered at Aviano), an expeditionary wing already operating in support of the Stabilization Force in Bosnia. The aircraft deployed north of the Alps (primarily tankers and reconnaissance aircraft) were attached to the 100th Air Refueling Wing at Royal Air Force Base Mildenhall, United Kingdom, and then designated as the 100th AEW. It is important to remember that at the outset of the conflict, there was no clear idea of how large the force would eventually become. The reinforcement plan continued to evolve after the conflict was under way. Consequently, beddown decisions for the initial flow of forces did not take into account what might be needed later. As you will see, the iterative nature of the force flow would cause some deployed units to relocate as more forces deployed to the theater.

As the air conflict intensified and more forces flowed into the theater, more bases were required. By the end of the 78-day campaign, the number of AEWs had increased from three to 10 (fig. 2). As the deployment of forces continued, the availability and location of bases had a strong influence on how wings were organized. These figures, however, do not show the numerous iterations in between as we moved units from one base to another or reattached them to a newly formed AEW. This chain of events was certainly not planned but was driven by the dynamic nature of the contingency and the decision process regarding what forces would be deployed.

For example, the 52d Fighter Wing (FW) initially deployed squadrons to Italy, where they were attached to the 31st AEW. As Aviano AB filled to capacity and more forces deployed to the theater, the 52d AEW formed at Spangdahlem AB, Germany. However, they were not all Spangdahlem units. A squadron of F-117s from Holloman Air Force Base, New Mexico, had deployed to Spangdahlem. So a

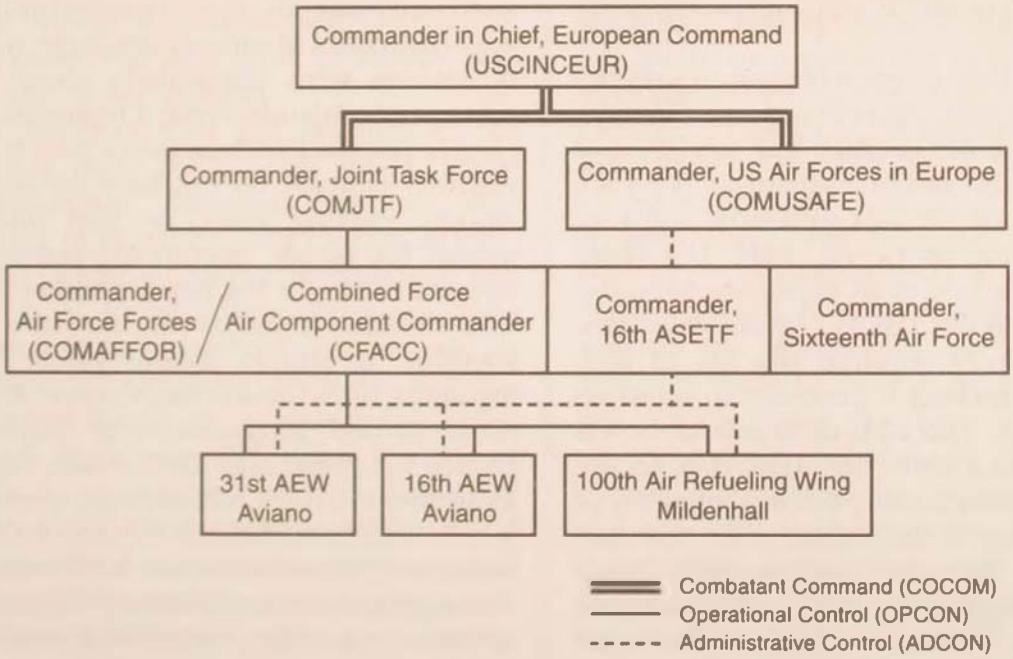


Figure 1. Initial Command Relationships

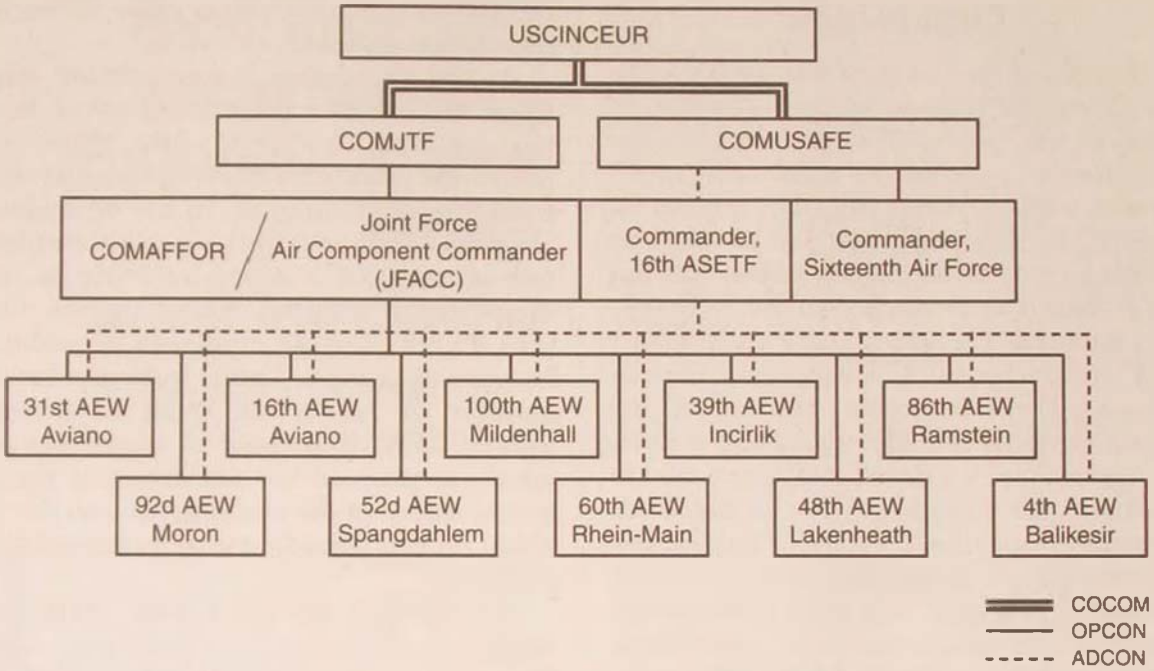


Figure 2. Final Command Relationships

peacetime wing commander flowed his own forces forward, and an AEW later stood up with units from the continental United States (CONUS) at his own main operating base. This AEW would eventually consist of groups at Spangdahlem and at Trapani and Gioia del Colle in Italy.

A similar chain of events occurred with the 48th FW. Two of its fighter squadrons had deployed early in the conflict: one squadron of F-15Es to Aviano and one squadron of F-15Cs plus an air base support squadron and a logistics squadron to Cervia, Italy. The latter units were attached as an expeditionary operations group to the 31st AEW at Aviano. Later, additional forces required the use of RAF Lakenheath, making it necessary to stand up the 48th AEW. The 48th units now at Cervia were reattached from the 31st AEW to the 48th AEW, reestablishing the unit integrity of the 48th. Some of the fighter units that had deployed to Italy returned to their home bases of Spangdahlem and Lakenheath and flew missions from there. This beddown adjustment put like aircraft types together at their home units, making support easier but increasing the distance to the fight. At the same time, it made room for more of the same fighter types at Aviano.

As the deploying force increased, it was necessary to find more bases for both fighter and tanker aircraft. Bases close to the combat area that could accommodate large numbers of tankers were particularly scarce. Since most North Atlantic Treaty Organization and former Warsaw Pact bases were built for fighters, they typically do not have the length of runway, parking space, or fuel supply required for tanker operations; nor are they stressed to handle the heavier tanker aircraft. This situation required reliance on such old standbys as Moron, Spain; Istres, France; Sigonella, Sicily; Souda Bay, Greece; RAF Fairford, United Kingdom; RAF Mildenhall, United Kingdom; and Rhein-Main, Germany. In addition to these locations, we were able to secure use of RAF Brize Norton in the United Kingdom, Mont-de-Marsan in France, and Ferihegy International Airport in Hungary. In addition to needing more bases close to the combat area, the ability to attack from all axes was also important. Bases in western Turkey

Deployment and redeployment of EAFs require logistical planning.

offered this advantage. The 4th AEW, with fighter units from Shaw AFB, South Carolina, and Seymour Johnson AFB, North Carolina, formed in Turkey at Bandirma and Balikesir. Deployed tanker units attached to the newly formed 108th Expeditionary Operations Group under the 39th AEW at Incirlik provided their tanker support.

This description of the creation of the AEWs may make the process appear somewhat haphazard. Although complete foreknowledge of how the conflict would develop may have yielded a different organization and beddown of forces, these decisions were based on a dynamic operational situation, an application of Air Force doctrine, and the judgment of theater air commanders. The authors of Air Force Doctrine Document (AFDD) 2, *Organization and Employment of Aerospace Power* (28 September 1998), could not foresee the exact circumstances we would face, but their instruction to "apply sound professional judgment to tailor . . . organizations and operations for the task at hand and for the requirements within differing theaters" (p. 31) provided exactly the flexibility needed.

The organization of the 16th ASETF was significantly influenced by the availability of bases meeting requirements for fuel, weapons storage, adequate runways and ramps, and the ability to support our personnel. There were also political issues, with the nations surrounding the area of conflict offering to contribute in various ways, based on the character of their bases and what their publics would support. For example, some nations were eager to support tankers but not armed combat aircraft. Another important consideration in the locations of the AEWs was the ability to support aircraft at multiple locations. Some bases that were offered would support only a few tankers, increasing the overall requirement for support personnel and services. Although some locations did have only a few tankers, the USAFE staff (functioning as AFFOR Rear) made a concerted effort to find bases that could accommodate 10 or more aircraft, making the most of our support capability.

Having determined that locations were logistically and operationally acceptable and that political support was likely, the USAFE staff proposed locations and an organizational structure to the 16th ASETF commander. As the deployment continued, the USAFE staff proposed expanding the organization beyond the 10 AEWs in an attempt to limit the wing commanders' spans of control. However, Lt Gen Michael Short, triple-hatted as the 16th ASETF commander, the JTF Noble Anvil JFACC, and the Allied Force CFACC, quickly realized that his vast responsibilities required him to limit the number of wings. This resulted in some wing commanders having a rather large span of control with significant geographic separation of some wing organizations. For example, the 92d AEW commander at Moron AB, Spain, had groups at Sigonella, Italy; Mont-de-Marsan, France; and Souda Bay, Greece. Similarly, the 100th AEW commander had groups at Mildenhall, Fairford, and Brize Norton in the United Kingdom and at Geilenkirchen in Germany. However, this command challenge was significantly mitigated by the availability of operational-support airlift, usually C-21s, for wing commanders to maintain contact with their geographically separated units. The USAFE staff also coordinated with the commanders of Air Mobility Command, the Air Force Reserve, and the Air National Guard on the organization and location for deploying units. When combat operations were suspended, units making up the 10 AEWs were operating from 27 locations in 10 countries.

Commanders' Responsibilities

As is the case in all military operations, the need to adapt rapidly to a changing environment was a challenge to all commanders involved. The wide variety of situations confronting our forces in the Kosovo campaign highlighted some responsibilities of unit command that are peculiar to, and sometimes magnified by, the expeditionary environment. These include determining whom and what to deploy, getting on-site as soon as possible, establishing a relationship with the host-nation commander, making the mental adjustment to the expeditionary environment, and, when the conflict ends, ensuring that redeployment is accomplished in an efficient, effective manner.

Deciding whom and what to deploy is critical. Take too little, and the mission may suffer. Take too much, and we waste valuable resources, including the lift required to get it there. In this contingency, units essentially brought whatever support forces and management overhead they wanted. Some brought logistics squadrons; others just brought logisticians embedded in their operations squadrons. Some brought an air base squadron and a command master sergeant; others did not. The War Mobilization Plan provides some guidance regarding the size of management overhead for deploying units, but that guidance can and must be tailored to meet the situation at hand.

As mentioned earlier, some commanders found themselves in situations not unlike those at Northern and Southern Watch. At Aviano, for example, a robust main-operating-base structure provides most base operating support. Typically, units deploying to Aviano brought only operations and logistics units. Other units like those at Moron and Rhein-Main, which might be called "permanent contingency bases," were supported by permanently assigned Air Force air base squadrons. Units at locations such as Bandirma, Balikesir, Trapani, Mont-de-Marsan, and Budapest, Hungary, found themselves in a very different situation. No US host was present, and the units either had to deploy or contract for base support. A tent city was required in the case of Balikesir, a Turkish air force fighter base, making this location perhaps the most purely expeditionary. This large support requirement and the geographically separated operating locations, Balikesir and Bandirma, dictated a more robust management structure to support the 4th AEW commander in carrying out his duties. In all cases, a thorough analysis of the deployed location and the organiza-

tions, as well as the people and equipment required to support operations, is the first step in a successful deployment. And this important analysis will require close communication among the deploying unit, the unit's major command, and the theater air component.

Having determined what and who should be deployed, the commander should proceed to the expeditionary base as soon as possible. This is extremely important in expeditionary operations, particularly when base operating support is not available and there are no US host units to establish relationships with the host-nation officials. Again, the 4th AEW deployment to Turkey is a good example. Anticipating the varied aspects of the Bandirma and Balikesir deployment, the USAFE staff arranged for the early arrival of Brig Gen Norm Seip, the wing commander. We gained a distinct advantage by having him arrive well before the aircraft. It allowed time to establish a relationship with the two host commanders—both brigadier generals—and to begin discussions on some of the more important issues of force protection, contracting with local vendors, and so forth. Although some may consider these details better left to subordinates, establishing the right relationship at the right level in the host country is critical. Deployed commanders must appreciate the importance of rank when dealing with officials of another nation. Whereas we may typically have a major or lieutenant colonel leading an advance team and making key decisions, a host-nation wing commander who reserves those decisions for himself may be uncomfortable or even unwilling to discuss those issues with more junior personnel. The advance team of subject-matter experts is obviously important, but having the commander on the ground will aid immeasurably in setting the right tone with the host. In addition, early arrival gives the commander time to focus on all the important aspects of base operating support before operations begin.

Command in the expeditionary setting also requires some adjustment in thinking for both the deployed commander and for the

EAF commanders must plan inbound flights while expanding the ground infrastructure for their units.

commander who remains at home but deploys forces forward. Units will always deploy into the area of responsibility of a theater CINC, and there will always be a theater air component commander. In accordance with AFDD 2, there will be an Aerospace Expeditionary Task Force commander (who will usually also be the COMAFFOR), and expeditionary wings, groups, and squadrons will stand up under that structure. As the Kosovo experience showed, some wings will deploy complete with commander and staff and be designated as expeditionary wings under the ASETF. Other units may come as squadrons or groups and be attached to AEWs commanded by wing commanders already in-theater. And still others may be a "rainbow" of wing staffs and squadrons from multiple in-theater and CONUS-based units. So what responsibilities does the deployed commander have, and what does the commander "back home" do? Put another way, which strands of the umbilical cord need to be cut, and which ones remain intact? During the Kosovo experience, these questions were raised in two particular areas—personnel management and sustainment.

Early on in the conflict, theater clearance requests arrived at Headquarters USAFE from CONUS-based commanders and command chief master sergeants who needed to "come make sure my troops are being taken care of." But was this really necessary? When units deploy and become part of an expeditionary unit, in many ways they are no longer

EAFs require careful and comprehensive medical preparation to speed worldwide deployments.

"my troops." If they are attached to an AEW at a main operating base, there will be a commander, command chief master sergeant, and so forth, to take care of those troops. If the deployed location does not have a leadership structure in place, the leadership management team to be deployed forward must be part of the predeployment planning. Every unit needs a commander and a command chief master sergeant or first sergeant, *but it needs only one, and he or she should be in-theater with the troops.*

Another situation highlighted the need for commanders—and the Air Force corporately—to adjust for the deployed environment. During the contingency, a noncommissioned officer promotion list was released. Locally based commanders notified their troops, but long-standing personnel system procedures that make the home-station commander responsible for notification of deployed personnel precluded notification of the deployed personnel at the main operating bases. This means the expeditionary unit commander can dispense bad news (he has Uniform Code of Military Justice authority) but not good news, such as promotions. Not surprisingly, some of our people felt momentarily "forgotten." Deployed commanders felt awkward, and some home-station commanders worried that their turf might be trod upon. The USAFE staff, in cooperation with the affected commanders and the personnel system, was able to resolve the issue. However, it illustrated the need to reexamine the suitability and feasibility of our policies in the context of expeditionary operations.

Expeditionary commanders may also have to adjust their thinking somewhat in regard to sustainment. Many commanders have developed a habit of "home unit reachback" to sustain their aircraft and provide supplies when they are deployed. This desire to use the "good ol' boy" net is very understandable. We all like to work with people and processes that are familiar. This method is often effective in the short term for individual units, but it is not an effective way to ensure long-term sustainment of multiple units in a large contingency. It also makes it impossible for the ASETF commander and his staff to stay abreast of the health of the fleet being deployed. As the contingency unfolded and the sustainment task grew to proportions that could not be managed by the logistics staff of a very small numbered air force, the 16th ASETF commander dual-hatted Brig Gen Terry Gabreski, the USAFE director of logistics, as his A-4 to handle all sustainment matters. She and her staff became the focal point for sustainment, and the flow of parts and supplies into the theater was directed from Ramstein AB, Germany. She established contact with logistics staffs at Air Mobility Command, Air Combat Command, Air Force Materiel Command, and the Air Reserve components to ensure the sustainment flow. The result was a reliable sustainment system; timely, accurate information on fleet health to the 16th ASETF commander; and a mission-capable rate that would be the envy of any peacetime air force. Expeditionary unit commanders need to understand that the route taken by sustainment may be different from that at home station, but it is one which will provide the best support to forces in the theater. Early and frequent communication between the A-4 staff and wing logisticians will get sustainment started on the right track and keep it there.

Expeditionary command responsibilities in Kosovo were different from those in most recent contingencies in one other important aspect. Unlike commanders in Northern and

Southern Watch, many commanders in the Kosovo conflict had complete responsibility for redeployment—not just aircraft and people but *everything* that had been deployed to the expeditionary location. Before the Kosovo deployment was complete, it became apparent that redeployment would soon begin. Senior commanders largely agree that redeployment needs improvement. Often cited are examples from Operation Desert Storm, in which units deployed with too much of some things and not enough of others—and left a lot of it in the desert. Gen John Jumper, commander of USAFE, was determined that we would do it better in Operation Allied Force and made it an issue for the expeditionary wing commanders. He placed particular emphasis on how units handled the disposition of supplies and equipment and how commanders ensured continuity of supervision as units redeployed.

Over the last few years, deploying forces have learned that they can significantly reduce the amount of lift required for a contingency by acquiring many items in-theater. Vehicles, fitness equipment, air conditioners, housing units, and even karaoke machines can now be leased or purchased at many locations to which we deploy. But what do you do with these items when it is time to redeploy? Take them home? Give them to the locals? Abandon them? The blindingly obvious lesson here is that there must be a plan. When Allied Force began, there was no plan for disposition of equipment and for redeployment. All expeditionary commanders were directed to develop a plan. Concurrently, the USAFE staff wrote a plan to guide the effort and published it in approximately one week. The process was quick and ugly, but unit commanders responded and planned for disposition of the very substantial amounts of equipment and supplies that had been acquired. Some items were redeployed to the home unit, some were retained in USAFE for use in future contingencies, and some were transferred appropriately to host-nation units.

This process is extremely important for many reasons. Because we have limited resources, they must be used wisely. Commanders must make important decisions considering cost of redeployment, utility of supplies and equipment for future use, legal and environmental issues, and our relationship with our host nations. By leaving a deployed location in a condition as good as or better than we found it, we improve current and future relations with our hosts, reinforcing with them and our own people that we are a professional military force from start to finish.

Finally, disposition and redeployment are tasks that expeditionary-unit commanders must personally see through to the end. Expeditionary units are established by the publication of a set of G-series orders, and those units exist until such orders are officially rescinded. From deployment to disposition and/or redeployment of supplies, people, and equipment, expeditionary units are living, functioning organizations with a commander responsible for all activities of the unit. In contrast to deploying and employing forces, which are pretty exciting, disposition and redeployment are just plain, hard work. And they come at a time when everyone, including the commander, just wants to "get outta Dodge." However, this is a time when the commander must be "present for duty" and intimately involved. For all who have had the opportunity to be operational commanders, we inevitably think of ourselves as operators. Consequently, during a redeployment there may be a tendency to focus on getting the aircraft home—and even to deploy back with the aircraft. Although the commander may not be the very last person to leave a deployed location, it is a basic command responsibility to oversee people, supplies, and equipment as redeployment continues. As Operation Allied Force wound down and units began to redeploy, COMUSAFE required that all deployed commanders receive clearance to leave the theater. The ticket home was an approved disposition and redeployment plan and an appropriate plan to ensure continuity of supervision at the deployed

location as he or she departed. All commanders, working with the various functional directorates on the USAFE staff, completed the task of disposition and redeployment, provided appropriate oversight over the last remaining elements of their units, and were cleared for return to their home units.

The following are the bottom lines for expeditionary commanders: prepare for the location to which you are going, take the right people and equipment, get there early to oversee the establishment of base support, build rapport with host-nation commanders, work within the theater command structure for personnel issues and sustainment of forces, and give redeployment the same attention as deployment.

Lessons Learned/Implications

As in all operations, the Kosovo experience yielded many important lessons with implications for how we prepare ourselves to organize and command expeditionary organizations in future contingencies. Those presented here are not intended as an exhaustive list, but are illustrative of crucial lessons learned:

1. One of the earliest lessons learned in Operation Allied Force did not involve command of expeditionary units. However, it uncovered a significant shortfall in our ability to quickly and accurately determine appropriate locations from which to support and operate expeditionary air forces. The process by which we conduct site surveys needs to be improved. Considerable progress has been made in developing equipment for use in conducting surveys and developing base-support plans, but we still need to develop and maintain a worldwide database of information on potential expeditionary locations. Various communities within and outside the Air Force may protest that the accomplishment of site surveys is among their core competencies. However, the Kosovo experience indicates that relevant information on potential deployment bases, even when available, is either dated or dispersed in so many agencies and in so many formats as to be virtually unusable in a rapidly developing contingency. Although such a database would not remove the requirement for an advance team, it could reduce the size of the team (currently about 25) and eliminate those bases clearly not suitable. Both would significantly reduce the cost and time required to make the beddown decision.
2. Host Air Force units at deployed locations should be designated "expeditionary" whenever appropriate. When units are deployed to contingency bases with permanently assigned air base units or squadrons (e.g., Moron, Fairford, and Rhein-Main), those commanders should be dual-hatted, and their units designated as expeditionary units attached to and working for the expeditionary commander. This arrangement provides unity of command and leaves no doubt that the efforts of that base are to be focused on supporting the expeditionary unit in the contingency. Similarly, support-unit commanders at main operating bases (e.g., Spangdahlem, Aviano, and Mildenhall) who are directly involved in support of the deployed forces in the contingency should be dual-hatted, and their units designated as expeditionary. Again, this arrangement provides unity of command and engenders a sense of pride in, commitment to, and ownership of their role in the expeditionary effort. It helps ensure the success of the operation, and it also helps ensure that the units and individuals who contributed to that success are appropriately recognized when the contingency is concluded.
3. We need to formally establish the process by which we determine the makeup of units being deployed to expeditionary locations. Even though commanders should retain the author-

ity to form their units, the theater air component is best positioned to advise commanders on what resources are available at the deployed location and what should be brought forward from CONUS. More definitive guidance in War Mobilization Plan volumes (currently oriented to scenarios for major theater war) and extensive predeployment discussions with the theater air component are both required to ensure the best use of limited lift resources and more effectively manned and equipped expeditionary units.

4. We need to educate our present and future commanders regarding the unique nature and responsibilities of expeditionary command. As the Kosovo experience showed, some commanders will find themselves in an unfamiliar command environment. In addition to the peculiarities of the deployed location, some commanders will find themselves responsible for oversight in areas, principally support, with which they have little or no experience. Commanders of operations groups and squadrons may find themselves serving at the next higher echelon of command, or they may become deployed-location commanders geographically separated from their wing commander. We need to approach this education process in two ways. First, we need to ensure that our doctrine is as clear on these responsibilities as it should be. Second, we need to take every opportunity to present the information when and where it is needed.

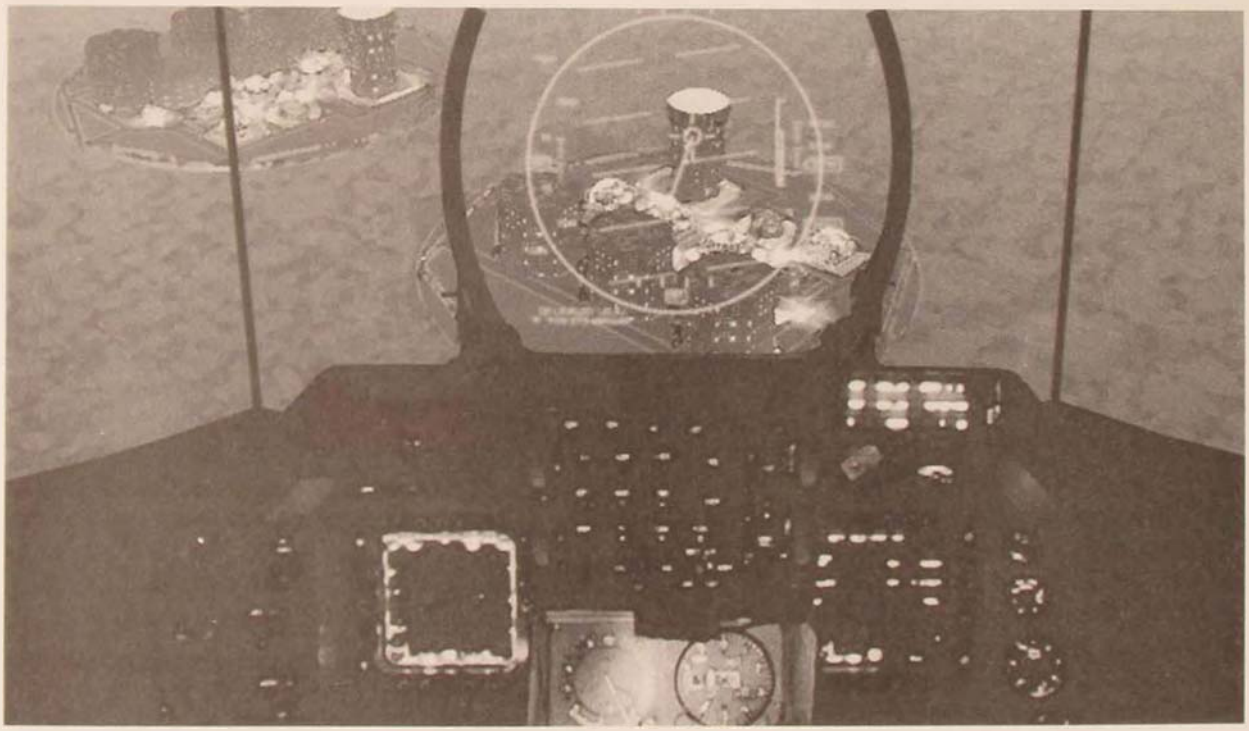
Brig Gen John Barry, my predecessor as USAFE director of plans and programs, wrote "Who's in Charge?"—an excellent article on service administrative control—for the fall 1998 issue of *Airpower Journal*. It is "must read" material for expeditionary commanders and planners. General Barry explains that wing commanders have ADCON and asserts that "we need to develop and standardize the degree of ADCON (call it 'specified' ADCON) that we want the expeditionary commander to exercise" (p. 36). The most recent version of AFDD 2 contains an expanded discussion of "complete" and "specified" ADCON, but we need to clarify and distinguish those gray areas in which responsibilities seem to overlap. For example, we need to be more specific, in either doctrine or policy, about what management and sustainment responsibilities belong to expeditionary commanders and the theater component, and which belong to the home-based commanders and CONUS commands. Operation Allied Force reconfirmed that the efforts of the entire Air Force team are required for success. It also revalidated the principle of unity of command, demonstrating that the efforts of the entire Air Force are used to best advantage when directed through and in support of the theater component and the ASETF commander. Having gotten the message right, we must deliver it at the right time to prospective expeditionary commanders. Although we could appropriately present such information in professional military education at all levels, it should also be particularly emphasized in the curricula of major commands as they conduct their required precommand courses. Further, commanders destined to be in charge at a deployed location need to be provided and to actively seek out opportunities to familiarize themselves with all the functions required to sustain deployed operations.

The expeditionary experiences gained during the Kosovo contingency will be invaluable to the effectiveness and efficiency of future expeditionary air operations. Operation Allied Force was extremely successful because our expeditionary commanders and their people performed magnificently. As in every great endeavor, we also learned there are things we can do better. It is important that we now take the time to remember and codify those lessons, make them part of our expeditionary culture, and use them to ensure success in the next conflict. □

F-16 UCAVs
A Bridge to the Future of Air Combat?

MAJ CHIP THOMPSON, USAF

> New World Vistas *also "got too focused" on high-performance unmanned fighters. I think UAVs* [unmanned aerial vehicles] *are moving in the right direction—that is, initially, we'll use them for intelligence, surveillance, reconnaissance and hopefully for longer dwell, greater survivability kinds of things. In the longer term, though, we'll have to look at whether a "smart" UAV is really the way to deliver weapons.*
>
> —Gen Ronald Fogleman



PROMPTED BY ISRAELI UAV combat successes and the remarkable performance of the Israeli-built Pioneer UAV flown by the US military in Desert Storm, the Department of Defense (DOD) is now actively pursuing new US-built UAV systems. Starting with subscale drones in Vietnam, the DOD effort has focused primarily on the surveillance and reconnaissance mission for UAVs. A major milestone for military UAV programs occurred in 1996 when the US Air Force started its first UAV operational squadron near Las Vegas, Nevada, flying the medium-altitude Predator surveillance and reconnaissance platform. In 1999, numerous Predator missions provided invaluable intelligence information to North Atlantic Treaty Organization (NATO) commanders and targeteers in the air war against Serbia.

Predator medium-altitude UAV

The USAF is currently researching other combat mission ideas for UAVs, including suppression of enemy air defenses (SEAD) at a "battlelab" in Eglin AFB, Florida. However, the DOD, in particular the USAF, has not prioritized or funded any substantial research into a bomb- or missile-carrying lethal UAV or unmanned (or uninhabited) combat air vehicle (UCAV). The USAF Scientific Advisory Board's *New World Vistas* report, the Defense Advanced Research Projects Agency (DARPA) office, and the Air Force 2025 project have all called for the rapid development of UCAVs. Military planners, industry experts, and scientists all agree that current "off the shelf" technology is adequate to field an effective UCAV platform. Yet, the USAF is reluctant to trust an unmanned remote-control aircraft with the responsibility of dropping bombs or shooting missiles. Due to defense budget cuts and competition from the manned F-22 Raptor and Joint Strike Fighter (JSF) programs, the operational fielding of new-technology UCAVs is decades away. In 1997, Gen Ronald Fogleman, USAF chief of staff, and Col Joe Grasso, the Eglin UAV battlelab commander, stated that lethal UAVs would not fly for at least 25 years.[1]

In the meantime, US military and political leadership must continue to rely on cruise missiles to deal with conflicts where the potential loss of American lives is unacceptable. Today, sea- and air-launched cruise missiles are the only offensive military instruments of power guaranteed not to produce US casualties or prisoners of war (POW). However, the current US stockpile of cruise missiles has ordnance limitations that prevent them from attacking important "hardened" military targets such as command and control (C^2) bunkers, underground weapons storage facilities, or armored vehicles. Even though the USAF and US Navy are now researching penetrating warheads and in-flight reprogramming, these new air- and sea-launched cruise missiles will still not reach the combat flexibility and capability of a modern multirole fighter. Finally, the United States has only a limited number of the one-million-dollar-plus expendable cruise missiles. This surprised many in the spring of 1999 when the Pentagon placed an emergency order for more air-

Northrop-Grumman's future-concept UCAV

launched cruise missiles only a few days into the air war in Kosovo.

Because of current cruise missile target restrictions, limited numbers, and the high costs associated with a "one-shot" delivery platform, US leaders need another unmanned military option today that can destroy most potential enemy targets and can be reused for cost-effectiveness. UCAVs can provide this additional unmanned military alternative to cruise missiles. Yet, as previously stated, new advanced-technology UCAVs are decades from operational fielding. Can the USAF quickly provide a cost-effective UCAV option to US leadership in the interim?

The USAF can quickly provide a cost-effective unmanned military option by modifying some F-16C fighters into dual-role UCAVs. The multirole F-16 is a combat-proven air-to-air and air-to-ground fighter platform that can perform all airpower missions with its capability to carry almost all of the USAF bomb and missile inventory. Slightly modifying an F-16C for unmanned flight while maintaining its manned flight capability gives the USAF most of the advantages of UCAV operations and reduces or eliminates many unmanned flight concerns. A remotely piloted, dual-role F-16C UCAV can quickly provide a politically safe, cost-effective, and flexible unmanned military option for US leadership.

An important prerequisite for this F-16 UCAV idea is proving that the United States now needs an alternative to cruise missiles. Therefore, this article presents arguments on why US leadership quickly needs an interim UCAV option before exploring the F-16C UCAV proposal. The objectives of this article are to (1) provide some UCAV background to the reader with the advantages and concerns related to unmanned flight, (2) explain why the United States needs an interim UCAV military option, and (3) recommend the dual-role F-16C UCAV. In summary, this article addresses two important issues. First, the United States needs an interim UCAV option to overcome cruise missile limitations as soon as possible, and second, a dual-role F-16C UCAV can quickly and effectively fulfill the requirements for this interim unmanned military option.

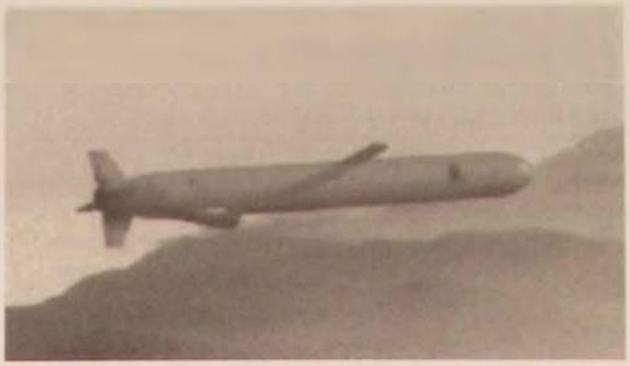
UCAV Research

Prompted by the USAF Scientific Advisory Board's recommendations in *New World Vistas*, DARPA research grants, and UCAV interest in the Air Force 2025 project, several US aerospace companies including Teledyne Ryan, Boeing, Northrop, and Lockheed Martin have started preliminary designs on advanced-technology UCAVs. Both Great Britain and Germany are also studying a UCAV replacement for their air-to-ground Tornado. Interestingly, the development and research phase of the Joint Strike Fighter now has four versions: USAF, USN, US Marine Corps, *and* a UCAV. Dr. Gene McCall, USAF chief scientist, predicts that the last JSFs to roll off the factory line will be UCAVs.[2]

Advancing technology, politics, and, most important, smaller military budgets may eventually persuade the USAF to operate unmanned lethal aircraft for most combat missions in the future. Primarily because UCAV "operators" conduct routine training in simulators, DARPA and other aerospace companies have suggested that UCAVs will save 55 to 80 percent in flight operations and support costs compared to manned systems.[3] Lower maintenance, training, and operation costs are only some of the advantages of UCAVs over traditional manned fighter aircraft. Table 1 lists some UCAV advantages over manned aircraft, and table 2 presents some concerns for future UCAV operations.

The USAF can overcome many UCAV concerns with experience and development of safe procedures and doctrine. Some, especially the security and protection of the critical UCAV C^2 links, may require new emerging technologies in communications such as data compression and data-burst transmissions. The USAF's vision of the capabilities expected from future UCAVs is expressed in the following excerpt from the *Air Force 2025* Strikestar executive summary:

> In 2025, a stealthy UAV, we refer to as "Strikestar," will be able to loiter over an area of operations for 24 hours at a range of 3700 miles from launch base while carrying a payload of all-weather, precision weapons capable of various effects. Holding a target area at continuous risk from attack could result in the possibility of "air occupation." Alternatively, by reducing loiter time, targets within 8500 miles of the launch and recovery base could be struck, thus minimizing overseas basing needs.[4]



Tomahawk cruise missile

Reasons for an Interim UCAV

As previously stated, it will take the USAF decades to put advanced-technology UCAVs

Table 1

Advantages of Future UCAVs over Manned Aircraft

Vehicle Cost	Cheaper to build since pilot requirements such as cockpit controls and gauges, ejection seat, oxygen, canopy, and pressurization are unnecessary. Saves about 10 percent on overall vehicle cost, including remote-control equipment. Some advantages negated by remote ground-station costs.
Range and Endurance	Longer flight times and ranges due to less drag and better engine placement without the canopy and cockpit. No human limits on flight-endurance time. Some UCAVs may fly for days over enemy territory.
No Crew Risk	No political risk from casualties or POWs. Can employ nonlethal weapons to put an enemy to sleep such as acoustic or brain-wave manipulation. Can operate in a nuclear, biological, or chemical environment with no risk to the pilot.
Survivability	Unmanned design without a canopy makes aircraft smaller and lowers radar cross section. Absence of humans permits high 10G-plus turns to avoid enemy missiles.
Training	Most training for UCAV operators is in simulators. No dependence on weather or maintenance-ready aircraft. Periodic exercise participation such as Red Flags to test doctrine and manned-flight interface.
Training and Support Costs	With only periodic flight training and little to no maintenance on the majority of "stored" UCAVs, there is a large reduction in peacetime training, fuel, and maintenance support costs.
Personnel	Fewer pilots and support personnel are needed. UCAV operators can fly numerous UCAV sorties sequentially or at the same time. With few training flights, fewer maintenance personnel and less equipment are required.

Table 2

Future UCAV Concerns

Datalink Communications	1. Loss of control due to enemy jamming or signal manipulation 2. Long connectivity lapses due to distance, satellite location, or friendly mutual interference 3. Limited amount of frequency bandwidths to accommodate large numbers of secure links for multiple UCAV operations
Air Refueling	1. Transoceanic deployment distances and communications 2. Risk to KC-135 or KC-10 high-value assets 3. Tanker joinup and multiaircraft air refueling
Operator Situational Awareness	1. Number of aircraft per operator or operators per aircraft 2. Air traffic control (ATC) and enemy airspace deconfliction from other aircraft 3. Threat reactions for visual antiaircraft artillery, infrared surface-to-air missiles, or enemy aircraft
Emergencies	1. Less capability to rapidly assess and correct aircraft problems 2. Unable to see damage, feel small vibrations, or smell smoke 3. UAV-capable alternate airfield recovery due to fuel or weather

into operational status. So why spend money on an interim UCAV? Cruise missile advocates argue that improvements to the sea-launched Tomahawk and the air-launched AGM-86 can handle high-risk missions for the next 20 years. However, even the improved versions of air- and sea-launched cruise missiles will still have some target limitations, and the more expensive costs for hard-target penetration and reprogramming may restrict their numbers. In addition to cruise missiles, Air Force planners point out that new "standoff" launch-and-leave weapons such as the joint standoff weapon (JSOW) and the joint air-to-surface standoff missile (JASSM) can destroy targets without risking lives. Although these expensive standoff weapons do put the aircrew farther from the target area at release, they may still expose the aircrew to enemy threats outside the immediate target area.

There are political, economic, and military reasons why the United States should immediately take steps to reap the advantages of UCAVs over manned aircraft. Although political advantages are inherent to both UCAVs and cruise missiles, the economic and military advantages to UCAVs overcome some cruise-missile limitations.

Political

UCAVs provide US political leadership another military-instrument-of-power option that will not risk American lives. In smaller-scale conflicts, the threat of losing a pilot and—even worse politically—the prospect of the enemy holding a POW have motivated President Bill Clinton to rely primarily on cruise missiles for post–Desert Storm standoffs against Iraq or for retribution against terrorism. The overwhelming national response to the Scott O'Grady shootdown and the size and complexity of his rescue have reinforced the value of a single human life in military missions to the president and Congress. For example, the *Washington Post* ran a front-page story for three straight days after the O'Grady shootdown. Yet, two months later when two Predator UAVs were lost over Bosnia, the same newspaper devoted only one small back-page article.[5]

Trying to plan effective and efficient military missions with zero loss of life is the almost

impossible task given to military planners today. Not only will UCAVs give war planners more options, the capabilities of UCAVs to strike all types of targets without loss of life represent an important deterrent to US enemies. A combination of UCAVs and cruise missiles will better enforce United Nations (UN) resolutions against tyrants such as Saddam Hussein or Gen Ratko Mladic, the Bosnian Serb commander who remarked that "the Western countries have learned they cannot recruit their own children to realize goals outside their homelands."[6]

Economic

Reusability is one of the key advantages of UCAVs over expendable cruise missiles. Tomahawk cruise missiles today cost between 1.1 and 1.2 million dollars per shot, with over 250 launched in the first week of Desert Storm alone.[7] In contrast, a five-million-dollar reconditioned "boneyard" F-16 converted into a UCAV would become more cost-effective than a cruise missile in fewer than eight flights, adding a conservative three million dollars for bombs, fuel, and one year of maintenance support. It is important that a UCAV is survivable for repeated missions, or it quickly becomes a very expensive cruise missile. Nonstealth UCAVs may need SEAD to survive a high-threat area with numerous surface-to-air missiles (SAM), or they may require air-escort protection through areas without air superiority.

By modifying existing or retired fighter or bomber airframes into unmanned remotely piloted aircraft, the USAF can have an interim UCAV program that saves the expensive research and development costs associated with a new aircraft. New technology is not needed to modify an existing airframe into an interim UCAV—only inexpensive off-the-shelf systems. The USAF will realize additional cost savings at the end of the interim UCAV program since Tyndall AFB, Florida, can use the retired UCAVs for air-to-air missile testing and save the current conversion expense of turning boneyard fighters into target drones.

With unmanned aircraft, another economic benefit is the reduced requirement for combat search and rescue (CSAR) resources. Not only high operational costs but also high temporary duty (TDY) rates affecting quality-of-life issues are continuous USAF concerns in maintaining a CSAR alert force for the UN and NATO missions in Iraq and Bosnia.

An interim UCAV can carry a variety of ordnance to destroy most enemy targets, and with "semiautonomous" flight, a human operator can identify the target area and consent to ordnance release.

Military

Long-range sea- and air-launched cruise missiles will always remain an important capability for the US military because of survivability and no requirements for forward basing. However, cruise missiles currently have ordnance limitations that restrict them to attacking only fixed-position "soft" targets. Another limitation due to the cruise missile's full automation is the lack of man-in-the-loop target identification and consent for release of weapons. On the other hand, an interim UCAV can carry a variety of ordnance to destroy most enemy targets, and with "semiautonomous" flight, a human operator can identify the target area and consent to ordnance release. In addition to increased target selection, other important military reasons to operate an interim UCAV include man-in-the-loop target verification and an improved transition to an unmanned Air Force.

Target Selection. One advantage of a UCAV over today's cruise missile is its ability to deliver a variety of ordnance. Currently, cruise missiles can carry only a thousand-pound explosive or about six hundred baseball-sized "grenades." These ordnance loads restrict military planners today to a single "soft" enemy target such as a radar dish or unsheltered aircraft. In addition, even if some

Iraqi bunker destroyed by a laser-guided bomb

future cruise missiles are capable of in-flight target reprogramming, they will still have difficulty hitting moving targets such as armored vehicles.

Air Force Systems Command is aware of the soft-target limitation and is planning to test AGM-86C cruise missiles with a thousand-pound penetrating warhead in hopes of providing this capability in two to three years.[8] However, these advanced cruise missiles have new terminal seekers that have not yet been verified to be as accurate as current laser- or TV-guided bombs. A successful attack on a small hardened bunker or underground facility usually requires a three-meter or less circular error probable (CEP) for "air vent accuracy" and may require more bomb weight for deeply buried targets. For many "hardened" targets, the Joint Munitions Effectiveness Manuals (JMEM) require near-simultaneous, multiple two-thousand-pound bombs for destruction, much more than a cruise missile's single penetrating thousand-pound warhead.

On the other hand, a UCAV-modified F-16C can fly the necessary altitudes, airspeeds, and dive angles to deliver the right ordnance to destroy most enemy target types—for example, the target-penetrating two-thousand-pound, steel-encased, GBU-24I laser-guided bomb. Reprogramming target coordinates in the air with the new joint direct attack munition (JDAM) or Global Positioning System (GPS)-guided JSOWs give a future interim UCAV the ability to destroy targets in any weather condition.

Mobile Scud missile launchers, SA-6 SAM sites, or columns of tanks are not viable targets for a cruise missile because its accuracy depends on the programming of correct target coordinates before launch. However, an F-16C UCAV could use its GPS, radar in the ground moving target (GMT) mode, and the forward looking infrared radar (FLIR) targeting pod to find moving vehicles on which to drop five-hundred-pound laser-guided bombs (LGB) or shoot Maverick missiles. In Desert Storm, a moving vehicle was the easiest to find and destroy since it was not buried in sand for protection or camouflaged to prevent identification. An unmanned F-16C carrying GBU-12s can work with a joint surveillance, target attack radar system (JSTARS) aircraft for real-time target position updates to quickly destroy up to six moving vehicles.

Man-in-the-Loop Target Verification. Even with terrain updates and target photo matching, a cruise missile does not always find the correct target. Mechanical errors such as a drifting inertial navigation system (INS), loss of GPS signal, or human errors in entering the wrong target coordinates always put some doubt in the launcher's mind. Without real-time target validation just prior to bomb release, many potential targets located near politically unacceptable areas such as hospitals, schools, or residential neighborhoods may remain untouched. An interim UCAV, however, with man-in-the loop semiautonomous flight control can identify the target area and consent to ordnance release. The ground remote-control operator receives real-time optical, infrared, or radar-mapping pictures of the target area and sends back, if needed, target position updates or corrections. When the human operator verifies that the unmanned aircraft is attacking the correct target, consent to release weapons is sent to the UCAV.

Even manned systems with enemy target identification technology are not completely reliable. For example, in Desert Storm an errant high-speed antiradiation missile (HARM) from an F-4G guided towards the

tail of a B-52, and the US Navy fired on one of its own aircraft. Until the US military is comfortable that artificial-intelligence weapon systems will not kill friendly troops, man-in-the-loop control will allow unmanned systems in the interim more flexibility in combat missions. Unlike cruise missiles with one mission (strategic attack), UCAVs carrying a variety of ordnance with man-in-the-loop control can conceivably fly SEAD, battlefield air interdiction (BAI), and offensive counterair (OCA) missions. Later, with more interim UCAV experience and acceptance, the USAF may allow missions to expand to close air support (CAS) and defensive counterair (DCA).

One more consideration for a UCAV man-in-the-loop control system is its ability to defend itself if attacked. Although cruise missiles rely on small size and radar cross section to survive to the target area, slow subsonic speeds and better radar technology are becoming cruise-missile survival concerns to the USAF. Since air defense exercises of the North American Aerospace Defense Command (NORAD) routinely practice F-16 and F-15 air intercepts to destroy simulated enemy cruise missiles, the US military must believe that future radars can detect and send modern aircraft such as the Su-27 Flanker or the Mirage 2000 to destroy defenseless subsonic US cruise missiles. An interim UCAV fighter, however, can carry advanced medium-range, air-to-air missiles (AMRAAM) for protection and use man-in-the-loop control to help prevent fratricide. With enemy aircraft confirmation from the airborne warning and control system (AWACS) or Rivet Joint aircraft, a future war may produce the first ground-station remote-control-operator "aces."

Transition to the "Pilotless" Air Force. Technological advances, funding, and political pressures may eventually force most combat aircraft that fly over enemy territory to be pilotless by the mid-twenty-first century. An interim UCAV program will help ease this transition by exposing pilots to the distinct advantages of unmanned flight and, more importantly, by working out many of the "bugs" for implementation of advanced-technology UCAV systems. For example, the Federal Aviation Administration (FAA) has been avoiding control and deconfliction of UAVs and civilian air traffic for years. The operational fielding of the Predator and its peacetime training requirements in US airspace have forced the FAA to begin seriously working unmanned-aircraft issues.[9]

F-16C UCAV

With years of experience turning mothballed fighters into full-scale target drones, remote-control engineers can convert any of the US military's aircraft for unmanned flight. So why is the F-16 the best candidate for an interim UCAV? Because the F-16 is a multirole fighter, it performs all USAF missions such as SEAD, DCA, OCA, killer scout, deep strike, interdiction, and CAS. No other current aircraft in the US military can explore unmanned doctrine in so many areas of air combat. Not only are the F-16s comparatively inexpensive aircraft weapons systems to procure and operate, they are more numerous than all other interim UCAV candidates combined, including the A-10, F-15E, F-117, B-1, and B-52. This would help the F-16 community better absorb an initial testing or operational mission loss versus a more expensive and less numerous high-value asset such as an F-117 or F-15E. The small size and superior maneuverability of the F-16 also increase its survivability over larger bombers such as the B-1 or B-52.

An interesting interim UCAV solution offered by Lockheed Martin Tactical Aircraft Systems (LMTAS) is to modify older F-16A jets baking in the Arizona sun at the Davis-Monthan AFB boneyard into remotely piloted UCAVs. However, this interim UCAV proposal must overcome critical hardware problems with the F-16A and the high cost of implementing a new weapons system into the USAF inventory. Designed in the early 1970s, F-16A models have no night or precision ordnance capability except for the AGM-65 Maverick missile. To update its antiquated avionics to current F-16C ordnance and main-

F-16As in storage at Davis-Monthan AFB, Tucson, Arizona

tenance standards may require up to five million dollars per aircraft. In addition, the USAF does not have the money or personnel resources during a pilot shortage to quickly bring an F-16A-model UCAV program to operational status.

To avoid many of the problems and costs associated with the LMTAS F-16A UCAV proposal, another F-16 UCAV option is to modify currently flying Block 40 and 50 F-16Cs into "dual-role" manned and UCAV aircraft. A dual-role F-16 will retain all of its original manned fighter capability with the addition of less than three hundred pounds of remote-control and communications equipment. If called upon to perform its unmanned role, the UCAV aircraft is immediately available with no additional maintenance. Initially, the USAF should convert only four to six jets in selected operational low-altitude navigation and targeting infrared for night (LANTIRN) system and SEAD F-16C squadrons into dual-role UCAV aircraft. This will reduce initial program costs and ease the transition to unmanned aircraft operations by training only a few pilots and maintenance personnel in dual-role operations and support. As unmanned flight operations and support become more routine, additional squadron aircraft can convert to dual-role status and more pilots and maintenance personnel can cross-train into the program.

Design Modifications

To give an F-16C a part-time UCAV capability requires two areas of modification: flight controls and communications. Engineers need to incorporate an auto-throttle and auto-land capability into the flight controls similar to the design proposal for the Block 60 F-16. Additional communications equipment for the F-16C is needed for remote-control operations and sensor feedback to the ground operator. Lockheed has already designed a communications satellite (SATCOM)-equipped F-16 for international customers. One possible location for engineers to put additional datalink hardware is in the vertical fin base originally designed to hold the canceled USAF airborne self-protection jammer (ASPJ) internal electronic warfare (EW) project. Rough estimates from QF-4 conversion experts put basic F-16 UCAV flight control and auto-landing recurring costs at three hundred to four hundred thousand dollars.[10] Adding SATCOM and additional secure datalinks and antennas would add two hundred to three hundred thousand dollars of recurring costs.

If the UCAV mission required additional combat range, maintenance can remove the seat and replace it with a twenty-three-hundred-pound cockpit fuel tank in a matter of hours. If future unmanned missions require F-16C

UCAV air refueling, one proposal is to add a small camera near the heads-up display (HUD) at a lookup angle so the remote ground or tanker-based operator could fly off the refueling position lights mounted on the tanker bottom.

Benefits of the F-16C UCAV

The F-16C UCAV proposal can quickly and effectively fulfill the requirements for an interim UCAV because of low program cost, low risk, and small impact on USAF integration. Additional dual-role F-16C benefits include increased survivability, high combat-readiness rates, and a better global-response capability.

Usually, the most important part of any new weapons system program is cost. The F-16C dual-role UCAV keeps costs low by modifying existing operational aircraft and by using the current worldwide billion-dollar F-16C infrastructure. Slightly modifying currently flying F-16Cs into dual-role UCAVs will be less expensive than the millions of dollars required to return to flight status the mothballed F-16A or develop a new aircraft. Since the F-16C is compatible with most current weapons systems, research, development, and testing would save money by focusing only on the remote-control interface and UCAV concept of operations. Sharing the current operational F-16C infrastructure will provide substantial savings compared to the normal start-up costs of a new weapons program, including Block 40 laser-targeting pods and Block 50 HARM targeting-system pods. Current manned F-16 operations budgets would absorb most UCAV costs involved with daily peacetime training, flight operations, and maintenance support. By using the current F-16C aircraft and its support infrastructure, the Air Force can make the dual-role F-16C a cost-effective interim UCAV.

In addition to cost-effectiveness, a UCAV program utilizing the current F-16C infrastructure greatly reduces the impact on the USAF in manning and combat-readiness issues. During a pilot shortage, the USAF cannot afford to transfer combat-qualified F-16 pilots to a new UCAV squadron. If the Air Force initially converts just four to six F-16Cs into dual-role aircraft, current squadrons can maintain combat-readiness status since they need to train only a few pilots and maintenance personnel in UCAV operations. Over time, with increased experience and more confidence in unmanned operations, if needed, the USAF can convert more F-16C aircraft into dual-role UCAVs. In addition to manning and combat readiness, slowly integrating a few UCAV-capable aircraft into the current F-16C infrastructure will reduce the predictable negative reaction from fighter and bomber pilots to lethal unmanned combat operations. Once F-16C UCAV flight operations become routine, the rated Air Force will see the advantages of remote-control flight and better accept the eventual transition of the USAF from a manned to unmanned combat force.

In addition to cost-effectiveness and USAF impact, the dual-role F-16C benefits from increased survivability, high combat-readiness rates, and a better global-response capability. Survivability is the key to reusability, which makes UCAVs more cost-effective than cruise missiles. With a modern radar, AMRAAMs, a good threat-warning receiver, countermeasures dispensers, towed decoys, and other self-protection capabilities, the Block 40/50 F-16C is a survivable aircraft. High combat-readiness rates for the UCAV will automatically mirror the manned F-16C combat force, with "code 1" maintenance ready rates, the highest among fighters in the USAF. Another benefit of the F-16C UCAV is the ability to rapidly respond to any global crisis. The F-16C would avoid current UCAV air refueling, diplomatic clearance, and air traffic control (ATC) problems by flying across the ocean as a manned aircraft. After landing, the aircraft requires no maintenance to immediately fly an unmanned mission, if needed.

F-16C UCAV Concerns

The primary obstacle for an F-16C UCAV program is limited combat range without air refueling. Manned F-16s can bomb targets thousands of miles away on missions with pre- and poststrike air refueling. Most UCAV support-

ers, including LMTAS, believe that unmanned air refueling, controlled either from the ground or by the tanker boom operator, is feasible with today's technology. However, manned F-16 air refueling requires numerous, rapid flight-control corrections and is considered a difficult pilot task, especially at night or in poor weather conditions such as clouds or turbulence. In addition, air refueling puts unmanned aircraft within a few feet of a US high-value asset with no room for error. Therefore, even with advanced technology, many years of testing and, more importantly, KC-135 and KC-10 manned tanker acceptance are needed for UCAV remote-control air refueling.

To extend combat range without air refueling, one can increase the F-16C UCAV's ground fuel load in several ways. In addition to the twenty-three-hundred-pound cockpit fuel tank previously mentioned, several overseas F-16 customers are planning to fly with six-hundred-gallon wing fuel tanks and the recently tested four-hundred-gallon conformal fuel tanks (CFT) on top of the wing roots. However, USAF F-16 pilots prefer the standard 370-gallon wing fuel tanks because the six-hundred-gallon wing tanks severely limit aircraft performance. Table 3 shows the approximate combat radius for a Block 42 F-16C carrying two two-thousand-pound LGBs and for a Block 52 F-16C carrying two HARM missiles. The F-16C computer flight-planning system (CFPS) version 2.0 computed both aircraft flying at .85 Mach carrying wingtip AMRAAMs and a centerline ALQ-184 electronic counter-measures pod.

For the LANTIRN and F-16C UCAVs with the HTS, the use of six-hundred-gallon wing tanks and the cockpit fuel tank gives over a 50 percent increase in combat range without air refueling over the standard 370-gallon wing tank configuration. However, with this increase in range, the UCAV increases the radar cross section and suffers decreased combat maneuverability that may lower survival chances in high-threat areas.

Other F-16C UCAV proposal concerns are the same as those for future advanced-technology UCAV aircraft previously mentioned in table 2. The use of automation in the F-16C UCAV C^2 loop will prevent aircraft mishaps due to datalink termination. If datalink is lost, the F-16C UCAV can automatically continue up to weapon release, waiting for datalink reconnection, or it can return to the launch base and execute an automatic landing. As previously mentioned, flight testing of manned aircraft with a remote-control interface will alleviate many of the concerns listed in table 2 and build USAF confidence in UCAV operations.

Implementation of the F-16C UCAV

With low modification costs, low risk, no new infrastructure, and minimal training, the USAF should immediately start planning for

Table 3

F-16C Combat Radius

Fuel Tanks (internal fuel 6,900 lb)	F-16C Block 42 (navigation pod and targeting pod) (2) GB-10C Cruise 25,000 ft	F-16C Block 52 HARM Targeting System (HTS) (2) HARM Cruise 30,000 ft
Current 370 Wing Tanks	450 Nautical Miles (NM)	525 NM
370 Wing + Cockpit Tank	550 NM	650 NM
600 Wing Tanks	600 NM	700 NM
600 Wing + Cockpit Tank	700 NM	800 NM

F-16C firing AMRAAM

the development, testing, and modification of F-16C aircraft into dual-role LANTIRN and HTS-capable UCAVs. To quickly field an F-16C UCAV program, the USAF must prioritize with increased funding for UCAV research in three critical areas: (1) the F-16C aircraft modification, (2) the remote-control ground station, and (3) development of a concept of operations (CONOPS).

F-16C Aircraft Modification

The modification of the F-16C into a dual-role manned-and-unmanned-capable fighter requires the addition of off-the-shelf SATCOM and datalink communications equipment and antennas. DARPA is currently planning with LMTAS the modification of the Advanced Fighter Technology Integration (AFTI) F-16 as a UCAV technology demonstrator.[11] With additional information on remote-control equipment and operations from the QF-4 aerial drone squadron at Tyndall AFB, LMTAS can quickly design plans for the USAF to modify at least one Block 42 LANTIRN and one Block 52 HTS F-16C as unmanned flight demonstrators.

As previously mentioned, initial flight testing of a remote-control interface with pilots having override authority in the cockpits will alleviate many unmanned-operation concerns. One possibility is for pilots from the 85th Test and Evaluation Squadron at Eglin AFB to fly the demonstrator F-16Cs utilizing the Tyndall AFB ranges with existing remote-control facilities and the drone runway. More advanced "battlefield" testing for weapons and communications jamming should occur at the Nevada ranges from either Nellis AFB or from Indian Springs Airfield, Nevada, using Predator ground-station facilities.

Ground-Station Design

The design of the F-16 remote-control ground-station "cockpit" must start prior to aircraft testing. The large and expensive F-16 visual simulators used to train new pilots are not needed and are not deployable. The baseline for a small, deployable F-16 UCAV ground station should be a single visual-screen unit training device (UTD) or part task trainer (PTT). Numerous UTDs and PTTs are currently used for F-16 training worldwide and are exact cockpit duplicates of the F-16 with a video screen behind the HUD. For a UTD or PTT to become a remote-control UCAV ground station, engineers must integrate datalink and communications equipment with the simulator computers. These small cockpit UTD or PTT simulators with their associated computers, video monitors, and

datalink/communications equipment can easily fit onto one airlift cargo pallet.

Does every switch and light in this remote-control UCAV ground station need to work? Should the pilot look at the current small four-by-four-inch F-16 multifunction display (MFD) or at 27-inch TVs around the cockpit? LMTAS may have the answers to some of these questions from several years of testing in its F-16 UCAV simulator in Fort Worth, Texas. Additional human-factors-engineering testing with LMTAS and F-16 pilots will provide the optimal compromise between mission effectiveness and a small, cost-effective, and deployable ground-station design.

Concept of Operations

The USAF should form a working group with personnel from the Predator squadron at Indian Springs, the QF-4 drone squadron at Tyndall AFB, the Eglin AFB UAV battlelab, and LMTAS, as well as USAF Weapons School instructors at Nellis AFB to develop an F-16C UCAV concept of operations. CONOPS development will initially attempt to answer many of the concerns in operating an unmanned F-16 such as air traffic control interaction and concerns about whether the F-16 UCAV should carry AMRAAMs. CONOPS development will define which mission areas require direct operator control, semiautonomous control, or UCAV fully autonomous control. The use of more autonomous and semiautonomous control of UCAVs will minimize communications bandwidth availability problems and reduce enemy EW detection.

If the USAF provides the necessary funding, then simultaneous research, development, and testing of the aircraft, ground station, and CONOPS can put F-16C dual-role UCAVs into operational squadrons in just a few years. The F-16C UCAV idea will require a small budget investment compared to normal Pentagon acquisition programs, and the interim F-16C UCAV is a low-risk investment. Even if the program suffers setbacks or is canceled, the USAF retains its manned F-16 infrastructure, and modified aircraft are easily returned to a "manned-only" status.

Future F-16C UCAV Missions

If an F-16-compatible deployment base is within eight hundred miles of potential targets, then US leadership and military planners will use aircrew risk and target type as two key considerations for the decision of whether to use cruise missiles, UCAVs, or manned aircraft to attack a target. Total aircrew risk is the combination of political risk and military combat risk. Even if the military risk due to few enemy threats and good weather is small, the political consequences of aircrew loss or collateral target damage may be too high. Likewise, in major conflicts with lower political risk for aircrew death, capture, or collateral damage, advanced SAMs, lack of air superiority, or poor weather may drive the military risk too high for manned flight. If the combination of political and military risk is high, target type will dictate the use of cruise missiles or UCAVs. Table 4 lists the most cost-effective weapons platform depending on risk, target size, and type.

USAF planners should use manned aircraft for all low-threat political and military missions because they are the most cost-effective and capable airpower tool. Because of current cruise missile CEP accuracy, UCAVs or manned aircraft with penetration LGBs are best for smaller hardened targets where the bombs need to "go down the air vent." An interim F-16C UCAV is the weapons system of choice if the political or military risk is high and the target is not cruise-missile capable. Because of the need for SEAD in military high-risk areas, F-16C UCAV CONOPS must address the coordination of both Block 40 LGB and Block 50 HARM unmanned aircraft.

Conclusions

Technology is taking the human out of the fight. In the near future, unmanned Army tanks, Navy ships, and Air Force aircraft will conduct battles controlled by operators hundreds or even thousands of miles out of harm's way. Advancing technology, smaller post-cold-war budgets, and political pressures

Table 4

Weapon-System Selection

Target Type	Military + Political Risk		
	High	Medium	Low
Soft	Cruise missiles	Cruise/UCAVs	Manned aircraft
Large Hardened	Cruise missiles*	Cruise*/UCAVs	Manned aircraft
Small Hardened	UCAVs**	Manned/UCAVs	Manned aircraft
Bridges/Armor	UCAVs**	Manned/UCAVs	Manned aircraft
Mobile/SEAD	UCAVs**	Manned/UCAVs	Manned aircraft

*If proposed hard-target penetration capability is available; otherwise, UCAV with LGBs
**Block 50 HTS UCAV SEAD may be needed for survival of Block 40 UCAVs

have convinced many scientists and military planners to push for research and development of unmanned systems despite the resistance to change from some leaders in the Pentagon. Because of past success stories and the current dependence of military commanders on the valuable battlefield information provided by systems such as Pioneer and Predator, the future funding of new UAV surveillance and reconnaissance platforms is assured. However, budget competition from the manned F-22 Raptor and Joint Strike Fighter programs has limited research and development funding and Pentagon enthusiasm for lethal UCAVs. Current estimates put the operational fielding of an advanced-technology UCAV system decades away.

In addition to cruise missiles, does the United States now need another unmanned lethal military option? Yes, the political, economic, and military benefits of quickly fielding an interim UCAV system are worth the additional funding. Similar to the important political advantages of cruise missiles, interim UCAVs do not expose US aircrews to the risk of death or capture, which also eliminates the need for CSAR resources. Unlike cruise missiles, however, reusable UCAVs may provide a more economical military option in certain situations than a one-shot, million-dollar-plus Tomahawk. Militarily, an interim UCAV provides more ordnance and target capabilities than cruise missiles, especially against smaller hardened structures and mobile targets. UCAVs also provide the military with a man-in-the-loop capability to identify target areas and give consent prior to ordnance release. In addition, the important CONOPS "lessons learned" and the resolution of other future unmanned flight concerns will greatly ease the transition of the USAF into an advanced-technology unmanned combat force later in the twenty-first century. A successful interim UCAV program will be an important stepping stone for the transition from a manned to an unmanned combat Air Force. For these political, economic, and military reasons, the United States needs an interim UCAV capability until advanced-technology unmanned combat forces are operational.

Can the USAF provide a quickly fielded, cost-effective, and capable interim UCAV? Yes, a dual-role F-16C UCAV is the answer. Converting four to six Block 40 LANTIRN or Block 50 HTS aircraft in current operational squadrons to dual-role manned and unmanned F-16Cs will provide a cost-effective and capable UCAV option that the USAF

could quickly field. The F-16C UCAV is cost-effective not only because the simple aircraft modification is the addition of off-the-shelf communications and remote-control equipment; more importantly, it uses the existing F-16 infrastructure. The use of the current F-16C airframe, support and operations facilities, and maintenance, plus pilot "operator" workforce, would eliminate expensive new weapons system start-up costs, including the training of additional personnel.

The F-16C Block 40 and 50 dual-role UCAV is a "can't lose" proposition. With a small program investment and limited risk, there is a huge potential payoff. The USAF should immediately start funding research and development for the operational fielding of F-16C UCAVs. □

Notes

1. Mark Walsh, "Battlelab of Drones That Can Kill," *Air Force Times* 57, no. 52 (28 July 1997): 27.

2. David A. Fulghum, "Groom Lake Tests Target Stealth," *Aviation Week & Space Technology* 144, no. 7 (5 February 1996): 27.

3. Slide presentation with notes, Col Michael Francis, Defense Advanced Research Projects Agency, n.p.; on-line, Internet, 1996, available from http://www.arpa.mil/ARPATech-96/slides/francis/100/1.gif.

4. Col Bruce W. Carmichael et al., "Strikestar 2025," a research study presented to the Air Force 2025 Study Group (Maxwell AFB, Ala.: Air Command and Staff College, August 1996), n.p.; on-line, Internet, 1999, available from http://www.au.af.mil/au2025/volume3/chap13/v3c13-1.htm.

5. Bill Sweetman, "Pilotless Fighters: Has Their Time Come?" *Jane's International Defence Review* 30, no. 6 (June 1997): 59–68.

6. Gen Ratko Mladic, as quoted in *New York Times*, 16 July 1995, A6.

7. "Tomahawk Cruise Missile Fact Sheet," US Naval Office of Information, Navy Public Affairs Library, Washington, D.C., April 1993, n.p.; on-line, Internet, 1999, available from http://www.chinfo.navy/navpalib/weapons/missiles/tomahawk/facts.txt.

8. James Burda, USAF Armament Production Group manager, Eglin AFB, Fla., *Precision Guided Munitions*, n.p.; on-line, Internet, 1999, available from http://www.issues.af.mil/pgm.html.

9. Dr. Robert Finkelstein, "Unmanned Aerial Vehicles Seminar Study Guide," study guide for the UAV Seminar, Washington, D.C., 17–18 November 1997 (San Diego, Calif.: Technology Training Corporation, 1997).

10. Ibid.; see also Air Force Audit Agency, *Full Scale Aerial Target Acquisition and Logistical Support* (Washington, D.C.: Air Force Audit Agency, 1997), 2.

11. David A. Fulghum, "ARPA Explores Unmanned Combat Aircraft Design," *Aviation Week & Space Technology* 144, no. 9 (26 February 1996): 23–25.

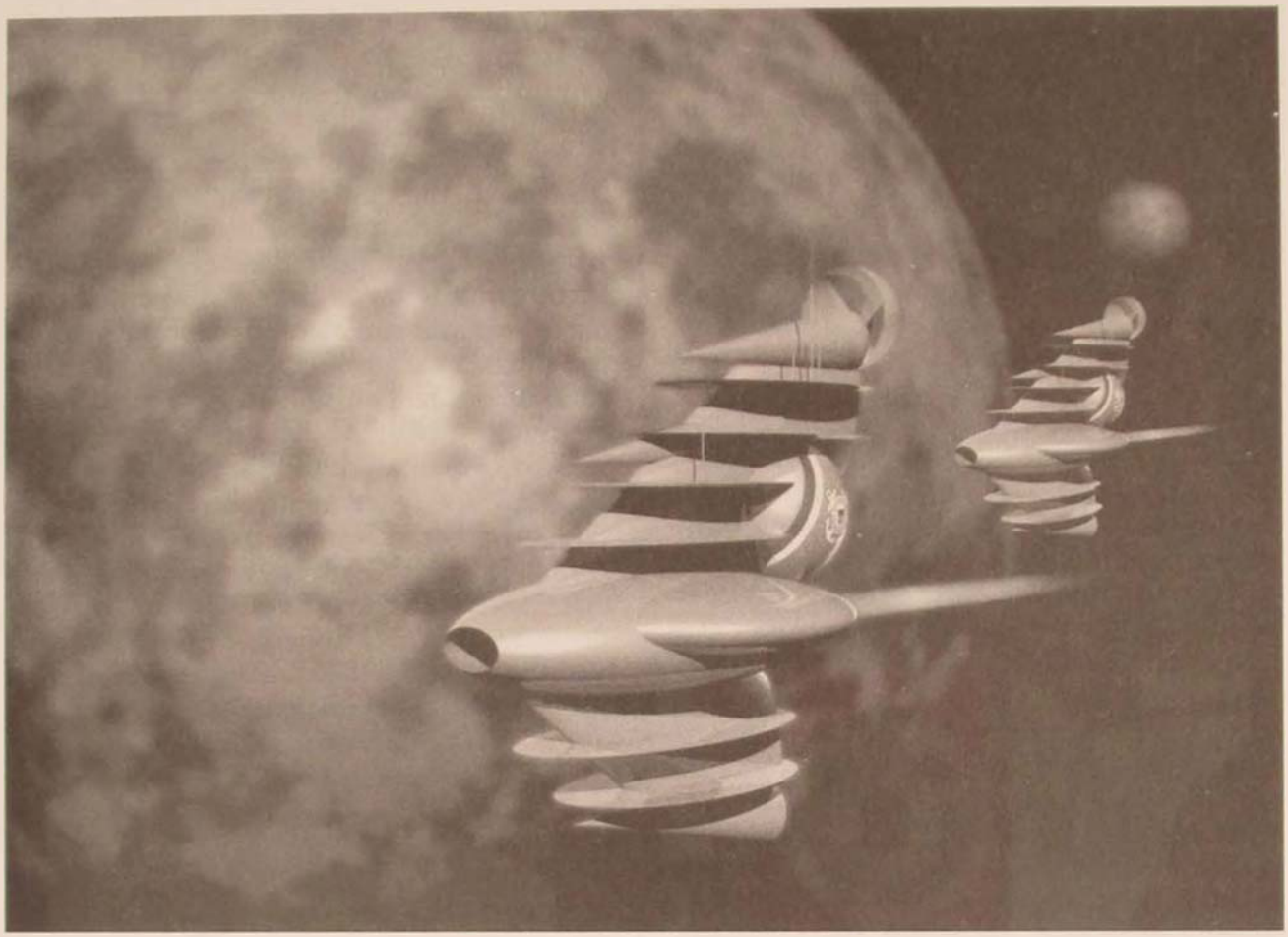
Being ready is not what matters. What matters is winning after you get there.

—Gen Charles Krulak

The Guardians of Space

Organizing America's Space Assets for the Twenty-First Century

Lt Col Cynthia A. S. McKinley, USAF*



When it comes to exploiting space for national security and economic prosperity, the United States is without peer. For over four decades, this nation has led the opening of the space frontier and has achieved unprecedented successes. We have developed new technologies; launched spacecraft into Earth orbit and beyond; and learned how to use spacecraft to better understand our planet, quickly communicate, disseminate information, warn of attack, and locate people and infrastructure on Earth. We have walked on the Moon and peered in awe at the surface of Mars and newly discovered solar systems.

But these past successes do not guarantee future successes. Maintaining our historical level of achievement demands that we consolidate current and future space services

*This essay owes its existence to Col Evan J. Hoapili's constant prodding and to our numerous discussions in 1998. Were it not for his encouragement (and insistence) that I set pen to paper, the Space Guard concept would still await illumination.

functions in one organization.[1] This article unveils the recommended organizational structure for our nation's space assets by examining the changed frontier and the imperatives that demand change, and by using the already successful historical model of the US Coast Guard as a springboard for future success. The recommended organizational structure promises to free the Air Force to pursue its aerospace power vision and allow this nation to use space assets most effectively and exploit space successfully in the coming decades.

The Changed Frontier

As is the case with the opening of any frontier, once opened, both the participants and the frontier are forever changed. Only four decades after its opening, the space frontier is already noticeably different.

Whereas space operations were once highly specialized and infrequent, many are now normalized and routine. Space services that initially supported an insular set of users are blossoming into global utilities. By opening the space frontier and ushering in the information age, we are connecting our daily lives to spacecraft orbiting far overhead. As barriers to entry fall left and right, the original US space team—the National Aeronautics and Space Administration (NASA), the military services, and the National Reconnaissance Organization—continues to be joined by an ever-increasing number of worldwide commercial space start-ups and civil entities exploring their own newfound space equities. In short, the nascent frontier—the once restricted domain of space characterized by high costs, low experience, and uncertain technologies—has already become the "common ground."

Imperatives for Change

This environment creates three kinds of tension in the three space sectors (i.e., national security, civil, and commercial sectors). Cultural and funding tensions are creating pressures within each sector, and organizational tensions are causing strife among organizations.

Cultural Tensions

Organizations are created to accomplish a unique set of missions. As its members embrace those responsibilities, a culture that epitomizes the organization's sense of identity forms around those core missions. When the organization begins to extend itself beyond this raison d'être, cultural tensions quickly emerge.

The Air Force, for example, was formed to "fly and fight," and the words *global reach, global power* best convey its sense of identity. With its fly-and-fight self-image, a degree of friction has always existed between the Air Force's air and space cultures. At the heart of this discord lies the fact that today's space capabilities remain outside the Air Force's sense of identity.

During the past decade and a half, this discord has been thrust into the spotlight each time the service's leadership has attempted to erase the cultural gap by force-fitting space operations into the Air Force's sense of identity. The Air Force's methods have included attempts to operationalize, normalize, and, of late, integrate space operations. The first two did not bridge the gap, and the last, despite its far more aggressive execution, will have the same result—but for reasons that bear explication.

First, a fundamental cultural dichotomy separates today's air and space communities: the difference between war fighting and support—between war-fighting and non-war-fighting cultures. Both war fighting and support are essential for national security, but the world in which each operates has different demands and expectations. At the most basic level, air warriors think in airpower war-fighting terms: operating and sustaining aircraft at bases, flying to targets, accomplishing a mission, and returning to base. They think in terms of campaign planning, operational art, and tactical success. Today's space operators think in terms of space services support: placing a satellite on orbit, continuously exploit-

ing its data, and sending its critical data to people who need it. These characteristics represent two equally important yet distinct cultures: one based upon a war-fighter mind-set and the other upon a support mind-set. Like trying to mix oil and water, it is, quite simply, unrealistic to expect the two to become one.

The drive to merge these two distinct cultures through integration has its roots in the fall 1996 Corona meeting of the Air Force's senior leaders. Although they originally viewed integration as a method by which to guarantee continued Air Force stewardship of space, within months of the meeting, integration was being interpreted as the necessary and sufficient condition by which the Air Force could seize the opportunity to call itself an aerospace force.

At the outset, it's important to note that the Air Force is the premier military organization for exploiting the aerospace. No other service can claim to have a war-fighting culture or vision that so fully embraces aerospace power. From day one, the Air Force's culture, core competencies, and sense of identity have been wrapped in its ability to provide global reach and power on behalf of our national interests. Indeed, the Air Force's transformation into an aerospace force should occur sooner rather than later, but to effect this transformation, the Air Force must grasp the true meaning and indicators of being an aerospace power. In addition to its inability to bridge the chasm between war-fighting and non-war-fighting cultures—regardless of the level of commitment and awareness—integration will not transform the Air Force into an aerospace power for at least two reasons.

Integrating space capabilities and personnel into mainstream Air Force operations and staffs neither equates to nor creates aerospace power in its most visionary sense. We will achieve aerospace power when we take the revolutionary leaps to foster new ways of employing forces and new ways of conducting warfare. We will achieve it when we directly employ space-warfare platforms to achieve military objectives.

In addition, the Air Force isn't alone in its quest to better integrate space capabilities. All of the military services face similar integration challenges and opportunities, the end state of which is spelled out in *Joint Vision 2010*.[2] To say that using space services to improve airpower makes the Air Force an aerospace force means that using space to improve land or sea power makes the Army a land-space force and the Navy a maritime-space force. Providing only space services and integrating those services into mainstream air operations will not create aerospace power. Again, the key to becoming an aerospace power lies in the operational use of space as a war-fighting medium.

The Air Force will achieve its vision of becoming an aerospace force, but it must first have aerospace power capabilities—that is, the attainment of aerospace power must precede the service's claims of being an aerospace force. Throughout our nation's use of orbital space for national security, the Air Force's war-fighting operations have been restricted to atmospheric war fighting. This will change early in the first half of the twenty-first century. The capabilities that will allow operational exploitation of the entire aerospace medium, create aerospace power, and allow the Air Force to change its moniker to Aerospace Force are already on the drawing board.

The most obvious example is the Space Operations Vehicle (SOV).[3] Within two decades, this vehicle will allow the United States to project power, not in the several hours it does today but in minutes. It will allow the United States to project power, not just within the atmosphere but in orbital space, in the atmosphere, and to the surface of the planet. This, along with other future capabilities, will naturally extend the war-fighting responsibilities of airmen into the entire aerospace medium. In short, in the next couple of decades, the Air Force's core competencies and visionary concepts will transform it from an air force into an aerospace force that operationally employs both air and space platforms to achieve our nation's military objectives.

But we are speaking of the future—not the present. Despite valiant efforts to force the Air Force's air and space cultures to merge, the gap between the service's sense of identity and its current space responsibilities remains. For the Air Force to achieve its vision of becoming an Aerospace Force, it must focus its space efforts on those systems that fit within its global reach, global power identity. Furthermore, it must relinquish its non-core, non-war-fighting responsibilities for providing space services.

Although the Air Force's leadership has not realized this fact or the magnitude of its implications, evidence exists that some senior leaders are beginning to discover it. During the past couple of years, the Air Force's senior leadership has found itself concurrently defending its space stewardship role while questioning, for example, its primary management of launch ranges—especially now that commercial activity outpaces government launches. It is becoming increasingly obvious that few of today's space-related activities fall within the Air Force's core competency of providing global reach and power.

Similar cultural tensions are apparent in other sectors of the space community. NASA faces internal struggles when it contemplates routine shuttle services, continuous replenishment of the international space station, astronaut rescue, and satellite repair instead of sticking to its science, research, and exploration charter. NASA questions how providing routine space shuttle operations—especially to the international space station—fits with its traditional focus on exploration. Similarly, the Federal Aviation Administration (FAA) questions its potential role as provider of both air- and space-traffic control.

These cultural stresses are natural. When organizations extend themselves beyond their sense of identity, cultural frictions inevitably arise. These tensions do not lessen the relative value of the missions in question. Quite the contrary, the missions remain vital and essential. Conducting shuttle flights and managing launch ranges are clear examples. But as the missions extend beyond the organization's raison d'être, cultural tensions will and must emerge.

Funding Tensions

This cultural stress is exacerbated by a second area of tension—funding. Today's zero-sum budget environment does not provide enough money for organizations to support both their core competencies and other essential, though ancillary, functions. Resentment over these extra responsibilities can arise because often they are "must-pay" bills. For example, NASA cannot ground the shuttle, and the Air Force cannot close its launch ranges without causing widespread outcry. Indeed, in many cases, the majority of users of space services resides outside the organization paying the bills.

A prime example is the Global Positioning System (GPS). The more we use GPS for human safety measures, the closer it approaches the status of a utility that the world population daily relies upon and that the United States finds itself obliged to provide. In the end, must-pay ancillary functions consume funds that otherwise would have been invested in an organization's core competencies.

This tension is particularly acute for the Air Force. A popular complaint against the service is that when it comes to choosing between air and space programs, air always gets 51 percent of the vote. This implies that the Air Force is parochial in its choices between air operations and space operations. It is not. Nor is it even close to being in a position that allows it to do so. The Air Force is not yet "comparing apples to apples" and will not get to that point of the debate until we stop rigging the game in favor of space services—until we do something about the must-pay ancillary bills.

In other words, the Air Force is not at the point at which it can debate the pros and cons of air war-fighting platforms versus space war-fighting platforms. It is not at the point at which it can debate the relative value of F-22s versus SOVs and airborne lasers versus space-based lasers. It is still pitting war-fighting platforms against support platforms—and those

support platforms, those space services such as launch ranges, navigation, surveillance, and so forth, comprise the largest of the must-pay bills.

This debate is fundamentally different from the traditional ops-support or tooth-to-tail decisions of the past. With space services, one cannot use the familiar models and processes that work so well with systems such as tankers and transports. This is true for at least two reasons.

First, space services are absolute. In the air business, aircraft need support from tankers. The size of the tanker force depends upon many factors: estimated operations tempo, employment strategies, projected threats, size of the supported fighter and bomber fleets, and so forth. Trade-offs with any of these variables can increase or decrease the number of tankers needed. This is not the case with space services.

Because space services provide a global, ubiquitous service, once a decision is made to provide a capability, the infrastructure requirements quickly become immutable. For example, regardless of the number of GPS receivers—one or one million—the satellite constellation must be a certain size in order to provide navigation services. Regardless of whether we expect a detection system to report on one missile launch or a multitude, if the nation wants to use space-based warning systems, it must procure and maintain a certain minimum number of satellites and processing stations.

Second, space services tend to be more open systems. Tankers, for example, can support only certain types of aircraft. GPS, weather, communications, and other satellites support any user who possesses the equipment to receive the signals. Consequently, many space services have become or are becoming global utilities, adding an external layer of pressure during internal funding trade-off deliberations.

For example, the Air Force may decide to take a calculated risk by limiting the number of tankers it buys. It can do so because its decision affects mostly itself or other military forces. The same situation does not apply to space services. The Air Force cannot take a similar calculated risk with launch ranges, navigation satellites, warning systems, and similar services because they support so many non–Air Force, nonmilitary, and even non-US users.

Under today's configuration, the Air Force is expected to equally prioritize funding opportunities for its own direct war-fighting capabilities as well as its own and its customers' support needs. These space services represent non-core, non-war-fighting services that carry some of our nation's largest must-pay bills. Responsibility for these space services keeps the Air Force from pursuing its aerospace vision. Functioning as a premier power projection force while at the same time functioning as the provider of space services to a multitude of customers pulls the service in opposite directions. To achieve aerospace power and become an aerospace force, the Air

Continued tensions among private space-launch contractors, the Air Force, and NASA are causing America to fall behind in space access.

Force must be allowed to carve out the space services portion of its current responsibilities.

Organizational Tensions

The third tension occurs among organizations. Organizational frictions arise as the domain draws more players and competing interests. As they go about their business, the players define niches and defend equities. For the space arena, the number of players and their linkages depict a tangled undergrowth. It is often difficult to know whom to consult to resolve policy issues, answer questions, or get help. The flip side is equally difficult. The organization receiving the call often does not know how to (or even whether it should) respond. For example, is it an Air Force responsibility to provide orbital collision avoidance data or analysis of satellite malfunctions to commercial interests? If not, to whom should these companies turn?

With the maturing of space exploitation, these three tensions are creating a universal sense of frustration. Commercial organizations feel hindered by government organizations that are not keeping pace with their rush to market. Civil organizations feel overburdened by essential operations that lie beyond their equities. And military visionaries who see future space operations as key enablers of a revolution in warfare feel tethered by a seemingly unsupportive infrastructure.

Organizing for Future Success

The path our nation should follow for successful space exploitation must strike a balance between mission requirements, core competencies, visions, and government responsibilities. It must account for the "common ground" space environment; reduce inherent tensions; resolve competing civil, military, and commercial interests; increase opportunities; allow the Air Force to achieve its vision to become an aerospace force; and continue to provide the space services upon which our nation depends. Arriving at the optimal organizational structure requires analysis of the space functions of today and the near future (table 1).

Table 1
Space Services Functions

- Range Management
- Navigation
- Spaceport Security
- Orbital Slot Protection
- Spectrum Use Monitoring
- Dealing with Piracy
- Dealing with Interference
- Space Surveillance
- Collision Avoidance
- Debris Mitigation and Cleanup
- Space Environment Research
- Terrestrial Weather
- Solar Research
- Astronaut Rescue
- Satellite Repair

These functions are currently performed by a variety of organizations throughout the three space sectors. As a result, no unifying organizational structure exists, and there is no possibility of these functions working seamlessly toward a national-level space exploitation objective. Interestingly, for another environmental medium, our nation has pulled similar functions together under the rubric of one organizational structure. This past success offers a notional organizational guide for our space future.

The United States Coast Guard

Between 1915 and 1942, the United States government consolidated the functional responsibilities of five separate government services to form the United States Coast Guard. It combined the "sea services" types of functions under one organization to provide better service to the nation and to ensure that the Navy was not encumbered by responsibilities that lay beyond its core competency of prosecuting campaigns and defeating other navies.

The Coast Guard's roots reach back to 1789 with the formation of the Lighthouse Service. Although all seafarers depended upon its support, the service was not assigned to the Navy. Instead, a separate federal service had the re-

sponsibility for guiding seafarers through the dark of night and fog of day. During the course of the next one hundred years, the Treasury and Justice Departments organized four other sea-related federal services—the Revenue Cutter Service, Steamboat Inspection Service, Life-Saving Service, and Bureau of Navigation—to satisfy the pressing needs of our nation. Consolidation of these five federal services began in 1915, when the Revenue Cutter Service and Life-Saving Service combined to form the Coast Guard. The final consolidations occurred between 1939 and 1942, when the Coast Guard assumed responsibility for the Lighthouse Service, Steamboat Inspection Service, and Bureau of Navigation.

Throughout its history, the Coast Guard has flexed with the needs of the nation. In times of peace, it attached to the Department of the Treasury (from 1915 until 1967) or the Department of Transportation (DOT) (from 1967 to the present); when the nation was at war during those spans of time, it served under the command of the Navy. During each war from the War of 1812 to the Persian Gulf War of 1991, Coast Guardsmen stood shoulder-to-shoulder with the Navy's sailors to fight for our nation's interests. Each time, they complemented the Navy's capabilities to provide the full array of sea-related military tools needed by our nation.

Just as important as the observation that the Navy and Coast Guard can complement each other within the same medium (the sea) is the parallel between Coast Guard missions and current or emerging space missions. The evolution and formation of the Coast Guard's missions reflect the importance of sea-based trade to the economy, of access to the sea by private citizens, and of the sea itself to national security. Orbital space now has that same level of importance to America's economy, standard of living, and national security. A quick comparison of traditional Coast Guard responsibilities and space requirements provides a telling story (table 2).

Table 2
Coast Guard Responsibilities and Space Requirements

Today's Coast Guard Provides	*Space Exploitation Requires*
• Waterways Management	• Range Management
• Aids to Navigation	• GPS
• Seaport Security	• Spaceport Security
• Fishing Protection	• Orbital Slot Protection
• Treaty Enforcement	• Spectrum Use Monitoring
• Dealing with Piracy	• Dealing with Piracy • Dealing with Interference
• Boating Safety	• Space Surveillance • Collision Avoidance
• Environmental and Pollution Control	• Debris Mitigation and Cleanup
• Ice Operations, Science, and Weather	• Space Environment Research • Terrestrial Weather • Solar Research
• Boater Rescue	• Astronaut Rescue • Satellite Repair

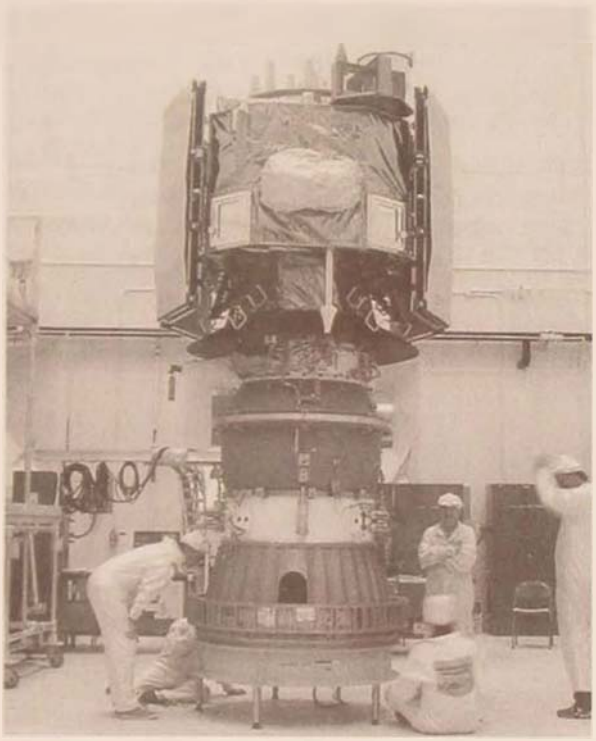
What jumps out isn't just the similarity in functions, but also the realization that the Coast Guard model represents the best organizational structure to accomplish these tasks. It provides services to several departments of government and sectors of the economy. Its mission responsibilities represent public goods. At all times, the government retains the option to designate the Coast Guard as a war-fighting component when it needs to do so for national security. Of particular note, the Guard bridges the tenuous area created when it becomes necessary to employ military forces in a zone designated for peaceful exploits. For example, no one seriously considers that a Coast Guard presence "militarizes" the Great Lakes. Finally, the Coast Guard's ability to shift between DOT and the Department of Defense (DOD) shows that no seam exists on the water, despite having two sea-faring services.

Looking at the above list of Coast Guard missions, one might ask whether it would make sense to place those missions in the Navy if we were to start today with a clean slate. The answer is no—because of the same core competency, war fighting versus must-

pay support, and organizational tensions outlined earlier.

The United States Space Guard

Looking at the space side of that list, we must ask the inevitable question, Should these existing and emerging space functions reside separately across several departments? The answer is no—there must be a better way.



The GPS is a space service similar to maritime navigation managed by the US Coast Guard.

What follows is a suggested organizational structure for the nation's space assets. The proposal offers the potential of satisfying and resolving the competing civil, military, and commercial interests and inherent tensions. It frees the Air Force to realize its vision to become a fully capable aerospace force, and it goes well beyond the "divest a program here, outsource a program there" methods currently under consideration.

The recommended organizational structure for space services is the United States Space Guard (USSG), a fusion of civil, commercial, and military space personnel and missions. Although an armed service and a ready instrument of national policy, the USSG would remain an operating administration of the DOT for day-to-day operations. In times of crisis, it may be designated as an arm of the United States Air Force. The Space Guard's funding should come not only from DOD coffers, but also from all military, civil, and commercial enterprises that benefit from its services.

In the near term, the Space Guard's responsibilities should include all space operations currently tracked under the national space policy's mission areas of space support, force enhancement, and space control. It should work existing issues such as spaceport safety and security, satellite design, debris minimization, and more. Like the historical evolution of its coastal counterpart, the USSG should soon assume responsibility for missions such as fixing disabled satellites, resupplying stations, refueling satellites, eliminating space debris, conducting astronaut search and rescue, monitoring treaties and sovereignty issues, arbitrating spectrum interference, and controlling space lanes.

Its personnel should come from existing space structures such as those found within the military, NASA, DOT, FAA, and others. Regarding the career progression of USSG personnel, they will have space services opportunities ranging from space launch and range operations, to satellite tracking and commanding, to on-orbit mission specialties. The Space Guard will at all times be com-

manded by general officers schooled, trained, and experienced in space specialties. Space professionals will have a clear and broadened career path, and other space specialists will lead them.

Pursuing the above recommendation results in an organization dedicated to civil space concerns, acceptable to many space stakeholders, and involved in national security—all the while allowing other organizations to focus on their core competencies.

Implementing the proposed model and preparing our nation's space forces for the future require the Air Force to return to its roots, to refocus its attention on its core warfighting responsibilities, and to accept the fact that it must let everything lying outside the framework of global reach and global power find a new home. In short, it means that the Air Force must accept the imperative for a fundamental divestiture of all space services. By divesting space services, the Air Force will be free to focus on its core warfighting responsibilities. It will be unencumbered by the enormous financial responsibilities of administering the nation's space services. Its culture will encompass the flying and fighting corps that has served it so well throughout its history. And it will be able to dedicate its space efforts to developing the future space force application systems that will finally allow it to claim the aerospace title. On a larger scale, the nation will have reduced the size of its force structure while improving its ability to exploit space for national benefit.

Conclusion

Space systems affect each of us daily. We learn of world events, communicate, and conduct business via satellite links; view distant galaxies via space-based telescopes; and consider it inevitable that we will eventually mine asteroids and planets to improve life on Earth. More than ever before, space is connecting the far reaches of our planet, exponentially increasing the rate of learning, and becoming the gateway to world economic growth.

The imperative for our original space team to divest is inescapable. We must do this smartly and in a manner that supports the needs of our nation and the space sectors. The only remaining decision entails finding the model that offers the best hope for success. The common ground of space is an internationally exploited domain, and our nation needs a multiagency organization to oversee its interests there.

The strength of the Space Guard concept lies in the fact that it takes space services in the same direction as space exploitation, resolves long-standing challenges, and frees the Air Force and others to refocus on organizational core competencies. It solidifies our space effort, clarifies organizational responsibilities, and unifies the many, disparate drumbeats demanding change.

The time for action is now. The USSG is the right organization for successful exploitation of space in the twenty-first century. As the exploitation of space changes, so must our space forces change. The government must retain oversight of the space services that both enable warfare and can be viewed as public goods. The commercial sector must stay ahead of its international competitors. A civil-military space service—the Space Guard—is our best hope for satisfying the competing interests of all government and commercial sectors. □

Notes

1. *Space services* refers to space-related support activities including, but not limited to, launching satellites, operating spacecraft, and providing or exploiting space capabilities such as communications links, navigation signals, weather information, and environmental sensing data. See also table 1.

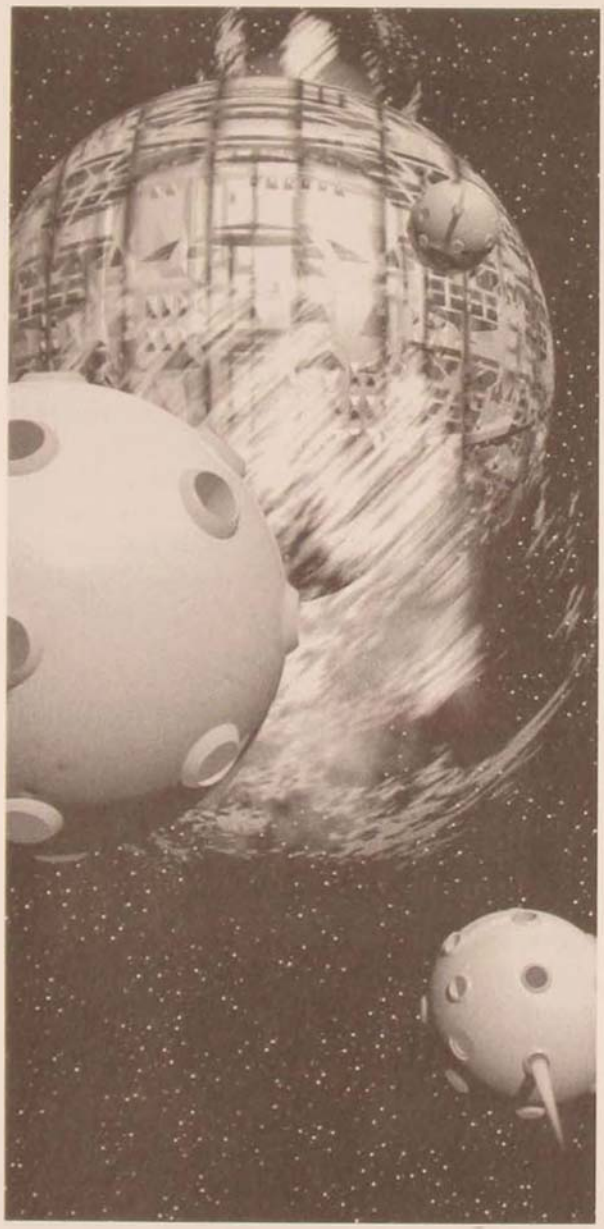
2. *Joint Vision 2010* (Washington, D.C.: Joint Chiefs of Staff, 1995).

3. The SOV has also been called the Transatmospheric Vehicle and Military Space Plane.

The Weaponization of Space

It Doesn't Happen in a Vacuum

Maj Howard D. Belote, USAF*



In the late 1950s, President Dwight D. Eisenhower set United States space policy on a vector it has sustained to this day. Despite the public outcry over the Soviet Union's launching of *Sputnik I*, Eisenhower crafted a space program that provided the national leadership with what it craved—information—while limiting government expenditures and preserving civilian control of national assets. Realizing that "first and foremost, space was about spying, not because the United States was aggressive, but because the USSR was secretive," the president finessed "a policy subtle in conception and delicate in execution. The United States [became] the champion of 'freedom of space,' . . . 'space for peace' and 'space for all mankind,' a thread in American policy that stemmed from traditional idealism and respect for the rule of law on the one hand and from Cold War competition for prestige on the other."[1] Quite simply, Eisenhower deeply believed that space without weapons was in his country's self-interest.

Almost immediately, however, the fledgling Air Force began to look for ways to extend its institutional prerogatives into the new medium. Although early attempts to come to grips with space focused mainly on nuts-and-bolts issues of international law and the limits of sovereignty,[2] airmen soon developed visions of space that were at odds with those of their political leaders. In fact, Air Force leaders pushed for dual-use research and development programs for space—witness the Dyna-Soar program cancelled by Secretary of Defense Robert S. McNamara—and

*I would like to thank three former and current faculty members of the School of Advanced Airpower Studies for their helpful criticism of early drafts of this article: Lt Col Roy F. Houchin II, who also suggested the article's format, Dr. Harold R. Winton, and Dr. David R. Mets.

some of them soon called for the weaponization of space.[3]

By no means did all airmen rush to advocate deployment of weapons in space. To the Air Force's credit, the service fostered a lively and wide-ranging space debate in the pages of its professional journals. Indeed, articles in the Spring 1999 *Airpower Journal* by Gen Thomas Moorman, Maj Shawn Rife, and Sen. Bob Smith (R-N.H.) show that the debate is alive and well.[4] A small but representative sample of that debate—five articles published between 1968 and 1998 in *Airpower Journal* and its predecessor, *Air University Review*—sketches the arguments of both proponents and opponents of space weaponization and provides a historical foundation for continued discussion. Significantly, the context in which the articles were written, their common themes, and their respective strengths and weaknesses suggest a viable space policy for the near future.

Early Steps toward Weaponization

In late 1968, Maj Gen Oris B. Johnson, commander of the 9th Aerospace Defense Division, wrote an article that helped open the door for weaponization advocates. In "Space: Today's Front Line of Defense," General Johnson emphasized the "continuity of the air/space medium" and the inevitable nature of the Air Force's growth into space. "Both physically and conceptually," he argued, "the extension of military systems beyond the lower atmosphere has turned out to be natural and evolutionary."[5] The general then struck a chord that would resonate in the space debate for the next 20 years: "The demonstrated space accomplishments of the U.S.S.R., together with their avowed intention of ruling the world, leave no room for complacency. Regardless of our intent and desire to use space for peaceful purposes, the fact remains that the Soviets are deeply committed to their space program and that it is conducted under military management."[6] Although General Johnson acknowledged America's avowed intention for peace in space, he used Soviet testing of a fractional orbit bombardment system and antiballistic missile (ABM) system to argue that "the necessity for effective space defense weapons is both obvious and urgent."[7]

Having emphasized the threat from the "Bear," General Johnson outlined the basics of aerospace defense. He described the four functions of detection, identification, interception, and destruction, and explained how each applies to both defense against intercontinental ballistic missiles (ICBM) and space defense. Regarding ICBMs, General Johnson noted the hows and whys of quick detection and then analyzed the technical difficulties of boost-, midcourse-, and reentry-phase interception. He acknowledged "formidable development problems" with any of the three, but posited an operational anti-ICBM system by the early 1970s.[8] Finally, he described the nation's nascent ability to track objects in space—at the time, the only existent aerospace defense capability.

Ill at ease with such a gap in defense, General Johnson concluded that the national strategy "depends primarily on the ability of our strategic forces to survive and react" and that "the nation which first deploys a cost-effective space defense system will enjoy a military advantage."[9] However—perhaps out of understanding the political restraints on space weapons—he danced around an explicit call for weaponization. Although in favor of "deployment of defense weapons against the existing space threat just as rapidly as cost-effective systems become available," he cited explicit requirements only for detection, tracking, and identification systems—not for destructive systems.[10] The general avoided stepping into a political no-man's-land but certainly pointed the way for later weaponization advocates to follow.

Overt Advocacy

In the 1970s, reflecting perhaps Vietnam weariness or the idealist nature of the Carter administration, *Air University Review* pub-

lished little concerning the weaponization of space. However, in the 1980s, an era framed by cold war "evil empire" rhetoric and mass-media nuclear fear,[11] the journal renewed the debate with intensity. One of the first authors to pick up General Johnson's threat-based line of reasoning was Maj Steven E. Cady, a B-52 electronic warfare officer who contributed "Beam Weapons in Space: A Reality We Must Confront."[12] Major Cady started off with estimates from the Office of Technology Assessment suggesting 70–160 million deaths immediately following a nuclear attack, with millions more to die later. He combined this vision with a warning that "the nation's deterrent power derived from its nuclear and other military arsenals is, however, probably much lower than most American military personnel assume it to be." Due to organizational, political, and behavioral factors, Cady argued, "the Soviet perception of America's deterrent capability is likely to be much less favorable than that of the leaders of the United States."[13] To finish his description of the threat, Cady listed a number of Soviet achievements to demonstrate that "the United States is no longer the strongest nation in the world on land, at sea, or in the air" and that "'*in terms of space weapons capability, they* [the Soviets] *are ahead and are likely to continue in the lead for the next several years*'" (emphasis in original).[14]

Fortunately for those frightened by his alarmism, Major Cady provided the remedy: "satellites firing laser [or particle] beams across thousands of miles to destroy enemy satellites, or ground-based enemy missiles immediately after their launch, or selected enemy targets on earth." Betraying a fundamental misunderstanding of classical deterrence theory, Cady argued that such directed-energy weapons "offer a remarkable potential for restoring America's deterrent power."[15] He brushed aside questions of legality with the observation that "preoccupation with the niceties of law would be appropriate in a utopian world" and conceded that deployment of such weapons might be difficult and costly.[16] However, he believed that such deployment need not lead to a space arms race: "The record of the Soviet Union in its foreign and military policy has never been one of rashness. . . . It is reasonable to assume that the Soviets would act with similar prudence if the United States opted for directed-energy weapons." Furthermore, because "the Soviet Union may well be ahead of the United States in developing such a system, the United States would be establishing parity only by also developing a system." Therefore, America " 'has no choice but to begin an urgent national crash program surpassing anything since the Manhattan Project.' "[17] In short, Major Cady used some commonly held but now discredited assumptions to demand overt weaponization of space.

Arms Control Counterargument

To be sure, it is unfair to ridicule Cady's suppositions in the light of post-cold-war hindsight; he was by no means alone in his beliefs. One must therefore note the existence of an equally vociferous and one-sided anti-weaponization faction, and *Air University Review* included such voices in its published debate. Reacting specifically against Ronald Reagan's Strategic Defense Initiative (SDI), Dr. Robert M. Bowman railed against those who would destabilize the international situation with ill-advised deployments of antisatellite (ASAT) weapons or space-based ballistic missile defense (BMD).[18] The author—a retired Air Force officer with a PhD from the California Institute of Technology, a long history of space- and engineering-related jobs, and (in 1985) the presidency of a space and security issues think tank—based his argument on an accurate reading of Schellingesque deterrence theory. First-strike capability was bad; survivability and transparency were good; ASATs—developed only because the Soviets were working on one—threatened "to negate the beneficial stabilizing influence of [vulnerable] surveillance and warning satellites."[19] Combined with the first-strike capability of the new MX missile, Bowman opined, an operational ASAT might drive the Soviets

to a launch-on-warning posture, making the survival of the United States "dependent on the reliability of Russian computers." Even worse, he asked, "What happens if a Soviet warning satellite is struck by a meteor or suffers a catastrophic electrical failure?"[20]

Leaving that image behind, Bowman turned to his real target: Reagan's "Star Wars" BMD system. Citing the technological similarities between ASATs and BMD, he declared that "from an operational military point of view, as well as an arms control point of view, space weapons must be dealt with as a whole"; he then noted that "the decision about whether to proceed [with ASAT and then BMD development] is time-urgent. . . . If Star Wars weapons . . . are either infeasible, unaffordable, or detrimental to our security, then we should attempt to negotiate a comprehensive and verifiable ban on all space weapons."[21] Unsurprisingly, Dr. Bowman cited the dangers of a less than completely effective BMD shield, listed a number of cheap counters to BMD, and concluded that "there is no way to get [a viable BMD] capability without, along the way, getting the capability to complete a first-strike posture."[22] Therefore, "Star Wars is far more than is required to enhance deterrence and far less than is required to replace it," and "the best way for the administration to show . . . that it is sincere . . . would be to join the Soviet moratorium on ASAT testing."[23] In sum, although his conclusion was certainly in line with Eisenhower's original "space for peace" vision, Bowman was as guilty of zealotry and single-mindedness as the weaponization advocates. His deterrence theory was sound, but he made far too large an inferential leap from "ASATs destabilize" to "no Star Wars."

Chicken Little

In 1989 the Berlin Wall crumbled, and the context of the space weaponization debate changed radically. Deprived of the monolithic Soviet bogeyman, proweaponizers needed a new threat to prod their audience into action—so they more or less created one. To illustrate the dangers still inherent in the post-cold-war world, Lt Col Michael E. Baum, a B-52 pilot and systems analyst with a PhD, wrote "Defiling the Altar: The Weaponization of Space."[24] Employing a fictional scenario, the article described the "worst intelligence failure in 70 years," when, on 7 December 2011, the Chinese executed a Pearl Harbor–like assault from space and crippled the United States with a series of devastating attacks from above.[25] The new enemy used ASATs and on-orbit kinetic energy weapons to destroy a wide range of American space-based command, control, intelligence, surveillance, and reconnaissance assets; uplink/downlink systems; launch systems; and even sink a carrier and *Aegis*-class destroyer. Simultaneously, the Chinese attacked the US-UN peacekeeping force in the Spratly Islands, which the international community promptly ceded to Chinese control.

To highlight the lessons of 2011's Pearl Harbor, the chairman of the Joint Chiefs of Staff testified before Congress on April Fools' Day, 2012. Gen William Smith, Baum's fictional chairman, admitted that "the US took from [the Gulf War] the wrong lesson—that we would *always* own the high ground of space and be able to *depend* upon our assets" (emphasis in original).[26] The post-cold-war military followed a procurement strategy incongruent with developing space doctrine, blindly failed to admit that space would become weaponized, and institutionalized a number of single-point vulnerabilities that the Chinese were able to exploit. Therefore, Smith/Baum suggested ways to overcome those vulnerabilities and recommended a three-part weapons program with space-to-ground kinetic energy weapons, active and passive on-orbit protection, and ASATs. As Major Cady had done 12 years earlier, Colonel Baum rejected the Eisenhower-era vision, cried out for space-based weapons, and implied that "freedom of space" adherents had their heads in the sand—but without a clear threat, he had to spin quite a yarn to do so.

Back to the Future

Finally, by 1998 the argument had come full circle to Eisenhower's original ideal of "free space," as evidenced by Lt Col Bruce M. DeBlois's "Space Sanctuary: A Viable National Strategy."[27] DeBlois, a former professor at both the Air Force Academy and the School of Advanced Airpower Studies, highlighted a piece of the puzzle omitted by Johnson, Cady, Bowman, and Baum: the historical, cultural, and political context in which the weaponization debate took place. "The immediate military advantages of being the first nation to weaponize space are undeniable," he conceded, "but must be weighed against long-term military costs, as well as against broader social, political, and economic costs."[28] Echoing the cold war writers, DeBlois outlined the history of deterrence and then took the contextual description much farther. He traced the background of Eisenhower's (and subsequent administrations') open-skies space tradition and stressed the political realities that support sanctuary, such as lack of a real threat, technological limitations, cultural impediments (Americans do not see themselves as aggressors), and the phenomenal opportunity costs of space-weapon investment. Wrapping up a 10-point refutation of weaponization strategies, the colonel concluded that "what can be done with space weapons can also be done from the air, without the political baggage of weaponizing space."[29]

To support his call for space sanctuary, DeBlois included a number of recommendations for promulgating a peaceful "space vision" and outlawing space weapons by treaty. Although he clearly opposed overt weaponization, DeBlois did not allow critics to accuse him of putting his head in the sand. On the contrary, he called for vigilance: "The other historical trend in US space policy has been to hedge our sanctuary bets with investments in space-weapons research and development. Pursuing space-sanctuary policy does not preclude being prepared to do otherwise; in fact, one can make strong arguments that such preparedness encourages other actors to follow the sanctuary policy, since they could gain no advantage by challenging that policy."[30] Along those lines, DeBlois stressed that space was not in itself a center of gravity; rather, space systems contain critical vulnerabilities that must be eliminated or protected. In any case, DeBlois argued, far better strategies exist for protecting national assets and capabilities than a space arms race: strategies that continue "the 40-year pursuit of a secure space environment and global stability, and . . . [project] several paths for cooperatively using space to seek US national interests: long-term national security, economic well-being, and world-wide legitimacy of US constitutional values."[31]

Conclusion

Through five articles culled from 30 years of *Air University Review* and *Airpower Journal*, an as-yet-unresolved debate over the merits of weaponizing space emerges. Moving away from President Eisenhower's foundation of free space, an aerospace defense specialist during the race to the Moon advocated the deployment of advanced surveillance and tracking satellites, and implied that defensive weapons should follow. Fourteen years later, at the height of ICBM and medium-range ballistic missile escalation during the cold war, an Air Force major cried "Bear!" and called for the immediate and overt weaponization of space. In response to similar calls—especially to President Reagan's SDI program—a retired Air Force officer and think-tank leader countered that space weapons were inherently destabilizing and must be avoided at all costs. Of course, the Soviet threat went away, but the space weapons enthusiasts did not—they prophesied doom at the hands of the Chinese unless America were to rapidly develop and deploy new space capabilities. Finally, an active-duty academic brought the argument back to its starting point, pointing out the excesses of the advocates' positions and suggesting pragmatic yet nonthreatening policy choices for the future.

What lessons can be gained from this tour of the Air Force's space weaponization de-

bate? Examining the common themes of the debate, one finds tendencies for the participants to ignore context and lapse into zealotry. The proweapon faction made a Hobbesian assumption that if people can create a new weapon, they will, and overemphasized the threat to create momentum for change. In so doing, they ignored history, culture, and economics. One cannot fault Major Cady too much for his early 1980s alarmism, but he overlooked Americans' unwillingness to appear aggressive, and his proweapon successor, Colonel Baum, completely missed the fact that SDI had bankrupted the Soviet Union! Why should China's economy be able to create a space weapon system able to cripple the United States at a single stroke? Moreover, all of the "weaponizers," including General Johnson, forgot the Clausewitzian primacy of politics. Every administration in the last 40 years has validated Eisenhower's original position; there exists no political will to break the "space for peace" paradigm. To paraphrase Walter McDougall, there is no "escape velocity" that will take one beyond the political realities of this country.[32] Finally, Dr. Bowman—this sample's single representative of the arms control lobby—also failed to create a balanced, context-based argument. He asked the reader to accept his lumping together of all space weapons and dismissed potential counterarguments without conceding the existence of genuine threats to protect against and desirable space capabilities at least to explore. As a result, his call to join a Soviet testing moratorium proved as unimpressive as the others' cries of "the sky is falling."

Taken together, the first four articles suggest that zealots tend to miss the big contextual picture; they frame their arguments vividly but make poor bases for policy. By focusing specifically on contextual issues, Colonel DeBlois's article avoided that trap and pragmatically crafted desirable and achievable policy recommendations. DeBlois rejected the Hobbesian notion that space weaponization is inevitable, leaning more toward the Kantian suggestion that realist international attitudes can change, and that the United States can ensure security without costly space weapon systems. More importantly, he advocated continuing a policy that has worked for over 40 years. Eisenhower once told his Cabinet that "we have got to meet the [Soviet threat] by keeping our economy absolutely healthy. Without the health and expansion of our economy, nothing we can do in the long run, domestically or in the foreign field, can help."[33] To facilitate that strategy—and firmly believing that space sanctuary served American self-interest—Eisenhower preserved space for peace and prevented a space arms race. It took 30 more years, but the end of the cold war proved the value of such an economic-based security policy. Today, with American technologies probably ahead of those of the rest of the world by an order of magnitude, the nonweaponization of space may be even more in the national interest than in Eisenhower's day. Why fix something that is not broken? □

Notes

1. Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore: Johns Hopkins University Press, 1985), 194.

2. See, for example, Col Martin B. Schofield, "Control of Outer Space," *Air University Quarterly Review* 10, no. 1 (Spring 1958): 93–104; and Maj Charles A. Roberts, "Outer Space and National Sovereignty," *Air University Quarterly Review* 12, no. 1 (Spring 1960): 53–65.

3. Dyna-Soar was a hypersonic, reusable, boost-glide, manned space platform designed specifically for several types of military space missions. For more on the manned military space program, see Roy F. Houchin II, "Hypersonic Technology and Aerospace Doctrine," *Air Power History* 46, no. 3 (Fall 1999): 4–17.

4. Gen Thomas S. Moorman Jr., "The Explosion of Commercial Space and the Implications for National Security," Maj Shawn P. Rife, "On Space-Power Separatism," and Sen. Bob Smith, "The Challenge of Space Power," *Airpower Journal* 13, no. 1 (Spring 1999): 6–39.

5. Maj Gen Oris B. Johnson, "Space: Today's First Line of Defense," *Air University Review* 20, no. 1 (November–December 1968): 96.

6. Ibid., 97.

7. Ibid., 96.

8. Ibid., 99.

9. Ibid., 101–2.

10. Ibid., 102.

11. Recall the high television ratings enjoyed by "The Day After," a miniseries depicting postapocalyptic life; Mel Gibson's roles in the *Mad Max* movies; and the popular movie *WarGames*, among other examples.

12. Maj Steven E. Cady, "Beam Weapons in Space: A Reality We Must Confront," *Air University Review* 33, no. 4 (May–June 1982): 33–39. For another representative proweaponization article, see Dr. Barry J. Smernoff, "The Strategic Value of Space-Based Laser Weapons," *Air University Review* 33, no. 3 (March–April 1982): 2–17.

13. Cady, 34. As support, Cady cites Roger D. Speed, *Strategic Deterrence in the 1980s* (Stanford: Hoover Institution Press, 1979); the argument echoes the more familiar work of political scientists Graham Allison and Robert Jervis.

14. Cady, 35.

15. Ibid., 36. As explained by political scientist Karl Mueller, professor of international relations at the School of Advanced Airpower Studies, classical deterrence theory postulates that threatening people is good but threatening weapons is bad, as that suggests an aggressive first-strike posture.

16. Ibid.

17. Ibid., 38.

18. Dr. Robert M. Bowman, "Arms Control in Space: Preserving Critical Strategic Space Systems without Weapons in Space," *Air University Review* 37, no. 1 (November–December 1985): 58–72.

19. Ibid., 62.

20. Ibid., 63.

21. Ibid., 65–66.

22. Ibid., 70.

23. Ibid., 71, 72.

24. Lt Col Michael E. Baum, "Defiling the Altar: The Weaponization of Space," *Airpower Journal* 8, no. 1 (Spring 1994): 52–62. For a similar futuristic threat scenario, see Capt Fred Kennedy, Capt Rory Welch, and Capt Bryon Fessler, "A Failure of Vision: Retrospective," *Airpower Journal* 12, no. 2 (Summer 1998): 84–94, wherein the North Koreans, Iranians, Iraqis, and "several multinational corporate concerns" join the space-threat coalition.

25. Baum, 53.

26. Ibid., 59.

27. Lt Col Bruce M. DeBlois, "Space Sanctuary: A Viable National Strategy," *Airpower Journal* 12, no. 4 (Winter 1998): 41–57.

28. Ibid., 41.

29. Ibid., 52.

30. Ibid., 57, note 43.

31. Ibid., 55–56.

32. Describing an early RAND study on the political implications of the space age, McDougall writes, "Despite the flights of fancy of some space law theorists, there was no escape velocity that took one beyond the political rivalries of this world" (178).

33. Ibid., 138.

Elephants and Blindness

Fodder for the Air Warrior's/Scholar's Professional Reading on the Gulf War

Dr. David R. Mets*

In every country where man is free to think and to speak, differences of opinion will arise from differences of perception, and the imperfection of reason; but these differences when permitted, as in this happy country, to purify themselves by free discussion, are but as passing clouds overspreading our land transiently and leaving our horizon more bright and serene.

—Thomas Jefferson to
Benjamin Waring, 1801

THE SAME IDEA conveyed in the epigraph has been variously attributed to Jefferson and Indian philosophy as a fable involving seven blind men and an elephant. All of the men examine the huge creature, and each relates a different perception of the truth. One sees it as a snake, another as a wall, a third as a tree trunk, and so forth. All are right—and all are wrong. What are seekers of truth to do? They can only search out as many of the views of blind men and weigh each into a composite picture of reality. So it has been with the Gulf War; so it is soon to be with the Kosovo War. The aim herein is to help the Air Force warrior/scholar enhance his or her vision of what is real in air war.

This article seeks to render a fuller description of the elephant by providing an overview of the Gulf War's historical background and then examining the deployment and combat phases of the war, the latter objective aided largely through a review of *Shield and Sword: The United States Navy and the Persian Gulf War,* an important new book by Edward Marolda and Robert Schneller Jr.[1] As noted in earlier articles in my "Fodder" series, the authors draw their inspiration in large part from the work of one of America's greatest military educators, the late Col Roger Nye of the US Army, whose book *The Challenge of Command* every warrior/scholar should know.[2] At the end of each of that book's chapters, Nye offers a list of 10 books

*I wish to acknowledge the valuable assistance in the preparation of this article from my colleagues Dr. James Titus, Dr. Hal Winton, Lt Col Wray Johnson, and Lt Col Pete Hays. All errors of fact and interpretation are mine.

on the subject, recommending two for openers and eight more for depth and mastery. Following that pattern, I close with a sampler of 10 books on the Gulf War that may help you with your own professional reading program.

A Shoestring Primer on the Gulf War

Ancient Times

Sophisticated civilizations were developed in what is now Iraq, Iran, and Egypt four thousand years before Christ—which causes many people from that region to look upon confident Americans as arrogant Johnny-come-latelies.

Modernity

Western civilization got its start much later and for a long time was enshrouded in backwardness. By the nineteenth century, however, it had passed the older cultures, especially in military technology. This enabled it to start a new wave of imperialism that imposed European rule over much of the Middle East and Africa in that century.

World War I

The Great War was a turning point in imperial history in many ways. The great Russian, German, and Habsburg empires collapsed, but the winners were really the prime colonial powers. However, they were so severely weakened by that war that they never were able to recover their former greatness, although Britian and France temporarily gained League of Nation mandates in the Middle East.

Internal Combustion Engines and Oil

An energy revolution started with the development of internal combustion engines earlier, but the massive interwar conversion of ships, land vehicles, and home heating to oil greatly increased the strategic importance of the Middle East.

World War II

This world war completed the process of setting the great French and British colonial empires on the road to oblivion. It also marked the transition of the United States from the first of the colonial powers to have broken away to the main champion of the fading imperialists—and thus it became an enemy of the Third World.

Palestine and Israel

Creation of the Israeli state soon after World War II further weakened the US position in the Middle East. We became the only guarantor of the survival of the Jewish state on land that, for many years, had belonged to the Palestinians. The United States, therefore, became the great Satan, not only to the Arabs but also to the whole world of Islam.

British Withdrawal

US security had long depended in part on the relationship of the United States with Great Britain. That began to weaken soon after World War II, when a lack of resources no longer permitted the British to maintain stability in the world between Singapore and Gibraltar. Gradually, the United States began to assume part of that role.

Nixon Doctrine

America further alienated large parts of the anticolonial world in its assumption of the French role in Vietnam, really as a part of its containment policy. But the Third World did not see it that way, and the American defeat in Vietnam led to a new policy whereby the United States would supply the sea power, airpower, and some economic power, but local counterrevolutionaries would have to fight their own war on the ground.

Fall of the Shah

The first test of the Nixon Doctrine failed because Iran, the pillar of the Persian Gulf region, collapsed to an Islamic fundamentalist revolution. The Shah fled his homeland and died in exile.

The Soviets, Afghanistan, and the Horn

For a time after Vietnam, there had been a period of détente in the cold war, but it disappeared in the late 1970s. The Russians got into their war in Afghanistan, and it was not immediately clear that they would lose it. Too, they were soon promoting instability in noncontiguous areas like the Horn of Africa, and that seemed to flank the Persian Gulf's oil lifeline on both sides.

Iran-Iraq War

After the Shah, Saddam Hussein grasped the opportunity that he thought arose from the instability, starting a war with Iran that lasted for most of the 1980s. Although he won, he was drastically weakened from the long fight. The United States, alienated from Iran by the seizure of its embassy there, slightly tilted toward Iraq in that war but did so with restraint because Saddam remained a Soviet client.

Osirak Reactor

Saddam had showed himself capable of using weapons of mass destruction (WMD) by attacking his own people with chemical weapons. Because the Israelis could not tolerate the nuclear development program he had undertaken, they launched a preemptive air attack on the facilities of Osirak in 1981 that set back his effort but did not kill it.

Invasion of Kuwait

Early in August 1990, Saddam attempted to restore his economy by taking over Kuwait, asserting that it was only a province of Iraq. This diminished the already tenuous stability of the Gulf region, and most observers saw this aggression as an intermediate step toward taking over Saudi Arabia, a rich country that nevertheless lacked the human resources to offer much military resistance to Saddam's army.

The Gulf War: Deployment and Combat

Permitting Saddam to dominate Gulf oil would have amounted to giving him dictatorial powers over the developed world. The entire world economy depended heavily on Gulf oil, especially that of the NATO allies and Japan, so the United States immediately decided to take military action. Although the first requirement called for setting up a credible defense, US forces had to deploy halfway around the world. Inexplicably, Saddam permitted the United States several months to assemble a coalition and deploy overwhelming force to the region.

The coalition's offensive against Iraq did not launch until after the onset of 1991, and then it included an air-only phase that lasted several weeks. The air campaign began with a strategic attack at the center of Iraqi power, seeking to achieve air superiority, undermine Iraqi command and control (C^2), and neutralize Saddam's WMD capabilities. The abundance of airpower permitted an almost simultaneous conduct of the later phases, which sought to gain control of the air over Kuwait and then prepare the battlefield. That done, the ground war commenced with a turning movement around Iraq's western flank, and airpower then began to support the ground operation, which lasted four days.

Outcomes and Implications

The coalition quickly attained all of its declared objectives at a very low cost in casualties and with minimal collateral damage to Iraqi civilians. Space capabilities, information assets, and precision-weapons technology received high marks, as did airlift, air refueling, and transportation systems. Many people thought that the experience implied that, in the future, air forces would increasingly become the supported elements while ground and sea forces would provide support.

Overview

Doubtless, what appears to Islamics as arrogance—our presumption of cultural superiority—tends to make Americans unwelcome in the lands surrounding the Persian Gulf. In part, this attitude arises from the Islamics' knowledge that civilization had its origins in the region—in Mesopotamia. For thousands of years before Christian white Europeans discovered America, culture and science had developed and advanced in Persia and the area now known as Iraq—and in the lands now occupied by Egypt as well.

Modernity

Western civilization got its start many centuries later in Greece and then in Rome, but after the fall of the latter, it receded into the Dark Ages and a partial return to barbarianism. Meanwhile, the intellectual development that had occurred in Greece and Rome was largely preserved in the Arabic lands to the south. In large part it returned to Europe through the Iberian Peninsula when Moors ruled that area (until the fifteenth century). But the West had bypassed the older civilizations in military technology—at least by the middle of the nineteenth century. In the latter decades of that era, such advances enabled a new wave of Western imperialism to penetrate the lands of North Africa and the Middle East, and on into the regions of the Persian Gulf and beyond. Through most of the early modern period, the Americas themselves became objects for imperialism, none of them advanced enough to participate much in the new imperialism of the late nineteenth century. Well past this period, colonial peoples widely deemed the United States the first colony to successfully break away from archimperialist Britain; thus it became an American model for the rest.

World War I

In many ways, World War I represented the great divide; for example, it marked the beginning of the end for the great colonial empires. Actually, both Spain and Portugal had long ago lost most of their colonies. Now, the Habsburgs in Austria-Hungary and the Romanovs in Imperial Russia came to ruin. So, too, did Germany, a newcomer to the imperial race. Fighting had occurred in both Mesopotamia and Palestine, and France and Great Britain inherited some of the colonies of Africa and the Middle East under the disguise of League of Nations mandates. However, the French and English had suffered such grievous wounds in the war that they had little chance to rise again to their imperial greatness. Although the United States had acquired a mini-empire in the Pacific and Latin America and had clearly emerged as a great power, the Islamic lands of Africa and the Middle East had not yet deemed it the Great Imperial Monster.

Internal Combustion Engines and Oil

One of the reasons that America had not yet become the great Satan for Arabs and Persians was that it had largely left that region of the world to the British and French. Even with the coming of the internal combustion engine, oil-fired fleets, and the discovery of the great oil deposits of those regions, American involvement remained minimal to the east of the shores of Tripoli. We had ample domestic petroleum resources for our own needs and even for export. The US Navy did show the flag in the Persian Gulf, even in the nineteenth century, but the United States had no vital interests there. However, as the interwar period progressed, the great navies of the world completely converted from coal to oil, as did the heating systems of the world's great cities.

World War II

This war pounded the final nails into the coffin of Western imperialism and marked the time when much of the Third World came to look upon the United States as the Satan who would prevent decolonization. We were still self-sufficient in oil, but when we joined the British and Free French in the North African

campaign, many non-Europeans came to view the United States as the soul of imperialism. In Asia, the initial great triumphs of the Japanese over the Europeans and Americans made a profound impression: the white man *was* beatable. On top of that, the mechanization of ground war and the coming of air war both increased the demand for petroleum, and both Hitler's and Japan's great overextensions originated in their lust for the oil of the Caucasus and the East Indies.

As the war went on, US involvement in the Gulf region increased in another way. Because of the desperate need to keep Russia in the war, lend-lease aid would have to get through. One route for that lay northwards through Persia, so that at the end of the war, the USSR occupied the upper third and the Western allies the southern two-thirds of Iran. Just after the war, the United States left the region and tried to pressure the Soviets to do likewise, but the whole experience did little for our former anticolonialist image. Nor did it help that President Harry Truman reversed President Franklin Roosevelt's policy toward the French recolonization of Vietnam. As the price for French support of containment in Europe, he aided them in getting back to Indochina and in hanging on in Algeria.

Palestine and Israel

The largest downturn in American relations with the whole world of Islam began with the creation of the Israeli state in 1948. Dating from Truman's immediate support of the new nation, the United States has consistently rendered crucial aid in Israel's many wars against the Arabs. Although we were not yet dependent upon Gulf oil, our NATO allies were increasingly so. Notwithstanding subsequent discoveries of oil deposits in the North Sea and on the Alaskan North Slope, demand for oil had increased, and the United States transitioned from oil exporter to importer. The problem has increasingly become one of squaring the circle of assuring the flow of oil to the West while preserving the security of the Jewish state against prevailing Islamic hostility.

British Withdrawal

Ever since President James Monroe issued his famous doctrine in 1821, a special relationship has existed between the United States and Great Britain. Insofar as that doctrine had any impact at all in stemming European imperialism in the New World, it depended on the British fleet—not the US Navy. After the *Alabama* claims were settled in the 1870s and after the great British-American rapprochement of the 1890s, the relationship became tighter than ever, yielding important payoffs for both sides. One of the benefits for the Americans was that the British preserved stability and to a substantial extent supported US interests in the regions from Singapore to Suez. However, the toll of the two world wars and the loss of empire so weakened the British that they simply could not sustain a major presence east of Suez much past the end of World War II. They stated as much to President Truman. To some extent, he led the United States in fulfilling that role by establishing the Sixth Fleet in the Mediterranean and sustaining a minor Navy presence in the Persian Gulf itself.

Meanwhile, the oil factor became ever more important, and basing for the Navy's small Middle East force in the region became ever more tenuous—hence, the need for alternative basing in the region. In the 1960s, the United States had acquired rights from the British for a communications station at a tiny atoll called Diego Garcia in the Indian Ocean. By the late 1970s, we had developed it into a naval and air base although it still was a long way from the Persian Gulf.

Nixon Doctrine

One of the legacies of the Vietnam War was the scarcity of way stations for air and maritime forces. Those in Southeast Asia were gone—in fact, the USSR occupied the great base at Cam Ranh Bay. Hong Kong seemed destined for Chinese Communist rule; World War II had demonstrated the vulnerability of Singapore; the United States was asked to leave Thailand not long after its humiliation

Photo courtesy of Dr. James Young, Air Force Flight Test Center

Marolda and Schneller show that the vast bulk of materiel for the Gulf War came by sea. But strategic airlift, especially by C-5s and C141s, made a huge difference in the early part of the deployment. The Air Force built the C-17, shown here, to replace the C-141; by the time of the Kosovo War, it had become the mainstay of the strategic airlift fleet.

in Vietnam; and US tenure in the Philippines was coming to an end.

Another such legacy entailed a stout American aversion to any notion of prolonged land combat in Asia or elsewhere. So what came to be called the Nixon Doctrine asserted that the local peoples themselves would have to use their own troops to fight off Communist external and internal aggression. The United States would only assist them with its naval forces, airpower, and economic power.

Fall of the Shah

Insofar as the Persian Gulf was concerned, everything hinged on Iran, led by its Shah. But this local pillar of the doctrine proved unstable. In 1979, the ayatollahs carried off a fundamentalist revolution in Iran, and the Shah fled, never to return. The oil embargo associated with the Yom Kippur War of 1973 administered a severe shock to the world economy, and in 1979 this new instability in the Gulf threatened a renewal of trouble. The United States had the airpower, sea power, and economic muscle—but had no regional protégé who could hold the line on the ground.

The Soviets, Afghanistan, and the Horn

Among the great inhibitors for the United States during both the Korean War and the Vietnam War was the fear of escalation to all-out nuclear conflict between the superpowers. That, as much as anything else, explains the failure of Operation Rolling Thunder. But both Secretary of State Henry Kissinger and President Richard Nixon visited the People's Republic of China in 1972 and also concluded the first great arms-control agreement with the Soviets in June of that year. Those things accounted for the greater vigor in Operation Linebacker than had been the case in the earlier air campaigns. The ensuing half decade of détente suggested that world peace was indeed at hand.

But it was a false dawn. At the end of the 1970s, trouble started again. The Soviets demonstrated a new aggressiveness in places they had never been before, such as Afghanistan—and no one could immediately tell whether the outcome there would resem-

ble the one in Vietnam. More serious was the Soviets' new participation in noncontiguous regions—on the Horn of Africa and in support of the insurgency in faraway Angola. These moves seemed to flank the Gulf region on both sides and raised fear in the West that the Communists would soon be able to choke off the flow of oil—so much so, in fact, that President Jimmy Carter, not much given to saber rattling, nevertheless warned that oil constituted a vital interest to the United States and, therefore, a casus belli (cause for war).

This situation led to creation of the Rapid Deployment Force, which ultimately evolved into US Central Command, and to an increase in defense spending after the post-Vietnam drawdown. Furthermore, the United States persuaded its NATO allies to increase spending and to accept the deployment of ground launched cruise missiles on their territories. But all that did not help much because the Iranians still felt capable of grabbing the United States Embassy and imprisoning its people. The apparent helplessness of the United States and the failure of the Iranian rescue mission led to Carter's defeat in the election of 1980, among other things. His successor, Ronald Reagan, came on with a platform of rearmament and restored assertiveness in foreign policy.

Iran-Iraq War

The endless agony of the Iran-Iraq war of the 1980s posed a real dilemma for the United States, whose long-standing policy called for promoting stability in that region (and others) and doing so while limiting the risks and costs involved. But this was a case of trying to choose between the devil and the deep blue sea. Clearly enough, Saddam was the aggressor, and Iraq had long been a client of the USSR during the cold war. But the pain inflicted on America by the ayatollahs was recent, and their hostility plain enough. The war destabilized the Gulf; Iran and Iraq knew that the oil line through it was a tender nerve for the West and for Japan and that they could cause a reaction by threatening it. No one foresaw the impending fall of the USSR, and the old inhibitions of the cold war afflicted the ability of the West to stabilize the situation. The fighting impoverished both sides, notwithstanding their oil wealth, portending additional trouble to come. In the end, the United States could do no more than "lean" toward Iraq a bit, albeit uncomfortably. Iraq won but realized no significant gains, emerging from the war in bad shape.

Osirak Reactor

Meanwhile, the threat of instability in the Gulf had become drastically more menacing with the Iraqi attempt to develop a nuclear capability. Though the Israeli air force made a spectacular attack on the Osirak reactor at Al-Tuwaitha in June of 1981, the program continued. During Saddam's war with Iran, he demonstrated his willingness to use WMD by repeated attacks with chemical bombs and shells.

Invasion of Kuwait

The story about the Iraqi invasion of Kuwait has been told so many times that there is little need to dwell on it here. Saddam's army crossed the border in early August, and tiny Kuwait had no chance to slow it down. Nor were Saudi Arabia's chances much better because of its sparse population. At the time, no one in the West had any idea where the Iraqi force would halt. Saddam's declared grievances included a claim that the Kuwaitis were stealing from him by pumping crude oil underground from his side of the border. In any case, he also proclaimed that Kuwait merely constituted one more province of Iraq. Because Saddam had funded his long war with Iran through loans from the other Arab states, his economy was in bad shape. For that reason, he had attempted to persuade Kuwait and the others to forgive some or all of those debts, but they were not so inclined. Like the Japanese and Vietnamese before him, he assumed that the West—the United States in particular—had no stomach for bloody ground fighting and made no secret that he

would use that to get his way. But the threat implied to the West was enormous. As President Carter had proclaimed, the oil of the region was so central to the world economy that if Saddam gained control of the Arabian Peninsula, he would then be able to dictate terms to everyone—a daunting prospect. So the first problem for the West entailed throwing together a defense that could halt the Iraqi onslaught before it rolled much further south.

The Gulf War: Deployment and Combat

Doubtless, history will record that the diplomatic and logistical effort that so quickly put a barrier in Saddam's path was one of the greatest of the twentieth century. Code-named Operation Desert Shield, many writers have described it in publications readily available to the readers of this journal—the *Gulf War Air Power Survey*, for example. But a fine, new official history will give the Air Force reader an excellent perspective from the viewpoint of a sister service—the US Navy. In *Shield and Sword: The United States Navy and the Persian Gulf War*, Edward J. Marolda and Robert J. Schneller Jr. have provided a seminal work on the conflict. They show that the sea service made a vital and very substantial contribution toward halting and then reversing the Iraqi aggression. Further, they make clear that the operation involved more than just adding another air force to the air war and that without the rest of the Navy's contribution, the campaign would not have succeeded.

It is hard to imagine two authors better qualified to write such a volume than Marolda and Schneller. A Vietnam veteran of the US Army, Dr. Marolda has a master's degree from Georgetown University and received a doctorate from George Washington University after writing a dissertation about the US Navy and the Chinese civil war from 1945 to 1952. He is widely published on the Vietnam War and clearly has a good understanding of both naval and air operations. Marolda now serves as senior historian at the Naval Historical Center at the Washington Navy Yard, his home for more than a quarter century. His collaborator, Dr. Schneller, who earned his doctorate at Duke University, first arrived at the Navy Yard at the time of the Gulf War and has worked there ever since. One of his many naval writings is a biography of Adm John Dahlgren.

Although one might reasonably expect to find a pro-Navy bias in *Shield and Sword*, the book is far less partisan than many others that have appeared in the wake of the Vietnam and Gulf Wars. To their credit, the authors give full treatment to the Navy's warts in the Gulf War, providing a sound basis for both understanding and reform where needed. Their excellent methodology results in comprehensive coverage of the important secondary sources and ample usage of primary sources—not at all limited to naval materials found in their local archives. Too, the authors make sound and extensive use of interviews of the principal naval actors, many of which they conducted themselves. The superb writing style and editing make the book a pleasure to read—unusual for an official history.

As the title suggests, *Shield and Sword* consists of two parts: getting there and then conducting the war. The first part, three chapters in length, makes it clear—more so than some Air Force literature—that no one could have known that Saddam would elect not to continue his march into Saudi Arabia. Thus, it becomes altogether too easy to assume that it could not happen and that defensive measures amounted to nothing, serving only to delay the coalition offensive. But the deployment was a massive and complex operation, involving much more than just airlift. Already the United States had reduced its forward presence substantially in reaction to the end of the cold war, but the constitution of one of our maritime pre-positioning forces based on Diego Garcia eased the logistical problem somewhat. Also, US Marine amphibious forces afloat had enough logistics support with them to sustain themselves ashore for a short while. Nevertheless, the operation still

Photo courtesy of NATO

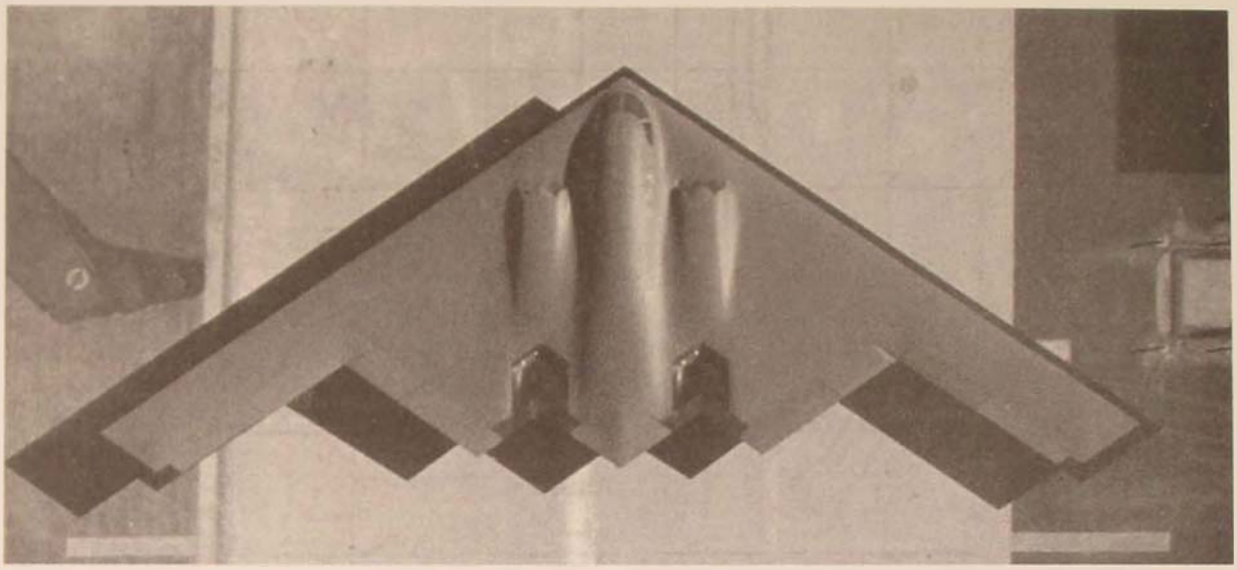
NATO countermine vessels. Marolda and Schneller suggest that the Navy has long neglected mine countermeasures, a deficit that showed up in the Gulf War when we found that several of our coalition partners were more advanced in countermine technology and tactics. Iraqi mines seriously damaged the USS Tripoli *and USS* Princeton; *without the countermeasures capability of our allies, it might have been much worse.*

required substantial sea lift, directly from the United States.

By the end of the first week in August 1990, two aircraft carriers, the USS *Independence* and the USS *Eisenhower*, were close enough to the region to lend support ashore and help defend inbound airlift, if that became necessary. Despite delays in departure, some of the maritime pre-positioning ships were steaming inbound to the Gulf before the middle of August. As Marolda and Schneller point out, Air Force units with ordnance aboard arrived early at well-prepared bases. But all of their weapons were air-to-air missiles and guns; most of the really heavy air-to-ground bombs required sea transport. Because air defenses had to go up first, followed by ground defenses, the heavy weapons for the offensive had to wait.

Some maritime forces threatened this orderly development, however. The Iraqi air force, for example, had demonstrated its air-to-surface capability some time before the war when it hit the USS *Stark* with Exocet missiles. Iraq also had some small naval units that could have caused disproportionate disruption had they infiltrated the logistical and amphibious units or even the vessels protecting them. Too, one of the warts that Marolda and Schneller deal with frankly and at length is the inadequacy of the US countermine force and associated doctrine. Although mines cramped operations and caused some losses, on the whole, we overcame the problems of Desert Shield without undue strain.

Another of the challenges for the Navy that *Shield and Sword* deals with frankly is the defectiveness of the C^2 system insofar as it related to integrating naval operations with the rest of the joint force. The authors admit that cultural inhibitions as well as the normal frictions of war disrupted the smooth development of joint C^2. The Navy was more or less left to its own devices for the control of over-water operations, but its flying over land had to be centrally controlled by the joint force air component commander (JFACC), if for no other reason than for the sake of flying safety and deconfliction. This meant that nothing could fly over land unless it was listed on the daily air tasking order (ATO). Although the Goldwater-Nichols Department of



One of the most discussed and "cussed" Air Force aircraft in history, the B-2 did not participate in Desert Storm but proved instrumental in the Kosovo campaign of 1999. It was the only weapons system equipped to drop the joint direct-attack munition (JDAM), capable of going through clouds and hitting targets with 10–15 meter accuracy. No other precision free-fall weapon or missile could operate in cloudy or foggy conditions. Cruise missiles, however, can operate in a wide variety of weather conditions, although they are more expensive than JDAMs or joint standoff weapons (JSOW).

Defense Reorganization Act covering this had been imbedded in the law for five years, the Navy's seaborne hardware and software still lacked compatibility with those of the rest of the joint force. Marolda and Schneller make clear that the culture of the service inhibited rapid reform before the war—naval officers, especially the aviators, typically thought the whole process too cumbersome and inflexible. However, the Gulf War experience tended to cause many of them to accept the inevitability of centralized C^2. But no easy solution existed for the short term, and the ATO could not be transmitted to the ships electronically; rather, aircraft ferried out a copy of the huge document every day.

Another puzzling complication in the control of naval forces was that the highest naval commanders, headquartered at sea away from the joint force commander, were very often transferred back to the United States during Desert Shield and Desert Storm. Apparently, the Navy's system did not permit the disruption of peacetime personnel routine for the sake of the war. Unhappily, this resulted in a tendency toward the disruption of continuity, but that problem appears to have been overcome.

The sea lift itself included several elements. Some of the material came in on the pre-positioning ships that had been acquired since the days of President Carter. That worked fairly smoothly and was a godsend. Some of it came aboard some relatively new roll-on/roll-off fast ships acquired in recent years, and that worked quite well because those vessels proved reliable as well as fast, making many round-trips before the end of the war. Less reliable were some of the older ships kept in the reserve fleet for specified periods during which they could be made seaworthy to meet contingencies. But crews often missed these time lines, machinery proved unreliable, and in at least one case, the ship's propulsion broke down in the mid-Atlantic, and it had to be towed to port.

In other literature, many analysts have asserted that the Saddams of the world also learned lessons from the Gulf War and that they certainly would not allow the United States time for another great buildup. This has led the US Army to begin thinking that it

had to make itself lighter to get to future fights on time. The Kosovo experience of 1999 so reinforces this idea that it seems likely the ground arm will really take that notion seriously in the near future.[3] Frictions arising from the reserve fleet in the Gulf War certainly support that notion. If indeed substantial reform does not take place in this area, it might have serious implications for the air warrior/scholar. The media has repeatedly expressed concerns about the danger of running out of precision-guided munitions (PGM) during the Kosovo War.[4] The bulk of air munitions necessarily must come by sea. If that is not feasible, are we to become all the more dependent upon PGMs? Does that mean we need to give renewed attention to the size of the inventory? Does it also mean that we should give even greater attention to the development of, say, the "small smart bomb" for more than just the F-22? Does it mean that, even for B-52s, the day of the "dumb bomb" is nearing its end? Is the purchase of huge numbers of joint direct-attack munition kits and laser-guided-bomb seekers cheaper than maintaining a reserve fleet of ships that seldom move and cannot be made ready on schedule? We had plenty of international support in both the Gulf War and Kosovo. We had no difficulty in contracting foreign-flag shipping for trips to the Persian Gulf. Will it always be so? And not just the Army and Navy should have concerns about this.

Neither Marolda nor Schneller has had Air Force service, but they have an excellent grasp of the planning and operations processes of the land-based part of airpower. Although the Air Force warrior/scholar will find much familiar ground in the employment part of *Shield and Sword*, he or she will nevertheless find it interesting because the authors tell that story from a different perspective.

The Plan

Marolda and Schneller are conversant with the plan for Desert Storm but do not get into its development very deeply. They lay out the four phases in standard fashion, noting the Navy's role in all of them. The fact that Navy technology and tactics for identifying enemy targets were not as developed as the Air Force's somewhat inhibited its air-to-air participation, a cause for some concern.

Naval Role

Although some Navy men have asserted that parochialism caused this problem, others saw the hazards of fratricide associated with limited identification capability. The Navy had six deck loads of airplanes on the scene for participation in the air campaign, and their distance from the targets caused some complications because of the air-refueling requirements (some of the carriers *were* sometimes closer to the targets than some of the more distant land bases). Here again, some Navy folks thought that the JFACC utilized the tanking capability at hand in a partisan way, but many others do not agree. The authors favor the latter interpretation in both cases.

The Navy also had on the scene a considerable number of Tomahawk land attack missiles (TLAM), which complemented the F-117 in an important way. The F-117 operated under the cover of darkness, so daylight would have compromised its stealthiness. The TLAMs, utilized in daytime, thus enabled the coalition to keep up the pressure in the high-threat environment over Baghdad around-the-clock. We fired 122 of them on the first day and 280 during the whole campaign; eventually, the Iraqis began to shoot some of them down. Then, according to the authors, Gen Colin Powell decided that the expense of the TLAMs made it inadvisable to fire any more of them.

Execution

Phase one principally aimed at bringing down the Iraqi air defense system (i.e., gaining air superiority). As Marolda and Schneller explain, when President George Bush decided to double the force in October, the preponderance of airpower assembled by January caused the first three phases (establishing

In Shield and Sword, *Marolda and Schneller write about the Navy and therefore largely concern themselves with strategic transportation. In* Every Man a Tiger, *Tom Clancy and Gen Charles Horner describe the major in-theater logistical contribution made by C-130s, especially their tactical role in giving the Army's VIII Corps the mobility it needed to move around Saddam Hussein's right flank in a short time. The greater part of the C-130 fleet is now manned by Reserve components; the one in this photo belongs to the Colorado-based 731st Airlift Squadron of the Air Force Reserve.*

air superiority and disrupting enemy C^2 by attacking strategic targets in Iraq; establishing air superiority in Kuwait; and preparing the battlefield) to merge. A single-seat F/A-18 appeared to be the coalition's first air-to-air loss, but, on the whole, the allies quickly achieved air superiority, inflicting major damage to the Iraqi C^2 system.

Arguably, ever since World War II, the Navy has led the way in the development of the suppression of enemy air defenses. For example, the Navy developed all of the missiles used for this purpose in Vietnam as well as the high-speed antiradiation missile, the principal lethal instrument in Desert Storm, although all the American air arms employed (and still employ) it. The Navy also had at the ready both towed and autonomous decoys, used to great effect by causing the Iraqis to waste many expensive surface-to-air missiles, which were in short supply.[5] Both services had dedicated nonlethal means of defense suppression in the air from the outset. In the Air Force's case, EF-111s—then still in the force structure—performed yeoman service. The Navy's counterpart, the EA-6B Prowler, provided jamming services for all coalition air forces and could deliver lethal weapons against defense sites.[6] By so quickly achieving command of the air, the coalition could pursue all the other missions in the air and on the ground.

The anti-Scud-missile part of the campaign did not benefit the Iraqis much in terms of physical destruction achieved. Rather, as had been the case with the German V-1 campaign in 1944, its chief value lay in supplying a decoy that absorbed a large number of air sorties without much physical effect—although Marolda and Schneller do seem to agree with many other standard accounts that the political impact was important.

As noted, the abundance of airpower made it possible to execute the first three

phases simultaneously. Phase three, preparation of the battlefield, absorbed the greatest part of the Navy's attention, one dimension of which entailed posing the threat of an amphibious landing on Saddam's left flank. The idea was to pin down his forces there, far away from the main attack—an end run around his right flank, the famous "left hook." This part of *Shield and Sword* is especially informative to Air Force readers.

The landing proved much more complicated than one might think. For example, the Navy had to remove mines even though it was only a feint, and the Kuwaitis were concerned that any landing on that coast would destroy much of the built-up property there. The authors seem thoroughly persuaded that the enemy took the amphibious threat seriously; indeed, major Iraqi formations undoubtedly remained along that coast. Some might wonder whether those units would have moved even in the absence of the feint. The ground war lasted only four days, a short time for a ragtag conscript army to build enough momentum for a complete change of front and move west to help meet the threat posed on that flank. (Keep in mind that we still marvel at Third Army's swift change of front in 1944 in response to the Ardennes Offensive. But the Iraqi conscripts were not Third Army, and Saddam Hussein was not George Patton.) Moreover, the same folks were in pretty bad shape as a result of the rigors of their war with Iran and the deprivations suffered during the air war. Marolda and Schneller cite an instance whereby some Iraqis attempted to surrender to an unmanned aerial vehicle (UAV)! In any event, the joint force commander decided against executing an amphibious attack; there was to be no Inchon this time.

One of the reasons that Iraqi formations in Kuwait might not have been able to move was the effect of the interdiction part of the battlefield-preparation phase, in which naval aviators played a significant role. For all the Iraqi attempts to work around the breaks in their transportation system, troops at the front were greatly weakened for the want of food and water. They simply did not put up much of a fight.

Naval air put even more sorties into "kill boxes," the result of the JFACC's dividing the battlefield into a number of squares. Airpower was so abundant that he adopted a "push" kind of operation that probably would have horrified his predecessors long ago in the African campaign of 1942–43. Coalition air forces would launch strikes on a regular basis without having any special requests from the ground forces. When aviators arrived at their assigned boxes, they checked in with the controllers, who would then assign them to a particular target on the ground—if one existed. If not, the airman proceeded into his box on a kind of armed reconnaissance mission to kill whatever target he came upon. According to *Shield and Sword,* Gen Charles Horner and the rest of the Air Force were determined not to do anything that resembled the assignment of route packages in Vietnam (assigning permanent geographic areas to a particular service for attack). Consequently, planners changed the boxes assigned to the Navy on a daily basis.

But things were different in 1943 in Africa and the Solomon Islands. Marolda and Schneller note that Adm John LaPlante, a surface sailor, grumped that the naval aviators dominating the staffs were so preoccupied with competing with the Air Force that they neglected his concerns about the Iraqi threat to his forces afloat (p. 255). So it goes in combat where our back is not against the wall. In Africa and the Solomons, defeat—even annihilation—was a real possibility. According to Adm James Winnefeld and Dr. Dana Johnson, that is the one thing which has sometimes, although rarely, suppressed service rivalry even during battle.[7]

The Navy also helped prepare the battlefield in another way—old-fashioned shore bombardment from the Gulf. The authors generally agree with most Air Force sources that one of the most serious difficulties in the war entailed getting feedback on the effects of one's attack. That had also been a problem for battleships from the earliest days of the

twentieth century, when the ranges of their great guns first began to exceed the distance to the visual horizon.

The fact that airplanes greatly enhanced the value of battleship guns by spotting the fall of shot made the fight over aviation so passionate in the 1920s—some aviators thought that airplanes should drop the shot themselves. By the time of the Gulf War, battleships had a new twist: UAVs. Now, they could send these vehicles into the target area with their television sets and data links so that the ship could get a close-up view of the damage inflicted—and get it immediately and without risking an aircrew. But it was not a free ride for them or the other surface ships offshore because mines posed a threat. The amphibious carrier *Tripoli* and the cruiser *Princeton* both suffered severe damage from Saddam's mines. Too, mines inhibited operations in other ways, in that they slowed combat operations and forced ships to stand further offshore than they might have liked. Still, the old battleships delivered heavy projectiles with very good accuracy as far inland as they could reach.[8]

Outcomes and Implications

One notes plenty of carping in the media and academia that the coalition cannot claim victory in the Gulf War. The argument depends on imagining some undeclared objectives and then asserting that we did not achieve them. Not so with Marolda and Schneller, who say that we not only achieved our declared objectives but did so with minimal losses. They claim that the Navy quickly learned more about operating as a part of a joint force. Further, they readily recognize defects in the institution (although seldom in the leadership) and note the beginnings of reforms to overcome them. Finally, they assert most strongly that the coalition achieved a *combined arms* victory and that the cost would have been much higher had we fought in any other way. The experience helped the Navy move from its old cold war mind-set to a new attitude more suited to the problems of the twenty-first century.

All told, then, *Shield and Sword* deserves a very high place on the air warrior's/scholar's reading list. Writing in a very readable style, Marolda and Schneller have thoroughly and soundly researched the main secondary and primary sources and generally manage to contain their institutional bias. The book is especially valuable to Air Force readers in that it covers a familiar story and will help them understand a sister service. They will find the elephant described in a way somewhat different from their own definition, and in that difference lies the road to understanding, as well as ever more effective joint operations.

Most authorities associated with the ground and sea forces, plus a number with airpower leanings, make a very big thing about the uniqueness of the Gulf War. Who can deny it? But all wars are unique, and to avoid studying them on that account would deny the value of scholarship altogether. No doubt the scope of the war was limited in time and geography, but it is the most recent documented war that we have. World War II had a much wider scope in time and geography, but technology and even culture have now changed so much that its value as an object of study has diminished considerably.[9] History is some combination of continuity and change. We have already seen some of the experience of the Gulf War repeated in Kosovo, yet some things have happened in Kosovo that are quite different from our experience in Iraq.

Even the elephant examined by someone with keen eyesight has changed from the day of the mammoth, but it is still big and has tusks. The task for air warriors/scholars is to estimate what will have continuing relevance and what was peculiar to the Gulf War (or any war they study). To do this, they must rely on the testimony of a host of blind men, most of whom yield a partial truth. If warriors/scholars rely on just one of them, more than likely the picture of the elephant will prove very defective. If warriors/scholars gather the visions of as many blind men as possible, they will im-

prove the odds that the view of the elephant will be close to reality—but no one can guarantee its accuracy.

When our air warriors'/scholars' moment of truth comes, our hope is that their worldview more closely approximates the real elephant than that of the adversary. All of us must hope that our defenders understand the uncertainty of war to the extent that they can build an organization able to adapt to the inaccuracies of the vision as revealed by combat—and to adapt more rapidly than can our enemies.[10] Finally, the Air Force is well endowed with disciples of joint operations and the synergies they can bring to war. By now, the latter-day Douhets are scarce. Clearly, General Horner (among many others in the Air Force), the JFACC in the Gulf War, understands that some circumstances dictate that Marine and Navy leaders retain control of their own air assets. Some of them, it seems to me, have yet to take the advice of Admiral Winnefeld and Dr. Johnson that in some cases, even if rarely, "all must realize that an air-only operation is a valid force employment option."[11]

A 10-Book Sampler on the Gulf War: Works for the Air Warrior's/ Scholar's Professional Development*

Two for the Baseline

Revolution in Warfare? Air Power in the Persian Gulf by Thomas A. Keaney and Eliot A. Cohen. Annapolis: Naval Institute Press, 1995.
Written by a leading warrior-scholar at National Defense University and a distinguished professor from Johns Hopkins University, this authoritative book should be the first on your list.

Shield and Sword: The United States Navy and the Persian Gulf War by Edward J. Marolda and Robert J. Schneller Jr. Washington, D.C.: Naval Historical Center, 1998.
This work by two leading naval historians is about as competent as official history gets. If you read only two books on the subject, make this the second one.

Eight for More Detailed Understanding

Guardians of the Gulf: A History of America's Expanding Role in the Persian Gulf, 1833–1992 by Michael A. Palmer. New York: Free Press, 1992.
This work is an excellent starting point, providing an authoritative historical background and adding a treatment of the Gulf War in relatively dispassionate terms, although heavily dependent on interviews. The author, now a professor at East Carolina University, has substantial experience as an official US Navy historian and is one of the leading naval historians in America.

The Generals' War: The Inside Story of the Conflict in the Gulf by Michael R. Gordon and Bernard E. Trainor. Boston: Little, Brown, 1995.
Written with great authority and in relatively dispassionate terms by a *New York Times* military correspondent and an experienced warrior, the book is necessarily based largely on interviews.

*This sampler is not intended as a definitive bibliography for experts. Rather, it is only a listing of readily available books that will introduce serving officers to the subject with sufficient detail to provide a conceptual framework on which to build. Hopefully, it will give them some idea of the varieties of interpretations that our "blind men" have contrived.

Crusade: The Untold Story of the Persian Gulf War by Rick Atkinson. Boston: Houghton Mifflin, 1993.
Atkinson, a Pulitzer Prize–winning author and journalist, did his homework and produced one of the most readable and best of the early books on the war. He presents a balanced story, gives airpower and diplomacy their due, warns that the experience would likely be hard to repeat, and does it all in a fine writing style.

Storm over Iraq: Air Power and the Gulf War by Richard P. Hallion. Washington, D.C.: Smithsonian Institution Press, 1992.
For a long time an official Air Force historian, Hallion was one of the first on the postwar market with a book on the Gulf War. *Storm over Iraq* is a readable work that gives many of the technical and tactical details in understandable form, but some readers complain that it unduly favors the Air Force view.

Every Man a Tiger by Tom Clancy with Chuck Horner. New York: G. P. Putnam's Sons, 1999.
The Gulf War air commander tells his story with vigor in the Tom Clancy style—an easy and interesting read. Horner's bias in favor of fighter pilots, Tactical Air Command, and airpower in general is clear. But he is no zealot and can see the virtues of jointness and coalition warfare.

Heart of the Storm: The Genesis of the Air Campaign against Iraq by Col Richard T. Reynolds. Maxwell AFB, Ala.: Air University Press, 1995.
Heart of the Storm was written by an Air Force officer, more a weapons controller/operator than a scholar, with a clear bias in favor of airpower and especially partisan to Col John Warden's role in planning the campaign. The book features an unusual but readable writing style that is rare for an official publication.

Thunder and Lightning: Desert Storm and the Airpower Debates by Col Edward C. Mann III. Maxwell AFB, Ala.: Air University Press, 1995.
A career Air Force officer with a good writing style and technical understanding produced this book—perhaps biased in favor of strategic attack and the ideas of Col John Warden.

Lucky War: Third Army in Desert Storm by Richard M. Swain. Fort Leavenworth, Kans.: US Army Command and General Staff College Press, 1994.
Written by an articulate Army colonel in a balanced, elegant style, *Lucky War* focuses on the ground operation but pays attention to the air aspect in a professional and understanding way.

One for Good Measure

A League of Airmen: U.S. Air Power in the Gulf War by James A. Winnefeld, Preston Niblack, and Dana J. Johnson. Santa Monica, Calif.: RAND, 1994.
Admiral Winnefeld was a naval aviator, but none of the authors has an obvious connection with the Air Force. Their book, which analyzes the subject in relatively dispassionate terms, would be a suitable substitute for either of the first two listed above.

Notes

1. Edward J. Marolda and Robert J. Schneller Jr., *Shield and Sword: The United States Navy and the Persian Gulf War* (Washington, D.C.: Naval Historical Center, 1998).

2. Roger H. Nye, *The Challenge of Command: Reading for Military Excellence* (Wayne, N.J.: Avery, 1986).

3. Jonathan S. Landay, "Battle over the Future of America's Army," *Christian Science Monitor*, 22 June 1999, 2.

4. Bradley Graham, "Air vs. Ground: The Fight Is On," *Washington Post*, 22 June 1999, 1.

5. Gen Wesley Clark, the NATO commander for the 1999 war against Yugoslavia, reported that this can be a two-way street because the clever Serbian use of decoys on the ground caused the NATO air forces to waste some expensive PGMs against fake targets. Joseph Fitchett, "NATO Misjudged Bombing Damage," *International Herald Tribune*, 23 June 1999, 1.

6. Now that all EF-111s have been retired from the Air Force, the remaining Prowlers, located at a jointly manned unit based at Whidbey Island, Washington, perform the entire job. They helped achieve air supremacy in the attack on Kosovo, but the media reported that they were stretched thin because of their limited numbers. Guy R. Hooper, "Prowler Goes Joint," US Naval Institute *Proceedings* 122 (September 1996): 37–39; Phil Kuntz, "The Pentagon Capitalizes on Kosovo War Successes to Lobby Congress," *Wall Street Journal*, 11 June 1999, 1; and Paul Mann, "Kosovo's Lessons Called Ambiguous," *Aviation Week and Space Technology*, 28 June 1999, 32.

7. James A. Winnefeld and Dana J. Johnson, *Joint Air Operations: Pursuit of Unity in Command and Control, 1942–1991* (Annapolis: Naval Institute Press, 1993), 33. Incidentally, they do credit unity of effort as being above average in Desert Storm in the general sense.

8. The author cruised aboard the battleship *Missouri* in the summer of 1950 and participated in gunnery exercises in the lower handling room of the number-one turret. The range then and still is about 20 miles. However, the Navy is now looking toward new guns with guided projectiles and ranges of up to 63 miles, which will come on-line early in the next century. Thus, the last remaining battleships are no longer going to be maintained in a reserve status but will soon be gone for good. "Navy Will Retire Last Two Battleships by Middle of Next Decade," *Inside the Navy*, 5 July 1999, 9; on-line, Internet, 7 October 1999, available from http://ebird. dtic.mil/Jul1999/s19990706retire.htm.

9. The reader should not assume too much from that statement; I would be among the first to argue that studying the campaigns of Alexander the Great still has value.

10. We are indebted to Michael Howard (and more distantly to Carl von Clausewitz) for that idea, by now having become common wisdom. Michael Howard, "Military Science in an Age of Peace," Chesney Memorial Gold Medal lecture, 3 October 1973, reprinted in *Journal of the Royal United Services Institute* 119 (March 1974): 3–11.

11. Winnefeld and Johnson, 171.

Attacking is the art of making the weight of all one's forces successfully bear on the resistances one may meet.

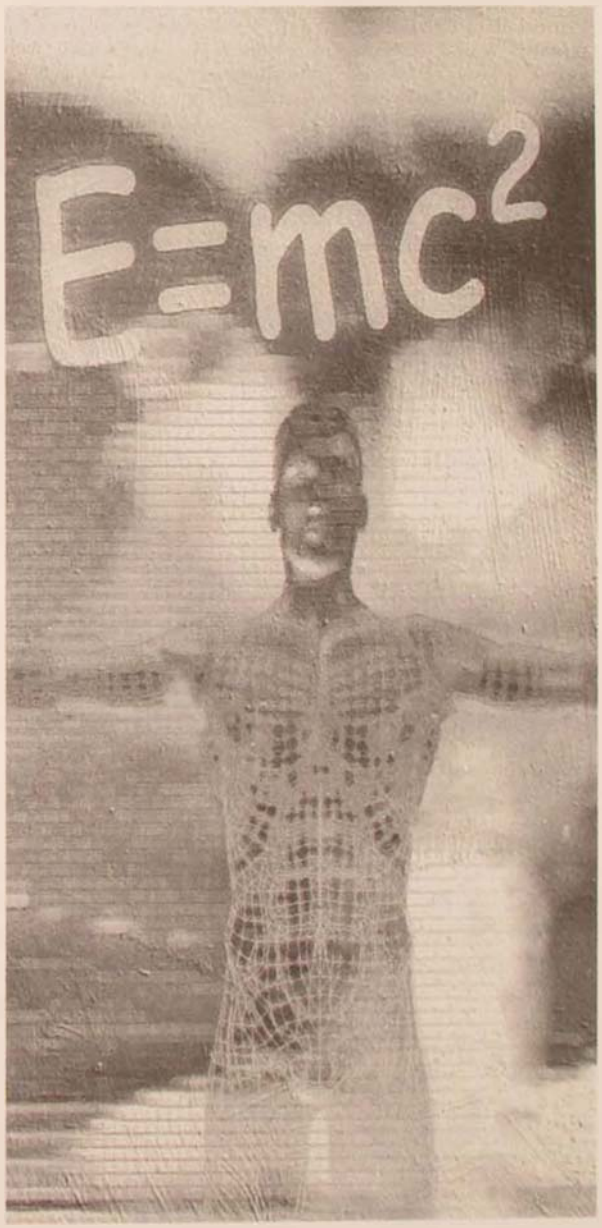
—Ferdinand Foch

The Need for Technical Warriors

Col J. Douglas Beason, USAF

> *A hiatus exists between the inventor who knows what they* [sic] *could invent, if they only knew what was wanted, and the soldiers who know, or ought to know, what they want and would ask for it if they only knew how much science could do for them. You have never really bridged that gap yet.*
>
> —Winston S. Churchill

SINCE THE BEGINNING of World War II, the Air Force has seen the introduction of jet aircraft, radar, atomic bombs, ballistic missiles, computers, lasers, precision-guided weapons, satellites, infrared (IR) (night) sensors, unmanned aerial vehicles, stealth—the list of scientific and technical contributions made to weapon systems is long, and their contribution to the success of the war fighter is nothing short of remarkable.



Science and Technology Advantage to the War Fighter

But as fast as new weapons have been introduced to the operational Air Force, advancements in science and technology have far exceeded even *that* pace, growing at an exponential rate. Records kept for millenia indicate that the world's knowledge, from the dawn of time until the 1950s, has doubled since the 1950s, and the pace is accelerating. This growth of knowledge has spilled over to the war fighter. Today's warrior is now fighting with more technologically sophisticated weapon systems than in the past, and that has resulted in fewer warriors being needed to fight on the battlefield.

Figure 1 shows the dramatic decrease in number density (or warriors per square kilometer) made possible by the exploitation of advanced science and technology (S&T). Introducing S&T in the battlefield has enabled fewer war fighters to levy more damage with more accuracy than in the past. For example,

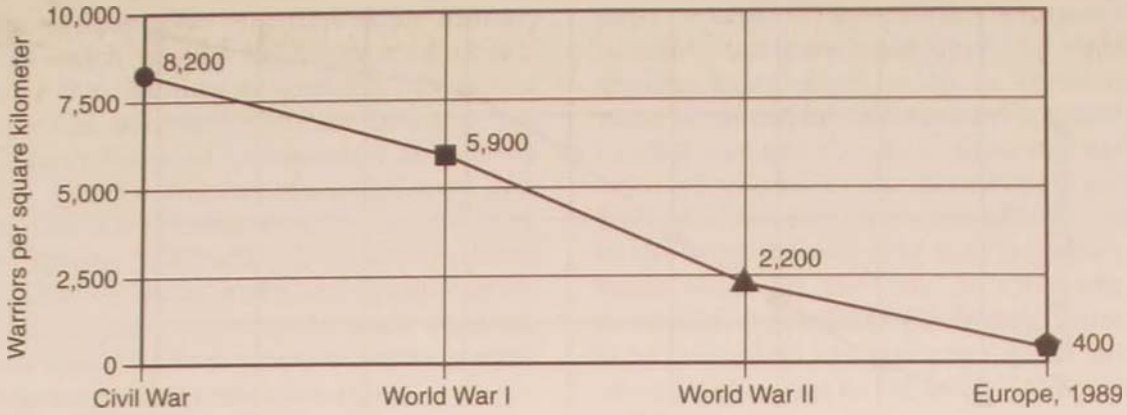


Figure 1. Manpower Density on the Battlefield (per Square Kilometer) (from Kenneth L. Adelman and Norman R. Augustine, *The Defense Revolution: Intelligent Downsizing of America's Military* [San Francisco, Calif.: Institute for Contemporary Studies Press, 1990], 53)

the range of a spear was extended by the bow and arrow; that range and destructive power was extended by a bullet, which was increased in turn by an artillery shell; and that was increased even more by aircraft and ballistic missiles.

In his National War College text on the Strategic Defense Initiative, Col Simon P. Worden expanded on the exploitation of S&T by defining military effectiveness as a basic measure of a weapon's military power.[1] Military effectiveness is a quantitative measure of a weapon's range, accuracy, and lethality (or destructive power) expressed in a single number.

Figure 2 shows the dramatic increase in military effectiveness due to S&T through the years. Here, the *y*-axis is shown as the exponent of powers of 10, so that the maximum value of "25" is not a simple factor of five greater than "20," but 10^5 or *100,000 times greater.*

For example, by Worden's analysis, today's nuclear-tipped intercontinental ballistic missiles (ICBM) are 10^4, or 10,000 times more effective than artillery was in 1930. Although military tactics and strategy have played a role in improving the lethality of these weapons, the stunning increase in military effectiveness is chiefly due to one reason and one reason alone: the advancements made in S&T and their transition to the warrior.

Science and Technology in the Battlefield

The S&T present in the battlefield is increasing. Tomorrow's battlefield will consist of global networks keeping track of targets; sophisticated sensors; information-linked combatants; stealthy air, land, and sea platforms (both manned and unmanned); and long-range, conventional (nonnuclear), high-precision weapon systems, all linked with digital computers.[2]

Figure 2 shows there has been an exponential increase of military effectiveness due to advancements in S&T, and this trend will continue. This means that in the future the Air Force will experience not just increases of a few percent, or even a doubling of military effectiveness, but increases of many thousands of times, all due to the exploitation of S&T.

The implication is that the US military's overwhelming superiority is directly due to research investments in defense S&T made 20 to 30 years ago.[3] This well-substantiated fact is embodied in such products as the F-117 stealth fighter; the B-2 stealth bomber; the Global Positioning System (GPS); cruise missiles; lasers; microelectronics; information tasking, exploitation, processing, and transmission; and small space platforms, to name a few.[4] S&T investment decisions made decades

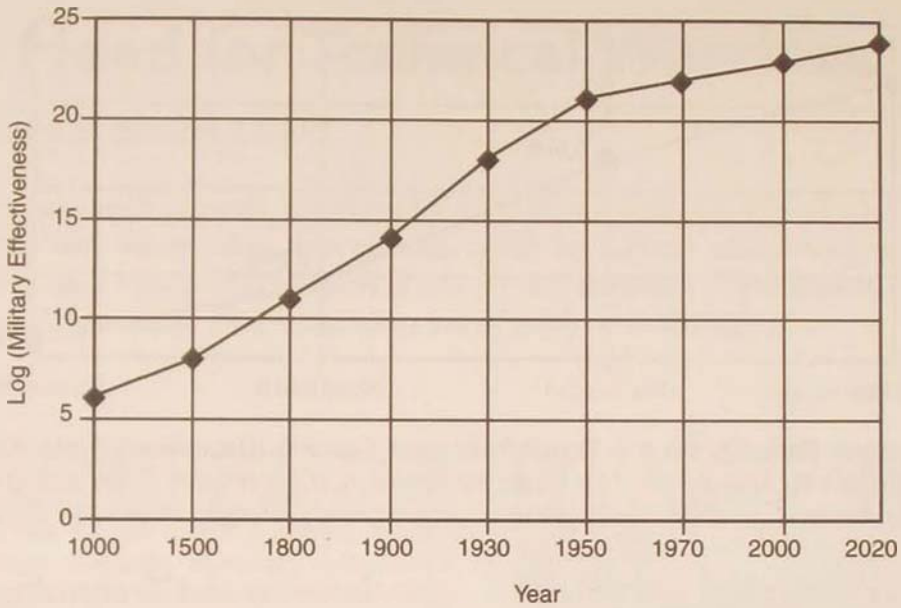


Figure 2. Increase of "Military Effectiveness" (Log Scale) Due to S&T (from Simon P. Worden, *SDI and the Alternatives* [Washington, D.C.: National Defense University Press, 1991], 15)

ago have gotten us to where we are today, so that warriors at the "pointy end of the stick" are sharper, faster, less visible, farther reaching, more accurate, more mobile, and more deadly than ever before—while producing less collateral damage.

Therefore, the lesson is that today's advances in S&T will produce the next generation of weapon systems for the war fighter. But advances in defense S&T do not happen overnight; nor do they happen in a vacuum. In the words of a former researcher at the prestigious Bell Laboratories, "Quality work requires sustained support. You just can't turn on the spigot and have Nobel Prizes overnight."[5] As in any other successful endeavor, S&T requires perspiration and persistence, as well as creativity. In other words, defense S&T needs to be nurtured, looked after, and sustained. Or it will die.

Science and Technology in the Changing Defense-Industrial Base

In the past, an infrastructure consisting of defense laboratories, industry, and academia generated the S&T that would be exploited for producing the next major weapon system. The end of the cold war forced the nation to turn away from maintaining a unique defense-industrial base and rely on the commercial marketplace to accomplish a significant fraction of the S&T needed for tomorrow's weapons.

But the commercial marketplace has also undergone change. Most worrisome, long-range industrial research has dramatically dropped. Corporations now focus on short-term demands, such as manufacturing and time-to-market problems, and have moved away from producing the advancements in S&T that once served as the basis for longer-range projects.[6] While some industries will continue to evolve technologies to develop and retain market share, in general there will be less risk taking and less innovation. And while some enabling technologies of importance to the military will be developed, there will be less integration of technologies for defense purposes.

Without the necessary infrastructure or profit enticements, the commercial marketplace has no motivation to perform research

in some unique areas required by the military services—such as the refinement of bombsights or the cleaning of stealth surfaces, for example. In addition, defense industry has significantly reduced its research and development (R&D) investments as military procurements have been drastically reduced, which greatly decreases industry internal R&D (IR&D). Aside from the opportunities to establish joint interests in such dual-use areas as space technologies, industry is moving away from long-term research.

Although defense laboratories are in a position to take up the slack, they are also suffering significantly as they too downsize and have difficulty attracting top talent. This problem is not unique to the Department of Defense (DOD); the Department of Energy's national security laboratories have the same problem.[7] Despite this, the DOD laboratories have a vital function in providing the critical transition bridge of S&T so that the right weapon with the right enhancements gets to the war fighter.

The Need for Technically Competent Warriors

The sophisticated nature of S&T demands the attention of experts. Just as it takes many years of experience to become an Air Force pilot, to exploit the appropriate S&T for the war fighter demands years of schooling and research experience.

Certainly a cadre of technical civilians is needed to support the defense S&T base. They would provide long-term continuity and allow the eagerness for the future to be tempered by reality and the lessons of the past. Some even argue that because the mission of the military is to fight and win wars, this cadre of scientific personnel should consist *only* of civilians—leaving the war fighting to the warriors and allowing this civilian cadre to produce new weapons. There is a good point to the argument that the military should focus on its core competency of fighting.

But war fighters cannot be insulated from the process of getting the right weapon to the field. Warriors have to be involved in this process, and they must have the right background from which to do it. These warriors must be technical officers who are competent in S&T and are able to understand and influence *all* phases of the acquisition process—from the scientist performing basic research, to the industry executive building the weapon system—to get the war fighters what they need. Unlike civilians (including retired military), technical warriors provide an *immediate, operational context* to focus S&T for maximum utility.

Technical officers have been exposed to a much greater breadth of military experience than their civilian counterparts. This makes the officer an "insider" to the war fighter's confidence and needs—a true "technical warrior." This is especially important when transitioning S&T, since defense S&T is inextricably tied to its final products—the weapons of war. Furthermore, sophisticated weapon systems demand that no discontinuities exist across the research and implementation phases from their birth to their use. Otherwise, this "interface" problem of transitioning S&T may cause something that is well intentioned but operationally lacking to be delivered to the field.

Therefore, the best way to ensure that a credible transition exists is to have a warrior be accountable for the weapon from birth to death. This demands a small but dedicated cadre of technically smart warriors—those who are closest to the war fighter yet have an impeccable grasp of technical subtleties, coupled with savvy and strong common sense—to maintain the continuity. But they cannot do it alone. These technical warriors must interact closely with long-term civilian S&T experts, as well as industry, academia, and other national assets.

Reasons for Having Technically Competent Warriors

The following reasons for nurturing a cadre of technically competent warriors have been culled from a wide variety of sources—

from bench-level scientists to vice presidents in major corporations, and from war fighters to senior executives throughout the government. Because of the dynamic job responsibilities of Air Force decision makers, it is important that these reasons be highlighted so that leaders can be made familiar with the underlying arguments.

1. The Air Force needs technical warriors to be smart buyers. By wearing the uniform, technical blue suiters are treated differently from their civilian counterparts. The operational experience of officers (or even the *perception* of this experience) gives them a stamp of authenticity among industry, academia, and other government agencies. An officer knows firsthand what the war fighter needs. And that knowledge just cannot be conveyed as convincingly through a civilian because it is *the presence of the uniform and the proximity to operational experience* that make the difference.

But wearing the uniform is not enough. The technical officer must have the appropriate academic credentials and research experience to be trusted by the S&T community. Just as the wings of a trained pilot give a stamp of credibility to rated officers, a doctorate degree is the "union card" that can open doors outside the Air Force.[8] It has been proven that technical blue suiters can be accepted and can move between both worlds, serving as smart buyers to get the war fighters what they need and when they need it. Plus, officers with a doctorate degree solve problems differently than war fighters do. They provide the ability to conceptualize, generalize, and synthesize, giving the war fighter access to a greater breadth of information.

2. The Air Force needs technical warriors to have a strategic view. The war fighter must react to short-term threats that may require quick technical solutions. Technical warriors with operational knowledge can help, either because of direct knowledge or by having access to the appropriate technology. In addition, there are longer-range problems that require more time and thought than simply reacting on a crash basis. The end of the cold war has severely constrained the budget for "getting anything at any cost, and getting it done yesterday." These problems require long-term strategies that lie beyond the quick reaction time needed of the war fighter. These are classes of persuasive threats and emerging challenges. Two examples are national missile defense and space control.

Responding to these highly technical, strategic problems requires a cadre of warriors with the scientific backgrounds that simply cannot be obtained through short-term training courses. These officers can couple the war fighter's short-term needs with long-term strategies to meet future threats and needs. In addition to having an operational viewpoint, these technical warriors can understand the realities, capabilities, and limitations of what S&T has to offer.

3. The Air Force needs technical warriors to serve as honest brokers. War fighters need to have access to the skills of a technical facilitator and translator who can easily move between two worlds—that of the warrior and the S&T community—and who can rise above parochial interests.

Simply witness the number of companies vying for defense contracts. It is hard for the war fighter to make a sound technical decision after hearing conflicting presentations that sound equally promising or baffling. However, having one of their own as an honest broker allows the war fighters to do what they have been trained to do: win the war.

4. The Air Force needs technical warriors to keep the S&T community honest. The S&T community knows the technical warrior is a peer and not an outsider, one who can be neither baffled nor patronized. Thus, the technical warrior can call a bluff and "run up the BS flag" if the S&T community is not forthright.

Conversely, technical warriors can serve as advocates for the S&T community if there is a technical breakthrough that deserves immediate, high-priority attention—witness the astonishingly short development time for the "bunker buster" penetrator during the Gulf War. Presenting better weapons to war fight-

ers with the facilitation of technical warriors will help win wars.

5. War fighters need technical warriors to be extensions of themselves. Technically competent warriors are needed to integrate across the seams of weapon-development stages, from cradle to killer. They must be equally at home, from the scientific bench to the office of the industry executive who is producing the new weapon system. Fundamental to this requirement is acceptance as a technically savvy, knowledgeable peer.

By having a warrior in this role, the war fighter works with a trusted blue suiter, one who has access to the fast-paced and dangerous climate of a war zone, as well as the esoteric research lab. The bottom line is that technical warriors have the war fighter's best interest in mind because they themselves are warriors.

Growing Technical Warriors

Just as the Air Force would not hesitate to put a rated officer in charge of a flying wing, put a military doctor in charge of medical care, or make a judge advocate general responsible for resolving legal issues, ensuring that the best S&T is exploited for national security demands no less than a military, scientific professional overseeing S&T concerns. In this era of exponential growth of scientific knowledge, *not* having a cadre of scientifically competent officers responsible for defense S&T is akin to conducting a battle with no war fighters. The idea is simply unthinkable.

Technical warriors can transition discoveries in basic research, through a creative concept of operation, to a weapon that satisfies a war-fighting requirement. Carrying the fledgling weapon across the "seams" through the sophisticated stages of the development process ensures continuity. Technically competent warriors are needed to recognize the future utility (or futility, as illustrated by the Navy's A-12 debacle) of a discovery and to transition the concept to become a militarily useful weapon.

Most importantly, technical warriors can keep the weapon focused on its ultimate use of supporting the war fighter. They can ensure that it doesn't become burdened with additional requirements, which are usually placed on weapons by a well-meaning bureaucracy. And they can do this by following the weapon through its life cycle from the scientific bench to the hands of the war fighter, providing a seamless transition.

But as noted before, obtaining a cadre of high-quality technical officers doesn't happen overnight. As with any group of motivated people, technical warriors must be shown career incentives if the highest caliber individuals are to be retained. Otherwise, the best and brightest will seek upward mobility elsewhere.

To that end, the Air Force Scientific Advisory Board (SAB) recently recommended to the secretary of the Air Force and the chief of staff that "we must have a path for more scientific and technical officers to attain the highest positions in our Air Force."[9] Thus, "the Air Force should consider career management of technically oriented officers with the same vigor as that of the rated force."[10]

In blunt language, this means providing technical officers with a clear and unambiguous path for promotion. Science and technology assignments must be viewed as career enhancing, and leadership opportunities must exist at all levels. For example, the Air Force Research Laboratory (AFRL) provides an excellent opportunity to grow superior technical warriors. By making slight modifications to its already successful structure, the AFRL could be a model for defense S&T.

To illustrate the point, most major Air Force units have adopted the traditional wing structure. Test wings exist, and even the US Air Force Academy's Office of the Commandant of Cadets has become a wing. By using waivers and by acknowledging the AFRL's similarity to a numbered Air Force by both the presence of a flag command and by size, it would be easy to establish "research wings" located at the major research sites already in existence. This would provide real wing-level opportunities for a spectrum of technical of-

ficers, from squadron and wing command, to S&T finance and S&T logistics. In addition to bringing the S&T structure in line with the operational Air Force, it would provide ample leadership opportunity for growing technical warriors.

Conclusions

S&T is fundamental to the war fighter. The best way to exploit S&T is to have technical warriors—competent military officers who have credibility both with the *war fighters* and the *S&T community*. The only way to ensure the highest quality technical warriors is for the Air Force to make a commitment to educate and promote a small cadre of officers to fulfill this role.

If the Air Force wants to maintain its S&T edge, it must have officers who can "speak the language," who can competently serve as an interface between both the warrior and industry, and who have both *technical vision* and *experience*. These officers need to be *grown* and need to have *a technical mind-set*—not just officers who have been exposed to S&T; for you will then simply get officers with advanced degrees and a casual acquaintance with S&T—not true technical warriors. For example, the Navy has made a commitment to produce and promote its technical officers through a rigorous, well-defined program for "EDs" (engineering duty officers), who are tasked with a wide spectrum of technical duties, from ship to flag position.

Finally, *a clear, upward path must be available* for technical officers. A pool of technical warriors is needed in the officer corps, with the means to choose or identify the best and to place them in senior leadership positions. Research wings under the Air Force Research Laboratory umbrella would provide an ideal structure. In these days of highly visible, national-priority, high-tech programs—space-based lasers, national missile defense, airborne lasers, and directed-energy weapons, to name a few—technical warriors are needed for the Air Force's future, now more than ever.

Finally, to paraphrase a recent Air Force SAB study, in today's rapidly changing, uncertain world, the technical warrior must provide the Air Force with capabilities to conduct any mission, meet any contingency, dominate any battlefield, and win any war. Only then will the ultimate goal of defense S&T be accomplished—winning the war. □

Notes

1. Simon P. Worden, *SDI and the Alternatives* (Washington, D.C.: National Defense University Press, 1991), 13–15.

2. Kenneth L. Adelman and Norman R. Augustine, *The Defense Revolution: Strategy for the Brave New World* (San Francisco: Institute for Contemporary Studies Press, 1990), 53.

3. Genevieve J. Knezo, *Defense Basic Research Priorities: Funding and Policy Issues* (Washington, D.C.: Congressional Research Institute, 90-506 SPR, 24 October 1990), 12.

4. Institute for Defense Analysis, "Report of the Task Force for Improved Coordination of Science and Technology Programs," Washington, D.C., August 1988, 8.

5. Dr. Cammy Abernathy, professsor of material science at the University of Florida, quoted by Robert F. Service in "Relaunching Bell Labs," *Science* 272 (3 May 1996): 639.

6. "Basic Research White Paper," *R&D Magazine*, October 1997, 9; on-line, Internet, May 1998, available from http://www.rdmag.com.

7. J. Douglas Beason, *DOD Science and Technology Strategy for the Post-Cold War* (Washington, D.C.: National Defense University Press, 1997), 76–77.

8. The quintessential story of what can go wrong is of the dynamic captain sent to brief industry. After a presentation that impressed industry officials, the captain was asked to view some equipment in the laboratory. The officials were dismayed when the captain did not even recognize the very equipment that he had just briefed. It was then discovered that the captain had memorized a "canned briefing" and had not understood a single concept outside of his presentation.

9. *New World Vistas: Air and Space Power for the 21st Century*, summary volume (Washington, D.C.: USAF Scientific Advisory Board, 1995), 62.

10. Ibid., 69.

There is no security on this earth. Only opportunity.

—Gen Douglas MacArthur

An Army View on Kosovo

COL GORDON W. ARBOGAST, USA, RETIRED*

> *In March of 1945 the unit I was with killed 100,000 Japanese in one night. And we didn't break their will. . . . Bombing has distinct limitations. . . . I don't think that the current generation . . . fully understands.*
>
> —Robert S. McNamara

THE RECENT WAR in Yugoslavia provided a new data point in military history. By reflecting upon this engagement, we may derive lessons learned, as well as validate traditional strategies and tactics. I believe that I can add objectivity to such an exercise since (1) my Army background gives me a perspective from a service not heavily engaged in the actual fighting and (2) my son Scott flew over 150 combat hours, engaging surface-to-air missile batteries over Kosovo as an F-16CJ pilot in the 23d Fighter Squadron based in Aviano, Italy.

The Classical View and Reality

As soon as the latest war against Yugoslavia began on 24 March 1999, a number of eminent Americans began to criticize sharply the decision of the North Atlantic Treaty Organization (NATO) not to consider sending a ground element into Kosovo. Conventional wisdom asserted that an air war would not be sufficient to achieve NATO's objectives in Yugoslavia. According to a long-standing axiom of war, one cannot defeat an enemy by airpower alone. In Army terms, a victor must send in ground troops to break the enemy's will to resist and to occupy terra firma. Indeed, William Odom, a retired Army general, advocated a massive, high-speed armored attack from Hungary and a sweep by ground forces down the Danubian

*Gordon W. Arbogast (USMA; MS, Georgia Tech; PhD, Clemson University) is a full professor at Jacksonville University. He served over 27 years in the Army, commanding various units through battalion level in Korea, the Dominican Republic, Vietnam, Germany, and the United States.

plain to Belgrade. He proposed a concurrent push from the south, forcing the Serbs to fight on two fronts.[1] Other retired military officers agreed, arguing that the allies could establish peace only with a strong ground force and considerable loss of life. They advocated concentrating a superior force for a Clausewitzian "set-piece" battle at a decisive time and place. This line of thinking maintained that the center of gravity was the regime of Slobodan Milosevic in Belgrade and that only a powerful ground force could topple it. Estimates of a ground force to defeat the Serbian army rose to two hundred thousand men with high casualties expected. Within the Central Intelligence Agency, there were also memos showing that aerial bombing would not work.[2]

In the face of criticism, the Clinton administration and NATO stood firm. In 1995 airpower had succeeded in bringing Milosevic to the negotiating table in Dayton, Ohio, and it had played a major role in destroying Saddam Hussein's divisions in Kuwait and southern Iraq prior to the ground offensive in Operation Desert Storm. Rejecting the doctrine advocated by Gen Colin Powell of committing troops only if one could fight a war with superior ground and air forces, NATO chose an escalating air campaign. Criticism rose sharply when Milosevic initiated savage ethnic cleansing in Kosovo and when allied bombing damaged Belgrade—especially the Chinese embassy there. Skeptics predicted that NATO would fracture, but the alliance and the US administration remained resolute, asking for patience to allow the air campaign time to take effect.

Early on, one saw little indication that this strategy was succeeding. Frustration was apparent on the part of Air Force officers, who viewed themselves merely as administrators carrying out the directives of Washington and Gen Wesley Clark, the NATO commander. Officers of all grades became disconcerted over the restrictions and failure to hit key target groups, particularly the national electrical grid and the Yugoslav leadership. In early May, Lt Gen Michael Short, the NATO air commander, hinted at such disagreement with the targeting strategy and the relative restraint of the early days of the bombing.[3] He stated that the main targets initially had been Yugoslav antiaircraft defense systems and military targets, none of them especially close to Belgrade. Perhaps not coincidentally, the air strategy then quietly but effectively changed. Additional airpower deployed to the region, and the number of air sorties escalated rapidly. By late May, General Short became more sanguine in his assessment, affirming that the air campaign was having a major impact, especially within Kosovo.[4] Nonetheless, naysayers still refused to accept the notion that airpower alone could win.

Suddenly, in early June Milosevic and his government had had enough of the bombing—and it was over. Milosevic agreed to accept peace terms and to evacuate his army from Kosovo. Critics who had advocated sending in a ground element were stunned by this development. On the day the Yugoslavian parliament accepted the Kosovo peace plan, a senior US

senator attended a change-of-command ceremony for the 23d Fighter Squadron in Aviano. He remarked that the people who charged that the allies could not win the war without a significant ground operation would have to eat some serious crow.[5]

Even so, some critics still tried to "spin" the situation. In their view, airpower had played a major role, but most of the damage inflicted on Yugoslav forces in Kosovo came from ground forces—namely the Kosovo Liberation Army (KLA), who helped draw Yugoslav troops into the sights of alliance pilots. In reality, however, the KLA played a relatively insignificant role throughout the entire campaign.

Early in the conflict, signs emerged that airpower alone might work. Milosevic's proposal for a unilateral cease-fire to mark the Orthodox Christian Easter indicated the effect that the air strikes were having on the Serbs. In late April, NATO estimated that the air armada had destroyed all of Serbia's oil-refining capacity and half of its ammunition production. The rapid loss of infrastructure throughout Yugoslavia became readily apparent within the first month.

When General Short stated in late May that airpower alone would either destroy Serbian-led government forces or chase them out of Kosovo, many experts dismissed his views as naïve and self-serving. In fact, Yugoslav options for their 40,000-man force in Kosovo were grim. Air strikes had virtually eliminated Serbian air, as well as the capability to refine and provision fuel and to transport munitions—as confirmed in May, when air strikes on Yugoslav fuel depots caused no secondary explosions. In addition, attempts to concentrate forces invited immediate attention from the air. Fragmentation of artillery and tanks into haylofts and barns marginalized a modern fighting force into noneffectiveness.

Ultimately, the Serbs could allow the allies to ravage their military piecemeal in Kosovo and bomb their country, or they could comply with NATO demands. The option of active guerrilla tactics in Kosovo was never viable because Albanians represented well over 85 percent of the population in Kosovo and because Milosevic had lost popular appeal. What was once a formidable regional power had now become a relatively minor state headed by an internationally convicted war criminal.

Implications for the Future

Potential conflicts of the future will be viewed through the prism of Kosovo. Now that we have established a precedent, airpower probably will become the force of choice, even within the borders of a sovereign state.

The reasons for the success of this air campaign have much to do with superior technology that can now take a heavy toll on military forces seeking to defend fixed terrain. Dropping "smart" munitions from high altitudes with pinpoint accuracy is a cheaper option than waging a prolonged and costly war. Traditionalists may argue that Kosovo was a

special case; however, this war will probably cause all the services to increase their emphasis on mobile, high-tech weaponry.

Such technological advancements may give the impression that one can conduct an air war with a minimal number of friendly casualties. But General Short has warned against this expectation, pointing out that future air wars will not be risk free.

Another interesting implication concerns the increasing importance of information warfare. In Kosovo, the focus of airpower targeting changed markedly. Unlike past campaigns that attacked a nation's industrial sinews and complexes, this campaign focused ultimately on commercial television studios and transmitters; public utilities; the homes of Yugoslav leaders; political-party headquarters; and elements of the economic, communications, and transportation infrastructure. In this war, the allies not only stalled the enemy economy with smart weapons, but also disrupted elements of the Yugoslav communications system with the first use of Internet "cyber bombs." Although information about these "cyber war" efforts is not likely to be made public soon, they will undoubtedly receive more emphasis in the future.

A variety of air and space weapons played a prominent role in the conflict and, no doubt, will increase in importance. The highly accurate, reliable, and essentially undetectable B-2 bomber operated from the United States, carrying 16 individually targetable precision-guided munitions. Unmanned aerial vehicles (UAV) and drones performed valuable functions in light of the operational imperative to avoid loss of allied life. Throughout Operation Allied Force, Predator UAVs carried out surveillance and battle damage assessment; they also displayed their newly acquired capability to designate targets below heavy cloud cover. The allies employed the Harpy, another UAV, specifically in the suppression of enemy air defenses. Keyhole and Lacrosse satellites formed the backbone of an imaging satellite system that swept over the region with electro-optical cameras, beaming important real-time photos to intelligence-processing centers. The combination of such satellites with U-2; joint surveillance, target attack radar system; airborne warning and control system; and Rivet Joint aircraft provided a robust intelligence-gathering network whose importance will only increase.

The final implication seems clear. If the United States wishes to engage certain enemies, it may no longer need aircraft carriers or bases close to a country's borders. It has the ability to destroy with impunity the physical assets of selected potential enemies on earth with minimal losses.

Conclusions

Airpower was a clear winner in Kosovo. NATO got nearly every term it had stipulated in the Rambouillet Accords and flew almost 10,000 bombing runs, losing only two allied planes and no airmen—a phenomenal achievement.

The ability to hit any target anywhere will have a sobering effect on future tyrants. The willingness to use that capability in confronting Milosevic sends a powerful signal to others that ethnic violence, even within one's own borders, is something the world may not tolerate.

Not only technology, but also the haunting images of the Vietnam War drove the selection of an air war strategy for Allied Force. US policy makers seem convinced that Americans will not accept large numbers of casualties. The desire to have sanitized, loss-free wars becomes even more important when allies are factored into the mix.

On the negative side, NATO strategy proved deficient by abandoning two key principles of war: surprise and flexibility. By taking any prospect of a ground element off the table, NATO surrendered the initiative in the short term with disastrous effect. With the uncertainties removed, the Milosevic regime realized that it could act quickly to expel the Albanians from Kosovo with little fear of direct intervention. Airpower ultimately arrested this fiasco, but we should not forget this lesson learned.

Additionally, the initial targeting strategy was flawed, and the target list too small. Allied forces could have targeted air defenses throughout the entire theater of operations, as well as Serbian forces within Kosovo, earlier and more effectively. The allies also needed to shoulder more of the burden of suppressing and attacking enemy air defenses. Furthermore, the allies needed better-defined rules of engagement and more robust initial air attacks. Attending to these matters probably could have shortened the war and lessened the Albanians' suffering and hardship.

Because technology is the key to future success, the F-22 is sorely needed in the US arsenal. Its development should not be adversely affected by the perception from Kosovo that current fighters can do the job for years. Furthermore, because of maintenance difficulties with aging aircraft, potential adversaries of the United States will be encouraged if the F-22 program is delayed or terminated.

Overall, the United States gained clout in the world community by again demonstrating its ability to lead military coalitions. We should commend US airmen, who flew the large majority of NATO missions, for an almost flawless performance. The air war assumed historic significance by producing the first military victory without a complementary ground force and without a single loss of life to enemy fire. Military planners should continue to analyze this conflict closely, along with projected improvements in technology, to derive its full significance for future wars. □

Jacksonville, Florida

Notes

1. Warren Bass, "Ground Rules," *The New Republic*, 17 May 1999, 19.
2. Eric Alterman, "Awful Options, Open Eyes," *The Nation* 268, no. 18 (17 May 1999): 10.
3. Craig R. Whitney, "Crisis in the Balkans: The Commander," *New York Times*, 18 June 1999, A22.
4. Ben Fenton, "We Can Bomb the Serbs out of Kosovo in Weeks," *Daily Telegraph*, 25 May 1999, 1.
5. Gordon W. Arbogast, "Give Air Power Its Due," *Florida Times-Union*, 27 June 1999, H2.

The Politics of the Air Campaign

Challenges for the US Air Force in the Aftermath of Operation Allied Force

Maj Ellwood "Skip" Hinman IV, USAF*

THROUGHOUT US MILITARY history, generals and politicians have battled over how best to prosecute war. The debacle in Vietnam represented how views could differ and how dire the consequences could be when disagreements remain unresolved. The United States learned from its defeat in Vietnam. Military strategists and civilian policy makers agreed that political involvement at the tactical level of war, gradual escalation, and the lack of clearly defined objectives contributed to failure in Southeast Asia. If any good came out of the US failure in Southeast Asia, it was a general agreement among civilian and military leaders that no future US military operation should resemble the flawed US intervention in Vietnam. This convergence of thought eventually led to the Weinberger Doctrine, which applied six major tests bearing on the decision to use US combat forces abroad, and culminated with the skilled manner by which politicians and generals ran the Gulf War. Since that war, however, military and civilian thinking has once again diverged. The widening gap between how different leaders plan to prosecute war constitutes the most important challenge facing the US Air Force today.

The recent North Atlantic Treaty Organization (NATO) air campaign in Yugoslavia demonstrated how this divergence in thought has brought the US style of warfare full circle and has unwittingly ushered in the uninvited ghost of Vietnam. Three particularly nasty emanations of the Vietnam War reared their ugly heads during Operation Allied Force: (1) political immersion at the tactical level of war, (2) the lack of clearly defined goals, and (3) the limited, incremental escalation of conflict. While Vietnam forced US policy makers to learn hard lessons by losing a war, the apparent victory in Serbia has unfortunately given new life to many of the same policies that failed in Southeast Asia. It is likely we won the air war over Serbia in spite of ourselves. While many military members have spoken out against the politics of the Allied Force air campaign, other nonmilitary opinions are that such policies are a political reality and are likely a vision of future air campaigns. Victory in the Kosovo conflict, therefore, may have polarized the two sides even further.

---

*Maj Ellwood P. "Skip" Hinman IV is currently attending Air Command and Staff College (ACSC), Maxwell AFB, Alabama. He is an F-117 pilot and participated in Operation Allied Force in that capacity.

Political involvement at the tactical level of war during Operation Allied Force capsulized this ongoing debate. Even Clausewitz, who viewed war as an extension of policy by other means, recognized the inherent limits of political involvement: "Policy, of course, will not extend its influence to operational details."[1] In fact, during the Gulf War, generals and their operational commanders were allowed to run the air campaign with only general guidance from civilian policy makers. And yet, during the air war over Serbia, air planners were required to seek the approval of 19 NATO countries before a single target could make its way onto the air tasking order. Countless missions were cancelled at the hands of a single nation's veto only to be rescheduled and cancelled again on another day. Fixation on the unfortunate reality of collateral damage led to directives from the highest levels of government forbidding the use of particular types of weapons. While military commanders expected to run the air campaign at the tactical and operational levels, they found themselves relegated to the duty of advisors, as their civilian leaders directed operations at all levels of the war.

This overinvolvement at the tactical level of war led to an even more unfortunate underinvolvement at the strategic level by civilian policy makers in charge of the NATO air campaign. Instead of providing military planners with clearly defined political goals by which to build a target list, political leaders seemed to focus on individual targets as if the targets themselves comprised the overarching strategy. Consequently, the air war over Serbia has been described by many as a target list in search of an objective. A year of intense planning yielded 40 different iterations, all based on the assumption that President Slobodan Milosevic would back down after a few days of light bombing. Simply stated, there was neither a coherent political strategy nor clearly defined military objectives for Operation Allied Force. There was no glue to hold the campaign together; and yet, the Weinberger Doctrine requires that the United States commit forces "only with clear political and military objectives."[2] *National Military Strategy of the United States of America* dictates that "military missions must be clearly stated, with achievable military objectives that support national political aims."[3] This stark difference between the manner in which Air Force leaders expected to prosecute the air war and the way in which civilian leaders ran the operation underlines the widening gap between the two schools of thought.

Perhaps the clearest vestige of Vietnam-era policy that proved to be most divergent from contemporary airpower theory, though, was the limited, incremental manner in which NATO's political leaders chose to run Operation Allied Force. Airpower theory is replete with calls for overwhelming, decisive force. *National Military Strategy of the United States of America*, in fact, espouses the use of "decisive force . . . to overwhelm all armed resistance in order to establish new military conditions and achieve political objectives."[4] Due to the political constraints of Operation Allied

Force, however, the fundamental airpower precepts of parallel attack, effects-based targeting, and inside-out warfare—so effective during Operation Desert Storm—were never applied to the air war in Serbia. The gradual escalation in the number of aircraft in-theater, the number of daily sorties flown, and the number and types of targets attacked during Allied Force eliminated any hope for synergy and shock effect.[5] While the Air Force planners had hoped for Instant Thunder, they got Rolling Thunder instead.

Despite the gross divergence between airpower theory and the political constraints regarding targeting, objectives, and incremental warfare, Operation Allied Force appears to have been a success. What is unfortunate, however, is that victory often brings more euphoria than it does reflection. Today we have stumbled upon victory with the same failed policies. As a result, in the aftermath of the war with Yugoslavia, the divergent trend continues. Air Force generals complain that the air campaign was mismanaged, while their civilian leaders appear convinced that politically correct warfare can lead to victory in future campaigns, as it did in Operation Allied Force. If the two sides are unable to bridge the gap, the fruits of a past victory may very well lay the seeds for a disastrous future defeat. □

Maxwell AFB, Alabama

Notes

1. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N. J.: Princeton University Press, 1976), 606.
2. Colin L. Powell with Joseph E. Persico, *My American Journey* (New York: Random House, 1995), 303.
3. Joint Chiefs of Staff, *National Military Strategy of the United States of America* (Washington, D. C.: Government Printing Office, 1997), 12.
4. Ibid., 20.
5. J. A. Kitfield, "Another Look at the Air War That Was," *Air Force Magazine* 82, no. 10 (October 1999): 40.

In war, situations are the products of mutually exclusive and incompatible wills.

—Brig Gen Samuel Griffith II

Public Perceptions of the Air War over Serbia

GENE MYERS*

RECENT ACTIONS AGAINST Iraq and Yugoslavia represent modern attempts to avoid traditional large-scale attrition war. In the past, the relative isolation of the United States, the distances involved, and the lack of true global-range systems and precision weapons required mobilizing and moving large joint-service force structures in response to enemy actions.

Now advanced aerospace systems—reconnaissance and surveillance, strike, and mobility—make the situation dramatically different. Reaction times are cut from weeks to hours, and one or two weapon systems can target and successfully attack what used to take hundreds of sorties. We can even react over great distances before a mobilizing adversary can prepare himself.

Such actions, however, require military preparedness and political will to achieve national objectives quickly and decisively. Past reluctance to do so has cost more than a concentrated initial assault. Awesome power, even when applied precisely, must still be applied in strong doses, or the cure will be long in coming. That is a clear lesson of this most recent conflict but a difficult lesson to relay to the public at large, which expects either World War II–style carnage or new "miracle weapons" to end suffering altogether. Both perspectives work against exercising the kind of campaign that can achieve the greatest results. Gen John Jumper, commander of US Air Forces in Europe, stated on 16 August 1999 at the Eaker Institute for Aerospace Concepts that

> it is the politics of the moment that is going to dictate what we are able to do. If the politics of the moment . . . means gradualism, then we are going to have to find a way to deal with a phased air campaign, with graduated escalation. . . . Efficiency may be sacrificed. It is not the way we [military commanders] want it.[1]

Critics list many flaws in the recent Balkans air campaign and question whether aerospace power achieved as much over Serbia and Kosovo as some enthusiasts claim. The air war over Serbia was clearly not perfect. Early efforts were constrained; command arrangements were confusing and confining; and intelligence and targeting were cumbersome,

---

*Grover E. "Gene" Myers is a senior defense analyst with Science Applications International Corporation and a senior fellow with the Air Force Association–sponsored Eaker Institute for Aerospace Concepts. A retired Air Force officer with over three thousand flying hours in rescue helicopters and B-52s, he served as a politico-military affairs officer in the United States and Europe. He has numerous publications on the subjects of aerospace doctrine and strategy as well as strategic policy and is currently a member of the team conducting the official US Air Force postcampaign study of the air war over Serbia.

inefficient, and generally not linked with desired effects. From a military perspective, political requirements had too much influence, creating problems as political leaders dictated targets and strategy (a condition General Jumper suggests military leaders may have to get used to). Yet, objectives of the North Atlantic Treaty Organization (NATO) were achieved—Serb forces left Kosovo, and NATO moved in. Military power never operates in isolation, and international politics strongly influenced the outcome. Had it not been for the air campaign, Slobodan Milosevic would have had little incentive to heed such political pressure. Milosevic's withdrawal came from his inability to stop the bombing or divide the NATO alliance as he had hoped.

During the extensive media coverage, which praised and criticized the air war campaign, a set of perceptions arose coloring public opinion of the campaign's success or failure. This occurred despite the revelation, outlined above, that war is now fundamentally different than it was just a few years ago, with different strategies, participants, technologies, results, and—most important—different political considerations necessitated by mass communications and the need to manage long-term alliance relations.

Despite the use of thousands of weapons from thousands of sorties, the campaign did very little to Serb ground forces. It seems that NATO did overestimate its successes in the tactical (vice strategic) portion of the campaign against fielded Serb forces in Kosovo. Dispersed and hidden ground-force targets were very difficult to find, and Serb deception and camouflage techniques were better than expected. But success in warfare is not, or should not be, about statistics—numbers of casualties or equipment destroyed. We should have learned that lesson pretty well in Vietnam. Rather, it should be about achieving objectives and making the other guy do your will. It means finding the right targets and achieving effects to make political leaders, not soldiers, say they've had enough. In that we were successful. Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, states that

> war is an instrument of national policy. *Victory in war is not measured by casualties inflicted, battles won or lost, or territory occupied, but by whether or not political objectives were achieved.* More than any other factor, political objectives (one's own and those of the enemy) shape the scope and intensity of war. (Emphasis in original)[2]

We must also remember that there was another phase of the air war—the strategic phase against petroleum, communications, and electricity in Serbia itself—that was credited far more than the effort against the ground forces with final success.

Loss of Russian support and the eventual threat of a NATO ground assault rather than the air campaign forced Milosevic to give in. There is little doubt that airpower did not singularly achieve the conflict's political objectives. It was, however, the only active military component; and without the air campaign and the attendant NATO solidarity to accomplish it, nothing would have been achieved at all. Loss of Russian support would have

meant little to Milosevic if there had been no air campaign, no threat of further military action, and no visible NATO determination to continue its campaign. We must remember that war is about politics—there will always be political elements that will contribute to the end state. Political and military objectives should be complementary, not contradictory.

The use of airpower exacerbated ethnic cleansing rather than stopped it. The agony of the Kosovars was vivid, leading some pundits to blame the air campaign for accelerating the genocide. Clearly the timetable accelerated when Yugoslav leaders began to sense they had little time to eliminate non-Serbian Kosovars. But mounting evidence of Serbian atrocities in both Bosnia and Kosovo and the speed of Serbian action in Kosovo demonstrated that Milosevic had ethnic cleansing and genocide on the agenda. Without NATO action it would likely have been a more methodical and thorough job with fewer refugees escaping to neighboring nations. The refugee problem was bad, but it appears certain to have happened anyway. It did in Bosnia.

> Gen Michael Ryan, US Air Force chief of staff, has stated that airpower could not stop the door-to-door . . . thuggery and ethnic cleansing that [were] going on, directly. The only way you were going to be able to do that [was by] taking it to the heart of the matter—in this case, to Belgrade.[3]

General Ryan reminds us that in this conflict, without a massed ground-force face-off, airpower had a difficult time finding various dispersed Serb forces who were causing trouble in one house or village at a time. It was the theater airmen's opinion that airpower could have been better used against strategic targets—petroleum production, electricity, and communications—than in trying to find dispersed Serb ground forces. These strategic targets were the ones that had the most effect on the Milosevic regime. The only problem was that strategic action to achieve specific effects on the Milosevic regime came late in the conflict. Stopping the ethnic cleansing directly would have required a massive commitment of NATO ground forces, something NATO was unwilling to do for fear of casualties, and something that very well may not have been necessary anyway.

In a Summer 1999 *Strategic Review* article, Lt Gen Thad Wolfe and I concluded there are times that we must act but that we must act responsibly:

> It would have done no one a service, not even the Kosovars, to sacrifice NATO soldiers when there were other options. The price of failure or even success with the expenditure of too many lives and too much treasure could be the collapse of NATO and unwillingness to aid a turbulent world's next targets of genocide—be they Kosovars, Bosnians, or Kurds.[4]

Hampton, Virginia

Notes

1. "Operation Allied Force: Strategy, Execution, Implications: An Eaker Colloquy on Aerospace Strategy, Requirements, and Forces" (Washington, D.C.: The Eaker Institute for Aerospace Concepts, 16 August 1999).
2. Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, September 1997, 6.
3. Quoted in John A. Tirpak, "Lessons Learned and Re-Learned," *Air Force Magazine* 82, no. 8 (August 1999): 24.
4. Grover E. Myers and Lt Gen Thad Wolfe, USAF, Retired, "The Price of Greatness: Air Power in the Balkans," *Strategic Review* 27, no. 3 (Summer 1999): 16.

Aerospace Power Chronicles

Contributor's Corner

The Contributor's Corner section of *Aerospace Power Chronicles,* a state-of-the-art on-line publication, features articles on the leading edge of the professional dialogue. Our latest article, "Fighting Deep with Joint Fires" by US Army officers Maj Roy C. Sevalia and Lt Col David C. Sims, describes the processes and procedures for the planning, synchronization, deconfliction, and execution of joint fires in the US Central Command area of responsibility by the Coalition/Joint Task Force-Kuwait, forward deployed in support of the commander in chief of Central Command. In "Gliders: Rethinking the Utility of These Silent Wings for the Next Millennium," Steven A. Torrisi ponders the benefits and potential obstacles to reinstating a glider capability, which in turn may stimulate a renais-sance of learning with regard to this neglected mode of flight.

Articles written by Air Force company-grade officers and published in Contributor's Corner that contribute to the professional dialogue are eligible for the "Two Air Forces Award" established by the Royal Air Force Historical Society and the Air Force Historical Foundation. The winner receives a plaque and congratulatory letter from the president of the Air Force Historical Foundation.

Do you have something on your mind, or have you been working on a paper you want published? Submit your work to *Aerospace Power Chronicles* for possible electronic publication in Contributor's Corner. Please E-mail your suggestions to editor@cadre. maxwell.af.mil.

Luetwinder T. Eaves
Managing Editor
Aerospace Power Chronicles

Pilots of the Former Soviet Union: Threats, Allies, or Forgotten Memories?

CAPT CHRISTIAN "CHEWY" WATT, USAF*

There you are, patrolling no-fly-zone "X" again. Finally, after years of biding your time broadcasting weightless United Nations warnings to violators, you get the call from the airborne warning and control system aircraft: "Rocket 11, the mission director requests that you visually identify a fast-moving bogey north of your position, 40 miles southbound." You acquire the bogey—low, fast, and definitely making a run toward good-guy territory. You think to yourself, "Yeah, baby, 'bout time I got some." You approach the bogey with utter confidence—for years Intelligence has briefed you on every detail about the capability of country X's pilots. You almost feel pity for him. As you converge on the bogey, you confirm that it is in fact an enemy plane: "Bandit, Bandit!" This could very well be your first kill, but before you can request permission to fire, the bandit does something you've never seen before—"Sweet move!" Now you're anchored, committed to fighting this guy, but still you've got confidence. There's no way this clown can beat you. As you start turning with the bandit, he just doesn't make the mistakes you would expect from a country-X pilot who supposedly has limited flying time and combat experience, poor training, and no concept of basic aerial combat. "Whoa! Didn't expect that!" You wonder where in the world your wingman is. You cringe, beginning to see the inevitable. This guy is now neutral with you and quickly gaining ground! Before your wingman can get in and take a shot, you see it—a puff of smoke off the bandit's wing. You look at him sideways and wonder, "How can he be shooting me from there?" You watch in amazement as the missile guides, but by now you are defenseless. You pray that your aircraft will survive the impact, that your wingman will wax this guy, that you will be able to limp home, that you won't be the next face on Cable News Network! As you ride down in the straps, you go through the steps they taught you in survival training: canopy, visor, mask, seat kit. But all the while you think, "Who was that poorly trained, no-aerial-combat-understandin' pilot who just shot me down?"

*Captain Watt is a tactical aviation and simulator instructor for the 50th Education Squadron at the United States Air Force Academy. He is also an adjunct instructor with the Russian Language Department and performs escort duties as a Russian translator.

FOR THOSE OF you who believe that we kings of the information age will always know the enemy and that we'll always be one step ahead with our machines and personnel, this article won't do much for you, other than provide some interesting tidbits and stories. For those of you, like me, who believe in David and Goliath and surprises—for those of you who believe that mercenaries exist; that "special advisors" aid potentially hostile nations; that there are some things even we Americans, the forerunners of the information age, might not know, this article should serve as a warning.

My focus is on the fighter pilot of the former Soviet Union (FSU), whom we try to better understand by examining the Ukrainian fighter pilot. Although the Ukraine is a peaceful nation that has made great strides toward democracy and potential acceptance into the North Atlantic Treaty Organization, understanding that country's combat aviators should provide insight into other threats we might face in the future. The world would have to become a very ugly place for the United States and the Ukraine to find themselves on opposite sides of the battlefield, but if you believe in the existence of mercenaries and "advisors," as I do, then you believe in the possibility of "Ukrainian-like" pilots flying bandit jets. Finally, by understanding the Ukrainian fighter pilot and his challenges and lifestyle, you might better understand a wide variety of other FSU fighter pilots. As Sun Tzu wrote, "Know thy enemy and know thyself."

A critical reader might reasonably ask where the author gets his information: what gives this person the right to draw these conclusions? Usually, the reader can check out the citations and closely examine whether the evidence supports the conclusions. But you won't find citations or references to other works here. Support for my conclusions is based almost solely on my own experiences. Therefore, you must know a little about them to have a prayer of believing anything I say.

My experience with FSU countries dates back to 1985, when I took Russian as a college elective. After four years of school and going through the Reserve Officer Training Program, I was ready to graduate with my math degree and start flight school. Instead, I extended my college work for a fifth year—three months of which I lived with a Russian family in Khabarovsk, a city in the Soviet Far East near Vladivostok—and earned an additional degree in Russian. In 1990, two weeks after returning from the Soviet Union, I started flight school and was assigned to the F-15E, which I have flown operationally for the last seven years. My Russian language skills lay dormant until a couple of years ago, when my base, Seymour Johnson, North Carolina, decided to reestablish ties with the Ukraine by picking a sister base, Mirgorod, about 80 miles southeast of Kiev, whose pilots currently fly Su-27s. The exchanges that followed commemorated the Operation Frantic missions of World War II, during which the 4th Fighter Group (now the 4th Fighter Wing at Seymour Johnson) conducted deep bomber-escort missions out of England against the Nazi threat in

Germany. The missions were so long that the planes had to land in the Ukraine to refuel before returning to England, thus reinforcing our relationship as allies of the Soviets until the end of the war and the creation of the Iron Curtain.

In the summer of 1997, we led a four-ship of F-15Es and one KC-135 to Mirgorod, where we stayed for just a few days filled with official functions, exchange flights, an air show, and encounters with several soldiers and citizens and their families. The trip was a huge success, and we invited the Ukrainians to the United States on a reciprocal visit. Shortly thereafter, I was chosen mission commander for the trip, during which we flew an Su-27 and an Il-76 across the Atlantic to Seymour Johnson. I was "crewed" with a Ukrainian pilot, and we became the first people to fly the Russian-built fighter across the Atlantic. Trip preparation included a quick language-refresher course at the Defense Language Institute as well as a Pentagon-sponsored "immersion" course in *Sankt Peterburg,* Russia, where I lived with a Russian widow who, as an army doctor, survived the Nazi siege of Saint Petersburg. We handled as many of the details as possible prior to the trip, and a couple of weeks prior to our departure from the Ukraine, I was sent over to finalize trip preparations and receive my training in the Su-27. This adventure, during which I gained much more insight into the life of the Ukrainian military, forms the basis for my conclusions in this article. The 21 days I spent crewed with Lt Col Ivan Chernyenko—in and out of his country, in and out of the Ukrainians' home life, coupled with my experiences dating back to 1985—gave me a framework to compare the new FSU to the old USSR. It also gave me a foundation to compare the lifestyles of their people over time and to draw conclusions about what the future might bring.

The Profile

So what are their lives like? From what challenges and experiences of Ukrainian pilots can we draw conclusions to help us understand FSU pilots and the potential threat they pose, either directly or indirectly? Three general categories provide some insight into these matters: economics, mentality, and ability.

Economics

Whether we like it or not, economics—*money*—is a huge factor when we make decisions, even those involving our views on right and wrong. Let's talk about a few money issues facing Ukrainian pilots: paychecks, bribery, and general living conditions.

Paychecks. When I was in the Ukraine in June 1997, the pilots told me that the economic state of their country, particularly as it affected the military, was so bad that they had not been paid since January. They weren't on strike or "outsourced"; the government simply had no money

to pay them. I asked them if they would receive back pay once the government obtained funds, but they simply weren't sure. In fact, at the end of our trip in 1997, they received their pay for the month of April but were uncertain of the status of the remaining five months of delinquent pay. You might naturally ask, If the pilots aren't being paid for their military service, how are they putting food on the table? Some of their wives work abroad. For example, compensation for nurses in Poland is four times a pilot's domestic pay. Others have significant skills and activities that help them "acquire" things.

Although Americans may think it odd to work for an organization for an extended period without pay, the problem is not unique to the Ukraine. In Saint Petersburg, I met a couple of working professionals—a chemist and a college professor. The chemist had been working for several months without either pay or promise of pay because he had no other marketable skills. He and coworkers like him were just hoping their industry would come alive again; in the meantime, that 50-year-old father went to his mother's home to eat every night. Once a builder of mighty rockets, he now hasn't a clue about what his future holds. The professor held a second job that kept food on the table.

Of interest to us is that, unlike the chemist and the professor, pilots of advanced fighters possess a rare, marketable, and lethal skill. With FSU governments selling off their advanced equipment somewhat indiscriminately, the demand for these skilled pilots has increased. Although you and I scoff at selling our services to some third world tyrant, how long do you think an FSU pilot can hold out while he watches his family suffer?

Bribery. The United States is adamantly opposed to bribery, a fact reflected in both our international and domestic business laws. However, the rest of the world is not completely on board with our principles. Examples abound in any number of articles on business practices in Latin America, Asia, and, in our case, the FSU. The Ukraine has its own problems with bribery. In fact, when we tried to leave the country with the Su-27, Il-76, and 36 personnel on our 1998 Frantic reunion, we had to pay customs officials a sum of money before they would release us and the aircraft. Ever heard of paying duties on exporting your own military hardware and personnel on an exchange? I'll let you do the math.

My point is not to evaluate the merits of bribery but to emphasize the dangerous mind-set it brings to the equation. A bribe makes people change their behavior—makes them do or not do something on the basis of *money*. In some cases, money becomes so important it can make individuals do something socially unacceptable, even immoral. Couple this practice with the lack of compensation, and the potential for trouble becomes immense. The United States can restrict me from selling my knowledge of fighter aircraft to other nations, but a bribe in the right pocket in a country where the practice is tolerated can open the door.

Living Conditions. Americans are lucky; people in the worst economic situations here still live better than so much of the rest of the world. We take running water and electricity for granted, but people in even the major cities of the FSU go without them for days, weeks, or even longer. Run-down living quarters, decaying base infrastructure, and intermittent utilities are only a few of the problems facing the Ukrainian pilot. The change to a market economy has not been easy on the FSU countries. In 1990 we walked around with pockets full of rubles, yet there was little to buy. Now, the shelves are full, but because the government no longer controls the prices, many honest FSU citizens can't afford to buy. To be blunt, how do you think a colonel in an FSU military can afford a $450 video camera when he makes only one hundred US dollars a month? For a more graphic example, consider the father of the family with whom I lived in 1990. Although he made only about three hundred rubles a month as the chief oral surgeon in a large Russian town, he paid cash for a 10,000-ruble vehicle—almost three years' salary. How?

People are willing to "donate" a lot to avoid a two-year wait for dental care. When I was in Saint Petersburg in 1998, it became clear to me that honest citizens had their hands full just trying to survive, while those who skirted the law could acquire some of the things that you and I take for granted. Economics in the FSU is a long way from becoming stable. Consequently, people in these situations learn that they must "cheat" to survive and that using their skills for their own government does not provide their families an adequate lifestyle.

Mentality

A few key factors help to shed some light on how FSU pilots might think differently than we do.

Russia/Ukraine Relationship. Some people say that the Ukraine considers Russia a threat. For instance, one of my Russian professors in college boldly suggested that if the Soviet Union ever attacked Europe, half of the Eastern Bloc armies would turn on the USSR at the earliest opportunity. The reality for Ukrainian pilots, which probably holds true for the other FSU countries, is that for the past 50 years they have been intimately tied to Russia, even using the Russian language as their international language for military purposes. Some Ukrainian pilots have Russian wives, and some Russian pilots have Ukrainian wives. Russians were still flying with the units during our 1997 visit, trying to decide whether they would remain in the Ukraine or take their Ukrainian wives and families back to Russia.

Sharing this common bond and history does not mean that conflict between the Russians and Ukrainians does not exist. During my weeklong visit in 1997, several Russian and Ukrainian pilots in the unit approached me with comments such as, "Hey, I'm not a Ukrainian; you can trust me" or "Hey, watch out for that guy; he's a Russian." But citizens of the FSU

countries have become accustomed to working for people they don't like—whose policies and actions they might even oppose. A couple of generations may pass before the FSU nations and their citizens become truly independent thinkers.

Postmilitary Life. With only very rare exceptions, American fighter crews know that their time in the military is just their first career. They prepare for their next career and plan their lives for the long haul. But life expectancy for FSU males is in the late fifties versus the early to midseventies for American males. When Ukrainian pilots retire, for the most part, they retire completely. With the collapse of the economy, as noted above, pension checks are far from guaranteed. What will happen to these pilots who have but one true skill—flying fighters to defend the homeland? The implication is disconcerting. They have to eat—airlines won't hire them, but a wealthy foreign militant could probably give them something to consider.

Hope. Although members of the younger generation in the FSU countries, with their cell phones and computers, appear to have embraced democracy and accepted the future, the older ones seem less optimistic. My impression of the older crowd, especially the soldiers, is that they feel time has passed them by. Most of their skills, once geared to abolish Western aggressors, are now obsolete, and they find themselves without employment. Indeed, some citizens hold them and their profession, once considered a vital component of their society's survival, responsible for the hardships they now face. Additionally, the poor economy can hardly absorb a large number of unskilled, middle-aged workers. One higher-level Ukrainian officer expressed complete hopelessness, stating that his "society is completely disintegrating." He wants his child to learn English so he can "have a chance to escape the terrible decay occurring all around him."

Reverence for Fellow Soldiers. We were all somewhat prepared for the amount of alcohol consumption, which was extreme, that would take place during the course of the exchanges. We were pleasantly surprised and impressed, however, with some of the Ukrainians' traditions. For example, when they toast, the third toast is always silent, in memory of their fallen comrades. Everyone takes a glass, stares at it, pauses to remember, drinks, and gently sets the glass down. During our prisoner-of-war/missing-in-action ceremonies, we have our own traditions to remember those who have fallen, but the Ukrainians do it every time they drink—daily at official functions, after hours, lunch, camping, and so forth. When you look into their eyes and listen to them, it isn't just formality or procedure—they mean it. Other than during an official function or holiday, when did you last pause to remember the 19 dead from the Khobar Towers bombing, the marines at Beirut, the people lost in all the wars and conflicts in our history? I'm proud to say that the 336th Fighter Squadron "World-Famous

Rocketeers" recognized the value of this tradition and now practice it in their own way.

Ability

When examining the aggregate ability of a fighter-pilot corps, Americans pay attention to such indicators as flying hours, training, and experience. Additionally, confidence tends to be a common trait (or flaw, some might say) of superior fighter pilots.

Training and Experience. "Country X's pilots are extremely inexperienced; they fly only a few hours a month, and the training is quite basic." Have you heard that before? Let's examine the situation a little closer, using the Ukraine as country X. The first statement is somewhat true—most of the younger Ukrainian pilots are extremely inexperienced. Starving for hours, they lack the operational training and real-world combat experiences on which analysts make their assumptions. Yet, what about the significant cadre of experienced senior flyers—the majors and colonels who are still around? They've been flying jets their entire careers (they are not distracted by attending professional military education schools and earning graduate degrees, as are American fighter pilots) and have no second career to worry about. They carry years of experience flying MiG-21s, -23s, -29s, and now Su-27s. They've even got combat experience—from Afghanistan at the very least. How many hours a year do these warriors really need to be proficient enough to be a threat? Have you ever heard of Col Nikolai Koval of the Ukrainian air force? His Su-27 demonstration won the "Best Solo Jet Demonstration" honors at the 1996 Royal International Air Tattoo. Do you think there might be a few others who could do it when it counted—in combat?

The second part of the statement—flying just a few hours a month with rudimentary training—holds true on both counts. However, don't make the mistake of rigidly equating flying hours to flying ability. True, a few hours a month would be grossly insufficient for the average F-15E pilot, whose sortie length hovers around the 1.5-hour mark. But in many cases, US pilots have a good bit of dead time when they fly. For instance, a pilot at Seymour Johnson takes off and drones for 20 minutes to a training area during most of the air-to-air training missions. He then flies the mission and drones home for another 20 minutes. Although he might log a 1.3- to a 1.4-hour sortie, he spends less than half an hour on the meat of the mission—aerial combat. This scenario happens because the United States has so much air traffic and because the military can't operate just anywhere.

Now, compare this situation to that of the Ukrainian pilot. He takes off with a half load of fuel because it is expensive and his air force can't afford to waste a drop. However, he doesn't have the airspace problems we have—either because of less air traffic or the fact that military aviation takes precedence over civil aviation in those FSU countries that evolved with a focus on war. He takes off, flies to a training area within a few

minutes of the base—if not directly overhead—accomplishes the training, and lands. His sortie might last for only 25–30 minutes, but he spends that time almost solely on the meat of the mission. So getting only a few hours a month might not be outstanding, but it's not nearly as bad as standard analysis would have you believe.

The statement about rudimentary training missions also needs some context. Ukrainians do not participate in Red Flags, multiship missions, or highly coordinated training sorties such as an intense Strike Eagle mission in which our pilots escort B-1s to a target area, shoot down some bandits along the way, take out an SA-6 site with AGM-130s, reset to protect the EA-6Bs and A-10s, whack a few more bad guys, and then go home to the traffic pattern, where it really gets dangerous. These missions are necessary for Americans, who make a practice of dominating an enemy on his own soil. But what about the Ukrainians, whose mission is almost strictly air defense? They might do one or two air-to-ground missions a year, but they don't carry the ordnance we do or concentrate in those areas. They spend their time doing one thing—getting to the merge where it's one-on-one. The point is that they don't have to split their time, partition their assets, or mess with configuration changes and the like. They do their thing, killing enemy aircraft, which makes a basic training mission good enough—as you will see if you find yourself in the position of Rocket 11, whose sobering tale began this article.

Confidence. Ten years ago, the Ukrainians at Mirgorod had a mission: sit alert and race to the Iron Curtain to blow the Yanks out of the sky before they invaded the homeland. Older Ukrainian pilots told me they had complete confidence that they could stop us in our tracks. What about now? Now that they've seen our planes in action through their own intelligence, Cable News Network, and our exchanges? Still, they have confidence. A pilot from the Mirgorod crew—the "political officer" (actually, he has a more politically correct title now), who asked most of the tough questions—made it clear to me that he could hold his own in a one-on-one fight with a Western pilot. The younger crowd did not venture into those conversations, straying away from any aggressive comparisons of aircraft, but the older ones seemed to share the confidence professed by their political officer.

Implications

Let's put all of these elements together to profile the Ukrainian fighter pilots. Economically, they are struggling with inconsistent pay, a society scarred by the corrupt practice of bribery, and poor living conditions, even by FSU standards. Mentally, members of the older crowd lack hope, have few prospects for a future outside the military, have grown accustomed to accommodating people with whom they do not agree (Russians), and have a deep respect for fallen comrades as they continue to protect a society

whose progression into the new millennium has left them behind. In terms of ability, they are the best of their corps. Masters of their machines and missions, they possess such knowledge and experience that a minimum amount of consistent flying could bring them up to our standards. Accordingly, they don't require much incentive to leave and create the potential for a "surprise."

The purpose of this article was not to propose that the "Red" threat is bigger than ever or that FSU pilots might become so frustrated with the unstable progression to democracy and market economy that they would revert to old ways. It does, however, give credence to what is happening to all of the hardware and personnel that once comprised these countries' extensive military arsenal. Although the chances of a massed Red threat marching successfully against the United States are slim, I am concerned that on an individual basis—one-on-one in the aerial-combat phone booth—you'd have your hands full. Given the economic outlook, ability, and mentality of the FSU pilots, the potential for a close encounter exists. Our pilots should be prepared for the worst every time they press to the merge against an adversary, even if they think they know that adversary's capabilities. □

Colorado Springs, Colorado

Nothing will disorganize an army more or ruin it more completely than pillage.

–Napoléon I

No Need to Run Up the Score

Dr. Daniel R. Mortensen*

> *It is no longer necessary for the airman to claim that he can win wars alone. His arm has reached an acknowledged importance and a recognized value and size so that there is no longer need for hyperbole in describing its vital role. The simple facts now coming from the world's battlefields speak . . . loudly of the power of air forces.*
>
> —Gen Henry H. "Hap" Arnold

STATED NEARLY 60 years ago by General Arnold, commanding general of the Army Air Forces, this sharp proclamation of early World War II airpower continues to be articulated by current air advocates who believe that airpower has the capability to win battles. Not to be outdone, on the other side of the aisle, ground-force proponents have long argued that mass and maneuver by ground forces are required for clear, decisive battlefield operations. It has often been an uphill battle by the airmen, not the least because the ground forces have centuries of history to back their claim. Airmen have less than a century.

Arguments over these service-related dictums heated up again in the aftermath of the Gulf War of 1991. Many leading airmen believed that airpower had been decisive in winning the war, and air proponents in the Pentagon argued for a reevaluation of service roles and missions in the congressionally mandated discussions that followed the war. The main issue and sticking point was that the ground proponents continued to argue the military usefulness of massed armored formations, even in light of effective stealth and precision airpower in the Gulf War. Army thinkers were not ready to accept Colonel John Warden's suggestion that "precision and stealth put us into a different era."[1] The debates enlivened again in the aftermath of the Kosovo conflict, but now the air argument clearly had a new and dynamic credibility.

In recent months, the political leadership has more fully embraced the prospect that airpower can substitute for ground-force operations. The minimizing of battlefield casualties is the underlying catalyst, and attrition-heavy massed ground warfare is under attack. Since he took office, Gen Eric Shinseki, the new Army chief of staff, has begun to reorganize some Army heavy divisions into lighter, more deployable units. These forces will

*Daniel R. Mortensen is chief of the Research Division, Airpower Research Institute, College of Aerospace Doctrine Reseach and Education, Maxwell AFB, Alabama. He is the editor of *Airpower and Ground Armies: Essays on the Evolution of Anglo-American Air Doctrine, 1940–1943* (Air University Press, 1998).

better fit small-scale contingencies that depend more on precision air firepower than massive firepower from traditional heavy tanks and artillery.

Other very significant reform ideas for the Army come from an active warrior/scholar, Maj Gen Robert H. Scales Jr.; these are particularly noteworthy in his monograph *America's Army in Transition: Preparing for War in the Precision Age,* recently published by the US Army War College.[2] This slick 29-page paper offers an intelligent discussion of both post-cold-war ideas for a changing Army and post-Kosovo recognition of airpower with its potential war-winning capability. It represents a clear change in the Army's attitude about the employment of air forces in a large-scale battle. Further, it comes from an Army advocate whom air advocates had long identified as an icon of a stubborn Army's unwillingness to accept the potential decisiveness of airpower in modern war.

General Scales first came to my attention in the immediate post–Gulf War period as the "principal author" of *Certain Victory,* a book that treated both the backdrop of the Gulf War as well as the great operational successes of the hundred-hour ground battle.[3] Although his purpose in that book was not to discuss the hundred-day air war that preceded the ground battle, all sorts of air advocates noticed that Scales shunned any mention of how air had clearly underwritten the success of the ground war. In the conclusion of the introductory chapter, Scales stipulates that the Gulf War represented an evolution rather than a revolution, quoting Maj Gen Barry McCaffrey's reply to the Senate Armed Services Committee: "This war didn't take 100 hours to win, it took 15 years," a reference to the effort of many young soldiers who spent 15 years reforging the Army institution that had been broken in Vietnam.[4] But referring to a war lasting a hundred hours in one of the first official publications to come out after the Gulf War hit a lot of airmen the wrong way.

Employing Kierkegaard's concept that while "life must be lived forward," it has to be "understood backwards," Scales concludes that "Desert Storm confirmed that the nature of war has not changed . . . that the core of joint warfare is ultimately decisive land combat."[5] The backdrop that made Scales an icon of Army stubbornness was the ongoing struggle over roles and missions in the Pentagon. All services were looking at further downsizing after the cold war, increasing missions, and struggling to buy expensive new weapons systems. Many airmen felt that Scales disingenuously treated the potential of airpower, even if it was his job to advocate ground-force modernization. Many claimed that he tried to wash out any attempt by the Air Force to claim greater military importance by way of the Gulf War. He was as responsible as anyone in the harsh and even nasty service posturing, but both sides argued unreasonably. In my view, the heated debate defeated efforts to develop a plan to properly modify all services in the downsizing of the post-cold-war era.

An accomplished historian with a PhD in military history from prestigious Duke University, Scales showed that, notwithstanding *Certain Victory*, he could deal with airpower in *Firepower in Limited War*.[6] Although his intention was still to describe Army ground operations—specifically, firepower in support of ground operations—he paid close attention to the planning and operations of the air war that shapes the ground battle. As might be expected, his interest in airpower corresponds to the dictum that to minimize casualties, ground commanders will employ all the firepower at their disposal—and airpower has always been a source of firepower. All service proponents agree with that in principle but disagree over application. His treatment of air support in North Africa in World War II and during the Battle of Khafji in the Gulf War illustrates that, in spite of his history background, this study misused historical knowledge and is more advocacy than evenhanded historical analysis.[7] He was, then, still dedicated to the proposition that only ground wars can be decisive, and the Gulf War had not invalidated that concept.

I am still impressed that an active-duty general, now commandant of the US Army War College, has time to publish and is willing to open himself up to the criticism that would naturally follow. Thus, when a new piece by him appeared, *America's Army in Transition*, I wanted to see if the Kosovo air war had changed his thinking. After all, the Kosovo conflict was not just airpower intensive but airpower exclusive. The title of the monograph suggested that Scales was now speaking to a new military condition, and I wondered how he would deal with airpower.

America's Army in Transition is a repackaging of two articles about changed conditions facing the Army: "Adaptive Enemies: Achieving Victory by Avoiding Defeat" and "From Korea to Kosovo: How America's Army Has Learned to Fight Limited War in the Precision Age."[8] I was pleasantly surprised to see that General Scales articulates some intelligent thoughts about airpower and even something affirmative.

Actually, a close reading will show a sea change between the two articles, even though General Scales claims they were both written in the aftermath of Kosovo. "Adaptive Enemies" represents his earlier, post–Gulf War persona wherein he serves as an advocate of the Army and pointedly ignores or denigrates the Air Force. "From Korea to Kosovo," however, seems to say, "Oh! Maybe airpower cannot be ignored in modern warfare." This change shows what I tell my Air Force advocate friends: Kosovo gave the Air Force assurance not gained after the Gulf War—that the Air Force's revolutionary ideas for modern warfare have merit to a large audience. And we don't need to run up the score by attacking any and all Army advocates who express different viewpoints about the future of airpower.

In "Adaptive Enemies," on the one hand, General Scales offers an intellectual thought piece on how groups or nations will change their tactics against America in light of our new military strengths and

weaknesses. On the other hand, if we keep in mind the history of the general's writing, we can readily see that the work is loaded, gratuitously so, as was *Certain Victory,* with an almost complete ignorance of airpower. He is an open advocate of Army ground forces and does not inject an honest depiction of what modern air can accomplish. It would have too great an effect on the scrambling in the Pentagon over service appropriations. Not once does he acknowledge the precision strike capability and associated doctrine of the Air Force.

Still, Scales does point out a real, tangible problem that the United States will face in future wars/conflicts: smaller nations and groups are not as likely to engage the United States and its allies in frontal attack but will counter our precision with dispersion, deception, and patience. He argues that these tactics represent a real counter to the superior technology upon which we depend—and he has a point. (Likewise, in "From Korea to Kosovo," he wisely advises that the United States fight limited war with limited means, not trying to quash little enemies with massive attacks, and he offers a maneuver-warfare plan with which to fight future conflicts.)

Scales appears to have great admiration for the Serbs, who turned to "patience, tenacity, guile, and ability" to counter the precision weapons of the North Atlantic Treaty Organization (NATO) coalition. He describes them as "a compelling demonstration of a thinking, creative, and adaptive opponent who can foil the best prepared plans."[9] It seems as though he was reluctant to note that their plan did not work and that NATO persevered.

General Scales uses "firepower" as the important medium to explain tenacity versus precision, and he sees the medium as a "preoccupation." I guess he might argue that we should not use firepower, and he points to some selected historic battles to illustrate how lesser forces adapted to superior firepower. For example, the Japanese, in the latter part of World War II (1944 on), learned how to hide and move quickly. This caused us great pain, but maybe it caused them even greater pain because many of them died of wounds or hunger after isolating themselves from our firepower on bypassed islands. The North Koreans learned the same lesson after the great rollback in 1951. The United States, Soviet Union, and Israel relearned the lesson in Vietnam, Afghanistan, and the Middle East, respectively. But does Scales want these more powerful nations to forgo technology? He claims, contrary to the evidence, that the inferior Iraqis adapted well to allied firepower: "The best trained Iraqi units endured several weeks of allied air bombardment with unbroken will and their combat capability essentially intact."[10] This concept is crucial to the Army understanding of the Gulf—that the "left hook" beat the Iraqis into submission and that air firepower was less important. He then explains how the US Army's VII Corps destroyed the Republican Guard divisions. (This too is precision firepower, but he doesn't play that card here.)

He finds the war in Kosovo only a continuation of the same theme. But he stresses, again, the importance of ground armies ("appearance of an infant ground presence in Kosovo in the form of the Kosovo Liberation Army") in making the air war successful.[11] Scales concludes with a few paragraphs on how the information age, as a form of advanced technology, will not be decisive in future wars. He may be right that information has a neutral effect—that everyone has capabilities. General Scales also may be right when he concludes that we must face a challenge to our preoccupation with precision strike, arguing in favor of balancing that capability with an Army role of precision maneuver: "Our future arsenal of military capabilities must include a 21st Century sword with two equally compelling edges: precision maneuver as well as precision firepower. Without these two applied in balance and harmony, future conflicts might well devolve into massive wars of attrition."[12]

But he fails to appreciate the air view—that perhaps armies are not always the targets and that they don't have to be destroyed. Scales suggests that attrition warfare is ground oriented. Not once does he give credit to a John Warden–like air doctrine. He stresses the enemy's patience but fails to recognize that troop patience will not work if the nation's heart and head are struck hard with precision weapons. The material here really is a throwback to nineteenth-century maneuver warfare.

The second article, "From Korea to Kosovo," written after digesting the lessons of Kosovo, represents a significant and important change of view. Its theme, that Kosovo "marks nothing more than another data point, albeit a dramatic one, along a clearly defined continuum of transformation by the United States," is intellectually honest and correct. It also continues the discussion about limited warfare from "Adaptive Enemies."[13]

But now Scales deals openly with the importance of airpower and the problem with massed tank warfare: "Fear of destruction in detail by precision strikes, principally from above, had already made linear, echeloned, massed armored formations an anachronism." Then he further exposes his transformation with the thought that "modern weapons technology has also raised the expectation that precision weapons can now substitute explosive killing power for manpower on the ground." Later on, he openly gives credit to the effect of airpower in the Gulf War: "The Gulf War in particular taught the value of protracted preliminary aerial bombardment to wear down and demoralize the Iraqis sufficiently to make the land campaign as casualty free as possible."[14]

General Scales emphasizes the position of the enemy ground force, whereas current Air Force thinking suggests the enemy army is not the principal target. This is, of course, good debate material. At least Scales gives airpower credit that a preemptive strike would frustrate enemy deployment and that airpower can easily target and destroy a moving

enemy ground force. He is also correct in noting that it is difficult to win a war by air alone.

What he asks is that we have a good balance between air and ground forces, a sensible idea that is both current and joint. He also notes that the Army is more interested in precision strike, providing examples from his earlier work, *Firepower in Limited War:* "Control of the air will provide the single greatest airpower advantage to American forces in the future."[15]

His conclusion reverts to ideas in the "Adaptive Enemies" article—that we have trouble with limited war and that technologies have changed battlefield dynamics, particularly in terms of the relationship between firepower and maneuver. Nonetheless, Kosovo appears to have changed his mind. Kosovo should truly strengthen Air Force confidence with ideas about airpower in modern war. General Scales in a reasoned discussion gives a lesson on how it works. Even though Scales is primarily interested in ground combat, he is ahead of the bow wave in describing a real future for limited, smaller task forces that will employ firepower from the air.

I find it gratifying, at least so far, that the heavy-handedness evident in service debate after the Gulf War seems muted by comparison in the aftermath of Kosovo. I think there is great purpose in interservice discussion and argument, and I recommend that all airmen read "From Korea to Kosovo." Scales offers some very intelligent, persuasive discussion that the war in Kosovo changed things irrevocably about the employment of airpower in warfare at the beginning of this new century.

Hopefully, neither side will resort to the hyperbole of earlier postwar commentaries. Perhaps Arnold's views have found fertile ground—that the air arm has acknowledged importance, a recognized value in a vital role. Confident in their role, air advocates will not feel the need to run up the score in their criticism of ground-force concepts. Besides, air and ground will play on the same team next time. □

Maxwell AFB, Alabama

Notes

1. Cable News Network, 7 January 2000.
2. Robert H. Scales Jr., *America's Army in Transition: Preparing for War in the Precision Age* (Carlisle Barracks, Pa.: Strategic Studies Institute, US Army War College, 1999).
3. Robert H. Scales Jr., *Certain Victory* (Washington, D.C.: Office of the Chief of Staff, US Army, 1993).
4. Ibid., 35–36.
5. Ibid., 388.
6. Robert H. Scales Jr., *Firepower in Limited War,* rev. ed. (Novato, Calif.: Presidio Press, 1995).
7. Ibid., 11–15, 257–59.
8. Maj Gen Robert H. Scales Jr., "Adaptive Enemies: Achieving Victory by Avoiding Defeat," *Joint Force Quarterly* 23 (Fall 1999) (forthcoming); and idem, "From Korea to Kosovo: How America's Army Has Learned to Fight Limited War in the Precision Age," *Armed Forces Journal International,* December 1999, 36–41.
9. Scales, *America's Army in Transition,* 5.
10. Scales, "Adaptive Enemies," 9.
11. Ibid., 10. Of course, a number of airmen have also stressed that the reason air strikes did not have the desired effect on the Serb army was that there were no friendly troops to encourage enemy-force massing.
12. Ibid., 14.
13. Scales, "From Korea to Kosovo," 17–28.
14. Ibid.
15. Scales, *Firepower in Limited War,* 290.

In military operations, time is everything.

—Duke of Wellington

Cigars, Whiskey, and Winning: Leadership Lessons from General Ulysses S. Grant by Al Kaltman. Prentice Hall Press, Paramus, New Jersey, 1998, 322 pages, $22.00.

Dr. Al Kaltman's *Cigars, Whiskey, and Winning,* a minor masterpiece of analysis, deals with Lt Gen Ulysses S. Grant's ability to advance leadership to a higher art form. Expressed as a grade, this book deserves an *A.* Kaltman makes a formidable contribution to our understanding of why General Grant was so effective in doing the right things at the right time for the right reasons. The author writes in a lively and provocative style. His treatment of Grant's leadership practices is clear, concise, and thought provoking; and he has put together a gold mine of information, commentary, and useful tools applicable to both military and civilian leaders at all levels within an organization.

Based largely on the general's autobiography, *The Personal Memoirs of U. S. Grant,* the book is organized into 11 chronological periods in the life of this towering figure. Using well-selected historic examples, each chapter is subdivided into a number of cogent lessons. Each lesson is based on a lucid account and vigorous analysis of key concepts taken from Grant's own literary composition and personal experiences. There are 250 lessons in all, each intended to get the reader to appreciate Grant, the quintessential military strategist and tactician. These lessons are soundly researched by the author and possess great value, not only as a basic reference work for the period, but as insightful, solid, and useful pieces of practical wisdom for more effective problem solving and decision making by leaders in a highly competitive world. People seriously interested in developing personal leadership potential or the leadership potential of those around them should own a copy of *Cigars, Whiskey, and Winning* and should read it again and again to see what they missed on previous readings. For these reasons and more, this book is a work of capital importance.

Learning leadership lessons from history is an excellent means of pursuing leadership development, and Kaltman's book successfully facilitates this process. History, studied in this way, gives its students an opportunity to relate hypothetically with significant figures such as Grant; more importantly, it can provide metaphors for more effectively dealing with contemporary leadership and executive issues. The strategy addressed in this book is simply to teach through historic example.

Someone once said, "There are those who make things happen, those who watch things happen, and those who wonder what happened." Ulysses S. Grant is one of those rare people who knew how to "make things happen" and did. Robert E. Lee, commander of the Army of Northern Virginia and Grant's foremost adversary in the American Civil War, said, "I doubt his superior can be found in all history." Abraham Lincoln added, "The great thing about Grant . . . is his perfect correctness and persistency of purpose."

Al Kaltman's book sends an array of clear messages to the student and practitioner of the art of leadership. The author emphasizes that Grant was a perceptive and surprisingly modern leader—a pragmatist who learned from his own and others' successes and failures. As exemplified by Grant's writings and actions, leadership is making what you believe in happen. He demonstrated that leadership is courage, determination, skill, strategy, and luck. Grant understood only too well that leadership is a lot like surgery—it's traumatic, tedious, and emotionally draining. Yet, as commander of the Union forces during the Civil War, he never failed to rise to the occasion and do his utmost in what he thought was right.

The author suggests that a large part of Grant's success was that he was sharply focused and value-based. He always asked two simple questions: What is our purpose? What is our strategy to accomplish that purpose? Grant's thinking took the form of a trilogy: Is it simple? Does it make sense? Will it work? The bottom line and the lines above and below the bottom line were, Will what we do help us to win? The author implies that Grant always seemed to know what the issues and problems

were. He had, as most great leaders do, a keen ability to deal with reality. The book indicates that as a leader, manager, and commander, Grant was unaffected by opinion. He dealt with the facts. He was undismayed by disaster and faced his work with great courage and hope. These were perhaps his greatest leadership characteristics, because all other distinguishing traits depend on them.

The book clearly makes the point that when you get under the skin of a true leader, you find true grit. Distinctly, the book suggests that Grant had strength of purpose, integrity, and the ability to make tough decisions and that he could live with the consequences. He made mistakes, but he admitted them. He refused to be intimidated, realizing that an intimidated chief can never be a great leader because one needs an independent mind to make the right decisions. Not everyone agreed with Grant, but self-confidence is a part of leadership at every level. The author also touches on other key aspects of Grant's success. In the Civil War, Grant was a fighting general, a man of action who understood that his place was where things really mattered—in the field with his men. His demonstrated qualities of decisiveness and aggressiveness served him well, and his confidence and belief in the ability and fighting spirit of his troops served him and the nation well in their hour of greatest need. His leadership enabled ordinary men to do extraordinary things in a struggle so fierce that even to this day it defies complete description.

According to Kaltman, Grant demonstrated that to be a leader, you have to know who you are, what you believe, and where you want to take people. In his chronology of Grant, the author suggests that the general constantly grew in stature. Beginning the war as simply a fighting general, Grant eventually attained the status of a grand strategist. He understood that leadership is the liberation of talent. In this connection, Kaltman maintains that Grant fully empowered his subordinate commanders and placed a high degree of trust in them. He understood that if people believe they are not trusted, they will never function at full capacity. Grant had a special ability to learn more from his failures than from his successes. As a leader, he demonstrated exceptional mental toughness, implicitly trusted his instincts, and remained goal oriented.

One is impressed at every turn with the care that has gone into this book, from its basic organization to its complete index. The 250 lessons are carefully selected and richly annotated, combining careful attention to detail with a breadth of vision that does justice to Grant the soldier and the leader. Although all the lessons cited have merit, I found the following 12 commonsensical and practical lessons particularly useful:

- Ask the right questions.
- Don't sit there; do something.
- Give no special favors.
- Know when to lead and when to follow.
- Learn from your mistakes.
- Recognize the limits of your authority.
- See the total picture.
- Trust but verify.
- Realize that we all make mistakes.
- Know that where you stand affects what you see.
- Surround yourself with good people.
- Realize that you needn't be a workaholic.

The book also contains an addendum in which the author rightfully—yet briefly, in only eight pages—examines Grant's presidency. The author acknowledges that a more in-depth treatment of Grant the president would require a separate volume. The presidency forever tarnished Grant's reputation—partly because he was a hero, and the nation expected more of him. Although there were scandals in his administration, there were also some very significant accomplishments. The author has done well in identifying a number of them, such as the passage of legislation to enforce civil rights, creation of the Department of Justice, reduction of the national debt, and return to specie-backed currency. The lessons here are that people often have expectations of their leaders that can be difficult to meet and that, often, people expect more than they have a right to. Although his record as president was certainly not equal to that of his generalship, this silent man could still point with pride to a number of significant accomplishments.

Dr. Richard I. Lester
Maxwell AFB, Alabama

Operation Deliberate Force: The UN and NATO Campaign in Bosnia by Tim Ripley. Centre for Defence and International Security Studies (CDISS) (http://www.cdiss.org), Cartmel College, Lancaster University, Lancaster LA1 4YL, United Kingdom, 360 pages, 1999.

Tim Ripley, a research associate at CDISS, covered the wars in the former Yugoslavia from 1992

to 1995 for *Jane's Intelligence Review* and *Flight International.* In the process, he published *Air War Bosnia: UN and NATO Airpower.* In *Operation Deliberate Force,* he has used his growing expertise to produce a thoroughly intimidating work on the year and events that we now recognize as pivotal in the agonizing series of conflagrations collectively referred to as the "Bosnian conflict." It is, as he says, a "snapshot" of a defining moment—not a history of the conflict.

Right up front, Ripley acknowledges that although the political maneuvers leading up to the Dayton Peace Accords are generally known through the press coverage they received, the military efforts to enable those political moves remain generally unknown. Thus, his book seeks to "redress the balance and provide an insight into the pivotal events in the autumn of 1995 from a military perspective."

He sets out to capture those key events, the ground campaigns and bombing offensives, especially in the autumn of 1995. Using first-person interviews with many of the key players, such as Ambassadors Chris Hill and Peter Galbraith; US general George Joulwan; British lieutenant general Rupert Smith, commander of UN forces inside Bosnia; French lieutenant general Bernard Janvier, commander of UN forces in the former Yugoslavia; and US lieutenant general Mike Ryan, he re-creates the failed American effort to arm the Muslims, the horrible bombing of Pale, the British/Serb showdown at Gorazde, the massacres at Srebrenica, US involvement in the Croats' Operation Storm, the development of the NATO bombing plan, and the deadly mortar attack on Sarajevo that triggered Operation Deliberate Force.

Ripley then walks us through that air campaign as preparation for the Dayton Peace Accords. It is not a pretty story. Nor is it easy to follow. That is not the author's fault—just the reality of the conflict. To most Americans, this subject is little understood and thoroughly intimidating. The acronyms alone are mind numbing. Regardless, Ripley has made a superior effort to capture this history. His legwork is awesome, and it shows in the detail of the work. At the end, his list of all the people he talked to is a "who's who" of the conflict—with one exception. Many people from the "other side" have yet to be heard from. Ripley notes that omission in his work and does acknowledge that if they do ever speak out, it may alter the history—an honest statement.

My one criticism is that I did not find his maps very useful. They seemed to lack an overall orientation. To me, clear and well laid out maps are an absolute necessity in military writing.

All in all, however, *Operation Deliberate Force* is a serious and impressive piece of work on a very difficult and confusing subject. I recommend it to anyone who wants to have a deeper understanding of the conflict we blithely label "Bosnia."

Col Darrel Whitcomb, USAFR, Retired
Fairfax, Virginia

Proud Legions: A Novel of America's Next War by John Antal. Presidio Press (http://www.presidiopress.com), 505-B San Marin Drive, Suite 300, Novato, California 94945-1340, 1999, 368 pages, $24.95.

As an airman who has wrestled with the complexities of warfare as a B-52 navigator, as a student at Air Command and Staff College and at the School of Advanced Airpower Studies, on the Air Staff, in senior service school, in command, and now on the Joint Staff, I knew that a gaping hole existed when it came to understanding how the US Army fights. In fact, there was a time when I understood the Russian army better than the US Army. I've studied AirLand Battle, I've studied Army doctrine, and I've pored over joint doctrine; but truly understanding the Army has come slowly—until now.

Proud Legions offers the layman the unique opportunity to fight the Korean War from a very personal perspective—that of an armored battalion. Presented with a series of serious combat situations, the commander of a stranded US Army armor battalion examines his circumstances, develops a plan, and then executes his plan against a numerically superior force charged with all the élan that the powerful propaganda machine of North Korea can generate. As either a study in leadership or in armored tactics, this novel offers the airman an opportunity to help the commander on the ground decide the next course of action. Worried about commander's intent and what it means? John Antal walks you through the thought process. How about developing objectives? They are there as well. Executing a maneuver to end-run an opponent? Here's a blueprint. In short, *Proud Legions* includes the basics of armored warfare in a readable, enjoyable format that even a navigator can understand.

Yet, this is not a work to be taken lightly. Within the armor community, Antal's book is swiftly becoming a handbook for success. Its message is so important that it has already been translated into Japanese, which means that our South Korean allies and North Korean foes will read it as well.

The message for airmen is equally important. We must be able to fight in a combined-arms environment. In that respect, this book will help.

Some aspects of *Proud Legions* warrant criticism. It's hardly believable that the armored officer will get the girl. It is equally unbelievable that airpower is generally unable to contribute during the early stages of a North Korean offensive. However, in light of the fact that the book seeks to articulate the vital importance of armored forces in combat, we can easily forgive such shortcomings. *Proud Legions* is fast-paced, so it's hard to put down once you've started it. After it comes out in paperback—and that will be soon—I highly recommend that you buy a copy and read it.

Lt Col George R. Gagnon, USAF
Washington, D.C.

Black Soldier, White Army: The 24th Infantry Regiment in Korea by William Bowers, William Hammond, and George MacGarrigle. Center of Military History, United States Army, Washington, D.C. 20005-3402, 1996, 294 pages, $26.00.

Black Soldier, White Army should be known to anyone concerned with or interested in race relations in the US military. It is an excellent case study that explores the impact of segregation and prejudice on a military unit and on combat performance. It is an important book but not a pleasant or uplifting one.

Although President Harry Truman ordered the US military to desegregate in 1948, the US Army fought the first half of the Korean War with segregated forces. (The Navy and the Marine Corps were also laggards in this regard, while the Air Force did considerably better.) The principal segregated Army unit employed in the Korean War was the 24th Infantry Regiment in the Army's 25th Division. It consisted entirely of black enlisted troops with both black and white officers. (All of the unit's commanders were white since Army policy would not allow a black officer to command a white officer.) The kindest and least controversial thing to say is that the 24th did not do well in action, and the unit's alleged failings led to its dissolution in October 1951. The regiment's combat record and the causes of this performance are all very much in dispute. Because of these questions and a critical Army history of 1961 that some have called grossly inaccurate, racist, and a public lynching, veterans and supporters of the unit urged the Army to reassess the regiment's record. The result of that nine-year effort is *Black Soldier, White Army,* which also proved controversial and, under threat of lawsuits, was reviewed at the highest level of the Department of the Army before publication.

Black Soldier, White Army begins with an introductory chapter that covers the service of black troops in the US Army up through World War II. Using extensive interviews and official documents, the authors discuss the 24th Infantry's occupation service in Japan in the 1940s and then focus on the unit's operations in the Korean War, until it was disbanded. They are critical of the unit's preparations for war and brutally candid about the racism present in the unit and the US Army, as well as the 24th's deficiencies. In battle, the regiment became known as unreliable, prone to panic, and the weakest of all US Army units in Korea. The reality, however, was much more complex and ambiguous. Clearly, the unit performed poorly, but so did other units early in the war. The authors also note the numerous acts of unit and individual achievement and courage in the 24th (including two Medals of Honor won by black enlisted soldiers).

The authors produce a detailed, balanced, abundantly documented, and critical study. As should be expected in a history on a very sensitive and complicated subject, particularly by official historians, they are very circumspect with both their language and conclusions. One can summarize their monograph in one sentence: the unit did worse than other regiments primarily because of a lack of unit cohesion due to long-standing racism and inadequate leadership.

Because of the controversy and sensitivity of this subject, *Black Soldier, White Army* has gained more attention than most historical studies. It has been and will be criticized, on the one hand as too sympathetic (politically correct) and on the other as unfairly critical. I would only question the heavy reliance on oral interviews, especially those done so many years after the events, when time has dimmed memories and radically changed the social climate. That said, I recognize that there is probably no way other than interviews to get at what happened and why it happened. Another possible criticism is that this study should have more vigorously compared the 24th's performance

with that of other regiments fighting in similar circumstances. The comparative performance of the 24th with other segregated US infantry units (3d Battalion, 9th Infantry; and 3d Battalion, 15th Infantry) would also have been relevant to this study. That said, I question if the unit's record could be more accurately appraised even if more facts could be gathered. In any case, the underlying factors responsible for this performance are more difficult—perhaps impossible—to assess. In short, I don't see how this subject could have been covered much better.

Critics accuse the military, military historians, and official historians of producing tepid, self-serving histories that glorify and romanticize war and the military. This well-done study certainly refutes such allegations. Thus, the Army and its historical branch deserve high praise. *Black Soldier, White Army* indicates how far the military has come in 50 years and makes clear that the "good old days" were not so good for all. Most of all, it highlights the consequences of both an unprepared military as well as a segregated military on combat performance.

Kenneth P. Werrell
Maxwell AFB, Alabama

Air Power in the Age of Total War by John Buckley. Indiana University Press, 601 N. Morton Street, Bloomington, Indiana 47404-3797, 1999, 260 pages, $19.95.

The first thing that will strike many readers about this work is the title. Since the Aeronautical Division of the US Army Signal Corps was established in 1907, it seems intuitive that airpower has always existed in the "age of total war." After reading John Buckley's incisive look into the industrial, scientific, operational, strategic, and even moral facets of airpower from its inception until present day, one will have a better understanding of the title and will have enjoyed achieving it.

Buckley's thesis is as follows: "To wage total war, air power was by far the most useful yardstick, as only a few [nations] were able to meet the challenge of fusing technical know-how with mass production" (p. 168). Only Western powers could meet this ability in the First World War and only the United States, the Soviet Union, and perhaps Britain during and after the Second. Today, Buckley suggests that such a capability "now rests only with the major powers, and possibly only with the United States" (p. 202). Although he rejects the temptation to lapse into blind "Douhetism," Buckley strongly supports the notion that combined industrial, scientific, and war-fighting advantages of the Allies won the air wars in the Atlantic and the Pacific. Further, he understands how these "strategic" campaigns eventually wore down the Japanese and Germans, destroying their air forces and ensuring their eventual defeat.

What is appealing about Buckley's thinking is that he does not, at any time, fall into the sort of shallow thinking which suggests that airpower must always be the correct tool. He rightly points out that tactical (read conventional) airpower has rarely been decisive since 1945. He cites as examples the inviting targets the Iraqi command presented in the desert and the Israeli experience in 1967 (and to a far lesser degree in 1973). Compared to the numerous instances of major powers being unable or politically unwilling to utilize airpower to its maximum in limited situations, these achievements do appear nearly singular in nature. Buckley suggests that the reason for the decline of the importance of airpower is that "air forces, by their very nature, can have only a limited impact in less than full scale war" (p. 216). He boldly asserts that this is a crucial concept because airpower, "born in the Great War, . . . played a crucial and arguably pivotal role in World War II, [and] is now a phenomenon of the past." To continue airpower as a method of total war would take far more economic, technological, and political resources than any nation would be likely to employ. Although it would be interesting to hear Professor Buckley's explanation of the recent air campaign in the Balkans, it is still possible to imagine a time when the substantial (and sharply increasing) costs of new aircraft systems could mean that even the United States struggles to field forces which could conduct "total war." Professor Buckley's suggestion that "air power and total war were linked as both causes and consequences of each other" (p. 222), thereby shaping the course of warfare in the twentieth century, is worthy of consideration by all of us interested in the historical and conceptual framework of our profession.

Capt Todd Laughman, USAF
Dulles, Virginia

American Airpower Strategy in Korea, 1950–1953 by Conrad Crane. University Press of Kansas, 2501 West 15th Street, Lawrence, Kansas 66049-3905, 1999, 252 pages, $35.00.

With the upcoming 50th anniversary of the Korean War almost upon us, we can expect an on-

slaught of books on that conflict. Those on the air war will inevitably be compared with Frank Futrell's *The United States Air Force in Korea, 1950–1953,* which is correctly considered the best on the subject. To quickly dispose of that comparison, Crane's effort is shorter, better written, narrower, and of course, more up-to-date. In my view, *American Airpower Strategy in Korea* will join Futrell's book as a standard work on the subject of airpower in the Korean War.

Like Crane's previous book on strategic airpower in World War II—*Bombs, Cities, and Civilians—American Airpower Strategy in Korea* is a thoroughly researched and very thoughtful book. Crane makes excellent use of many American archives as well as an impressive amount of secondary material. It is a well-written, tightly argued, and up-to-date scholarly treatment of the subject. Balance is one of its strong points. When Crane deals with the tactical level, unlike authors of other Korean War histories, he devotes relatively less attention to the glory of the F-86 and air-to-air combat, and proportionally more to the less well known activities of the slogging B-29s, as well as the effective F-51s and F-80s. He also does exceptionally well with the neglected B-26s. To maintain a tight focus, for the most part Crane concentrates on the headquarters level, although he does add some interesting tactical details that seldom if ever appear in secondary works. These include such tidbits as US efforts to salvage a MiG downed behind communist lines, guided weapons, and such innovative weapons as tetrahedral tacks and steel darts (flechettes). I would also highly praise the author for his informative, balanced, and most interesting treatment of American top leadership. He not only gives the reader interesting insights on Truman and MacArthur but also on the Joint Chiefs of Staff and the commanders in the field. Finally, Crane's citations and bibliography will greatly assist anyone interested in this subject. These by themselves commend *American Airpower Strategy in Korea.* But there is more—far more.

Crane does exceptionally well with three significant topics. The chapter entitled "Manning and Inspiring the Force" is an excellent extension into the Korean War of the pioneering work done by Mark Wells *(Courage and Air Warfare)* on World War II flying morale, psychology, and personnel management policies. Crane deals with the issues of recalling reservists for flying duties and spreading the inconvenience and the risk of aerial combat in a limited war. (The present problem of retention of military aviators in the force is, of course, related.) His discussion of the proposed American use of nuclear weapons is also excellent and eye-opening. Although this topic is dispersed throughout the book, the author does an excellent job with it, especially with putting it into context. Crane shows that the use of nuclear weapons was discussed frequently during the war, both in Korea and Washington, and details the arguments made for and against their employment. He also does a superior job of dealing with the controversy over communist allegations of US use of germ warfare.

I have no criticism of this book worthy of mention. I would anticipate, however, that some may not like Crane's vantage point and may long for more tactical detail. But this was not Crane's explicit intent and is for other writers. The author delivers on what he intended to do and does it in a superlative manner. *American Airpower Strategy in Korea* is an important book—one that is must reading not only for students of the Korean War but also those interested in airpower application in a limited war. Both the author and University Press of Kansas are to be highly complimented for producing this outstanding work.

Kenneth P. Werrell
Maxwell AFB, Alabama

The U.S. Air Force in Space: 1945 to the Twenty-First Century: Proceedings, Air Force Historical Foundation Symposium, Andrews AFB, Maryland, September 21–22, 1995 edited by R. Cargill Hall and Jacob Neufeld. Air Force History and Museums Program, 200 McChord Street, Box 94, Bolling AFB, Washington, D.C. 20332-1111, 1998, 195 pages.

It is a rare event when a symposium on space can bring together a number of "founders" and distinguished Air Force historians. Organizers of the 1995 Air Force Historical Foundation Symposium are to be complimented on the fine lineup they assembled and on the excellent quality of the topics covered in this volume.

As is true of any proceeding or edited collection of essays, one inevitably finds a qualitative difference among the individual parts. In this work, the difference tends to be greater than usual because some of the entries are scholastic papers and some are close to the "there I was" genre of reminiscing. Although one notes some overlap in the essays, especially those dealing with the Air Force's early space history, the editors have succeeded in fitting

the various parts together well. Overviews of each section are especially useful in smoothing out the narrative flow.

The book consists of three basic parts: a reexamination of the formative years (1945–61) of Air Force space activities, a review of mission development since 1961, and a look at what the current Air Force issues are and where we may be heading in the future. Several of the topics deserve a closer look.

The review of efforts to develop an Air Force operational organization for space by Brig Gen Earl S. Van Inwegen, USAF, Retired, may deserve the most consideration from current space operators. It has long been understood that the research and development roots of the Air Force's space efforts made control of the deployed systems haphazard at times. Attempts to form a specified Air Force command were long and arduous due to interservice rivalry and a lack of understanding in the Air Force over which structure would best suit an operational space force. General Van Inwegen's comments about the establishment of Air Force Space Command bring these problems—and the solution—into clearer focus.

Donald Baucom's look at the interplay of technology and strategy from 1957 to 1961 is also interesting. In unusually blunt language, Baucom develops a theory that during this period the Soviet Union and the United States were engaged in a technological war—one in which space was perhaps the major battleground. Surprisingly, Baucom states that the Soviets understood the excellence of our joint military/civilian space programs, and it "created in [them] a kind of inferiority complex."

Other essays of note include Gen Bernard Schriever's reflections on military space activity, Adam Gruen's review of the utility of manned versus unmanned space missions, and Gen Donald Kutyna's overview of space systems in the Persian Gulf War. All have something to offer, as does this volume. Anyone interested in the history of the Air Force in space should read this work.

Capt Todd Laughman, USAF
Dulles, Virginia

Fast Tanks and Heavy Bombers: Innovation in the U.S. Army, 1917–1945 by David E. Johnson. Cornell University Press, 512 East State Street, Ithaca, New York 14850, 1998, 229 pages, $37.50.

Readers can be excused for questioning a book that combines a doctrinal discussion of two weapon systems that seem to have little in common. There is much of an "apples and oranges" atmosphere about this book. After all, tanks were seen as tactical weapons to be used on the battlefield, whereas heavy bombers were viewed as strategic weapons best used far beyond the battlefield. In numbers produced and importance to the World War II effort, the airplane dwarfed the tank. So why does Johnson throw these two seemingly disparate machines together? The author is attempting to address the traditional charge that the US Army was woefully unprepared for modern war in 1941, as evidenced by shortcomings in tank and airpower doctrine and equipment. He admits this was the case but rejects theories that focus on the inherent conservatism of peacetime armies or of external factors such as the Great Depression or American isolationism. Instead, he argues that "internal barriers to change and the myopic vision of single-issue constituencies contributed significantly to the Army's unpreparedness for World War II" (p. 2). Johnson argues that Army doctrine and equipment were inadequate due to the parochialism and selfishness that were rife throughout the Army. There are several problems with this thesis.

First, although Johnson makes it abundantly clear that the US Army did indeed fight all of World War II without a suitable tank, he shows no such comprehensive failure regarding airpower. Concerning air bombardment, he correctly observes that the need for a fighter escort was a major oversight. However, he fails to note how quickly that oversight was overcome. Disastrous bombing missions in October 1943 convinced American airmen they needed fighter escort. Yet, in February 1944, a scant four months later, this problem was solved, and air superiority was achieved over Europe. All "failures" should be so quickly remedied!

Moreover, the author compounds his error by then chastising air doctrine for being insufficiently attuned to the needs of the ground troops. To support this assertion, he offers the example of the heavy bombers of the Eighth Air Force that were used to carpet bomb German positions in front of Omar Bradley's 12th Army Group at Saint-Lô. When this mission was carried out, however, several hundred American troops were killed by short bombs. Johnson sees this episode as a failure of American tactical air doctrine. This is a baffling example and interpretation. Airmen never maintained that the use of heavy bombers in such a tactical role was wise; they flew the operation because the ground commander earnestly requested that

they do so. Nonetheless, despite the bombing accidents, the air operation was still considered an outstanding success by the Army—breakout was achieved.

More importantly, the author totally fails to mention the enormous effort the Army Air Forces put into tactical air support. The Ninth and Twelfth Air Forces—larger than the entire Luftwaffe—were specifically designated to support Allied army groups. In this, they were outstandingly successful. Yet, we never hear of Hoyt Vandenberg, "Opie" Weyland, or Joe Cannon, and only briefly of Pete Quesada; nor do we hear how George Patton relied on Weyland's XIX Fighter Command to serve as his right flank on his drive across France. In truth, the American air-ground team was far superior to its German counterpart.

Finally, it is surprising that the author does not draw the obvious conclusion from his own evidence regarding the importance of leadership in the Army's problems—both bad and good. He notes, for example, that until the very end of the war, neither Dwight Eisenhower nor George Marshall was aware of how inferior our Sherman tanks were compared to the German Panthers and Tigers. They did not even know how vilified the Shermans were by their own tank crews. How is such an incredible oversight possible? It would seem that the failure of Army leaders to understand what was going on in their own units had a far greater impact on American tank doctrine and equipment failures than did intraservice parochialism before the war. Similarly, although the author notes that even modest tank reform would have been impossible without the adamant advocacy of the Army G-3 in the late 1930s, he fails to grasp the significance of this fact. The Army G-3 was Maj Gen Frank Andrews, an airman with broad and original ideas on future war. On the other hand, the man largely responsible for thwarting Andrews over tanks, but who also rejected Air Corps plans to build the revolutionary new B-17, was Gen Malin Craig, the Army chief of staff. Leadership seems to have enormous consequences in this story, but the subject is not pursued.

Overall, this is an interesting if flawed book. Readers will be especially dumbfounded by the numerous examples given of cavalry officers who abjectly refused to acknowledge the limitations of the horse, even after the outbreak of the war in Europe in 1939.

Col Phillip S. Meilinger, USAF
Newport, Rhode Island

War and the World: Military Power and the Fate of Continents, 1450–2000 by Jeremy Black. Yale University Press, P. O. Box 209040, New Haven, Connecticut 06520-9040, 1998, 334 pages, $35.00.

This book is designed to be a college textbook, but its style, ease of reading, and global perspective make it a remarkable book in a field which is flooded by new texts each year. It provides essential information about battles that most will know from European and American history, but it also seeks to open new horizons by showing that other powers such as China, Japan, and native armies in the Americas and the Indian subcontinent played an important part in molding the concept and conduct of war. In contrast to other books that have focused on global military developments using technology as the driving force, this book looks at social and political developments to show how societies have adapted to the ultimate challenge of war. As Spain, Portugal, Holland, and then Britain moved to create commercial empires, Black is able to show the role of maritime and firearms technology in abetting European overseas expansion. Ottoman battles in North Africa are featured in this text as are Chinese maritime operations around Sri Lanka. The reader is struck by how familiar these operations are, even when conducted by another power three thousand miles away from the previous occurrence in history.

Changes in defensive firepower by infantry are detailed, as is the importance of close combat fighting in Africa, Asia, and the Americas, even after the introduction of European rifles. The use of fortresses to control native populations is a recurring theme in the book, as is the need for governments to adapt to new political systems if wars are to be successful. The book touches on air warfare only after World War I; thus its primary focus remains on land and naval power. Black also takes issue with long-held views of European dominance in war fighting and global abilities by examining every conflict in this single volume, an accomplishment which makes this a useful background text for any military historian. Post-1945 colonial struggles and modern Russian counterinsurgency operations are all described so that the book is comprehensive until 1998. Modern arms trade, limits in technology, and nuclear weaponry are all covered.

The final chapter, the "Look Ahead," will strike familiar themes; resource wars such as the British-Icelandic Cod War and population and consumption issues will move into the forefront during the next century as the world population expands without bounds. China, if it is indeed to be a long-term player, must find a new economic and political balance unless it intends to take a Genghis Khan path that will elicit a counterhegemonic response from the other world powers. Technological advances in terrorism, a topic rarely seen in history books, has shown Israel and India their limitations when their forces tried to intervene in Lebanon and Sri Lanka.

The world is thus faced with rival ideas for order—the nationalistic one known to mankind since 1450 and a global one led by the United Nations that has yet to emerge from the post-cold-war era. According to the author, the strife could set off a new round of war as nations seek order, stability, and wealth. While certain phases of past conflicts will not be repeated, globalism is a theme that was around when Britain conquered the French, Spanish, and Dutch colonial empires, giving it a market share and a dominance other nations would like to have in the twenty-first century.

This is a history book that provides excellent background, is concise and filled with a wealth of details, and serves as an excellent reference work for the military historian. Black's arguments with existing scholarship are well laid out and do not detract from this text. They provide a new starting point from which to examine current military history classes at the academic level.

Capt Gilles Van Nederveen, USAF
Maxwell AFB, Alabama

Rolling Thunder: Jet Combat from World War II to the Gulf War by Ivan Rendall. Free Press, 866 Third Avenue, New York, New York 10022, 1997, 336 pages, $26.00.

Pilots are good; high technology is great; graduated application of airpower is a cardinal sin; and the Israeli air force is worthy of worship—that is the song of Ivan Rendall in *Rolling Thunder.*

Rendall is British, and the book jacket claims that he has served in the Royal Air Force (RAF). Some of the reviewers say that he served as a pilot in the RAF, but one suspects they have escalated that some. It seems to me that the naive attitudes in the book are highly untypical of professional flyers, though not of television producers (Rendall's present occupation). In fact, the book shows strong signs of having been spun off from the script of a television series of which he was the producer. Certainly, he has wide interests. His other titles include *Ayrton Senna: A Tribute* (to a racing car driver); *The Checkered Flag: 100 Years of Motor Racing; Flyers: The Spirit of Kitty Hawk;* and *The Power and the Glory: A Century of Motor Racing.*

Rolling Thunder is a bad title for an American book because the work covers much more than the Vietnam War, and that title yields a false impression of its scope—the subtitle would have been better. There is little or nothing that is new in the tale. Jet combat has been a favored topic for the last half century and is well covered in many other works. The current one is so full of technical mistakes that its credibility is undermined. Atop that, the editing is slipshod, and one wonders why a respectable house like Free Press was persuaded to let it appear under its auspices.

It would take another book to cover all the factual errors, but the following illustrate the point: identifying the C-135 with the Boeing 707; saying that the weapons load for the F-117 includes Mavericks and high-speed antiradiation missiles (HARM); asserting that the Implementation Force growing out the Dayton Accords included 60,000 US troops; and asserting that the GBU-28 is stuffed with forty-seven hundred pounds of explosive. The C-135 is significantly smaller than the 707, although they are similar; the F-117 is not among the airplanes qualified to deliver Mavericks or HARMs; the entire Implementation Force contained 60,000 troops, and the US contribution was only a fraction of that number; and the GBU-28 contains only six hundred pounds of Tritonal.

Worse than all that, the work is undocumented, and it becomes a mind-numbing series of anecdotes without much thought to airpower in its larger sense. The name of about every fighter ace since Manfred von Richthofen is mentioned, but the Gulf War is described in some detail without any mention of the work of Col John Warden or Gen Charles Horner. Too, Rendall seems to know nothing of the plans that were guiding the application of the coalition's airpower. His focus is largely at the lower end of the operational and technical spectrum, and there is much more to airpower than that. Finally, his attitude is so in tune

with that of people who lament the political control of airpower that it suggests the German stab-in-the-back myth in the period right after World War I. Lyndon Johnson *had* to worry about starting World War III, and it was the duty of airmen to carry out the commander in chief's direction (or resign their commissions). And some people think that gradualism worked in the Cuban missile crisis and in Kosovo—Thomas Schelling makes a plausible case for it.

Samples of the slipshod editing include the following: using the acronym *IAF* to describe both the Israeli and Iraqi air forces; employing *between* when *among* would be correct; missing the correct date when the Soviets closed off surface traffic with the Berlin blockade; using the word *aggression* when *aggressiveness* is meant; misspelling Gen Matthew Ridgway's name every time it is used; and permitting 68-word sentences. That is only the tip of the iceberg.

Dr. Kenneth Werrell knows a good deal more about airpower (he *was* a pilot) than Rendall seems to. Werrell reviewed *Rolling Thunder* in another journal and did not recommend it—proposing as an alternative Lon Nordeen's *Air Warfare in the Missile Age* (ironically, Rendall does cite another book by Nordeen in his bibliography but even manages to misspell the author's name there). I second Werrell and suggest most strongly that serving air warriors/scholars conserve their precious professional reading time for better tomes. David C. Isby's *Fighter Combat in the Jet Age* is in a different format—almost like a reference book—but it covers the same ground and does so much more authoritatively than does *Rolling Thunder*. The tragedy (presuming that the thrust of the television series resembles that of the book) is that television producers have a much wider influence than do the Werrells of the world.

Dr. David R. Mets
Maxwell AFB, Alabama

The Korean War: No Victors, No Vanquished by Stanley Sandler. University Press of Kentucky, 663 South Limestone Street, Lexington, Kentucky 40508-4008, 1999, 330 pages, $19.00.

Stanley Sandler, currently a visiting professor at Virginia Military Institute, is an experienced and well-published military historian who for many years was an Army historian with Special Operations Command. His book *The Korean War* is a straightforward, traditional military history of that conflict, complete with endnotes (six pages) and an extensive bibliography (33 pages). The first half of the book is a narrative of the war; the second half is a topical treatment that covers a number of key topics. These include air and naval wars, prisoners of war, guerrilla warfare, medical aspects, civil action, diplomacy, home fronts, and integration of the US military.

This is a fine, concise, balanced, detailed, and critical treatment of the subject. The subtitle reflects the author's overall conclusions and establishes his low-key, evenhanded approach to the subject. (Sandler chooses his words carefully as he makes it clear that the true losers of the war were the Koreans.) The author clearly points out what the deficiencies of US forces were at the beginning of the war and how they were outfought in the early months of the war by the well-disciplined, more experienced, and at times outnumbered North Korean forces. He is equally candid about the massive American defeat at the hands of the Chinese in late 1950 and early 1951, surely one of the worst military defeats ever dealt US forces. Sandler writes of American disdain for both Korea and the Koreans and is more positive about the South Korean military effort than authors of other secondary sources. Compared to other histories of the war, *The Korean War* is one of the more—if not the most—critical and opinionated. To a large degree, this makes for an interesting book.

I was most impressed by Sandler's command of recent scholarship. This familiarity, combined with his sharp reading of the existing material, allows him to present a number of observations not previously mentioned by authors of similar overviews of the war. For example, he makes excellent use of a variety of sources, including Russian material, to note Soviet participation in the air war. He also discusses the very controversial conduct of the segregated 24th Infantry Regiment with fairness and candor, as well as the recent and likewise controversial Army history of that unit. As a result, he presents an up-to-date, solid account. The sizable bibliography is very useful.

As with all published works, there are weaknesses and flaws. First, the six maps, although more abundant than in most similar works, fall short because they do not show a number of the place-names mentioned in the text. Second, Sandler includes endnotes, but on occasion too few of them. For example, he mentions evidence of captured Air Force pilots being taken to the Soviet Union and not being returned (p, 188). In the next sentence, he writes that of 56 F-86 pilots who

fell into Communist hands, the fate of 30 remains unknown, implying that more should have survived the war. Because this topic is very provocative and controversial, it deserves further discussion and most certainly demands documentation. There are, however, no citations for either sentence. Of course, Sandler may be correct, but without citations there is no way of quickly checking his sources. (Using the bibliography, I uncovered the source of this material but did not find it convincing.)

That being said, *The Korean War* is an excellent book—in my view the best short history available on the Korean War. It fulfills all the reasonable requirements for a text in an outstanding manner and clearly outperforms similar efforts. Therefore, I strongly and unreservedly recommend it for adoption for any military history course on the Korean War, as well as for use by anyone who wants a short, up-to-date, broad, readable treatment of the war. Two thumbs up.

Kenneth P. Werrell
Maxwell AFB, Alabama

Lemnitzer: A Soldier for His Time by L. James Binder. Brassey's, 22883 Quicksilver Drive, No. 100, Dulles, Virginia 20166, 1997, 386 pages, $32.95.

Lyman Lemnitzer (1899–1988) served in uniform for more than half a century. A member of the West Point class of 1920, he was 15 years a lieutenant; however, he wore stars for 27. During Lemnitzer's career, the Army moved from mules to missiles, from a minuscule defense force to the cold war's finest, and one not yet crumpled by the Vietnam experience when Lemnitzer retired in 1969.

Lemnitzer left West Point for an Army in decline, and his first 15 years were characterized by this Army's shrinkage. With the armistice, the officer corps plummeted from two hundred thousand to 19,000; and the decline continued until the mid-30s in cost-conscious, defense-oriented, isolationist America. Even Lemnitzer's choice of branch couldn't move him up when there was no place to go. Lemnitzer chose the Coast Artillery, traditionally the plum in Fortress America but already a dying branch.

Lemnitzer showed little promise in his early career. His evaluations were okay but not dazzling. Then at Corregidor, Col Stanley Embick recognized something special in Lemnitzer, upgraded his evaluation, and set the young lieutenant on an upward path. Lemnitzer's performance also improved. By 1943, he was a two-star general on Field Marshal H. L. Alexander's staff. And he got brief combat commands in Italy and later in Korea. He eventually rose to the position of Army chief of staff, then chairman of the Joint Chiefs of Staff. He held responsible positions during the Bay of Pigs and early in Vietnam. He finished as supreme allied commander, Europe, during the presidency of Lyndon Johnson. After retiring from active service, he became a stump speaker for a strong national defense. His was a four-star performance, although it had no blazing guns, no triumphant returns or massed landings, and no political outbursts. Lemnitzer was a planner, a staff officer without peer. No wonder he's the most obscure four-star general in American history.

All biographers run the risk that the record will write their book for them. Binder has fallen into this trap. Drawing heavily on the Lemnitzer archives, Binder re-creates the person those archives contain. He draws often from officer evaluations, which even then consisted of stock phrases more than insights into character. He uses an abundance of Lemnitzer anecdotes, including a couple of jokes, and Binder is up front in noting that Lemnitzer's views are obscure except on military issues. Binder traces the career, but wider research might have helped him develop the man and his times better. He has produced a public biography that is short on explanation of the how and why of Lyman Lemnitzer.

Lemnitzer got into some controversial situations (even if we don't know exactly what he did or what he thought). Binder appears to supplement the Lemnitzer archives by finding a book, any book, to plug the gaps. That's bad technique: pick the wrong book, get the wrong story. For instance, Binder's treatment of the Italian surrender overlooks Lemnitzer's involvement in a questionable deal to protect prominent Nazis from war crimes prosecution. Had Binder read more widely, he might have developed a different assessment of Lemnitzer's character. Perhaps not. At least he would have been better able to create the context that is so vital to any biography.

That said, biography is extremely difficult. Binder has written a good career biography, and

the general would probably approve. However, because Lemnitzer was not flashy, this will undoubtedly be the biography that defines him for posterity. It's less than it might have been if Binder had identified the traits that attract sponsorship and had Binder placed Lemnitzer more reliably within his times. It's worth reading for what it says about getting a sponsor early on and having all the right entries on the resumé.

Dr. John H. Barnhill
Oklahoma City, Oklahoma

The Military and Conflict between Cultures: Soldiers at the Interface edited by James C. Bradford. Texas A&M University Press, Drawer C, College Station, Texas 77843-4354, 1997, 233 pages, $37.95.

The overarching theme of this edited collection of eight articles concerns Western military forces in conflict with the indigenous forces of non-Western societies. The work is divided along several subordinate themes that include two articles on the premodern era, three on Western forces and indigenous peoples, two on the impact of twentieth-century cultural perceptions, and one article on concluding reflections. Virtually all the articles are interesting for the points they explicitly and implicitly develop. My principal complaint is that the reader's ability to follow the arguments of the various authors is hindered by the distracting lack of maps, forcing one to try to conjure up some geography or sending him or her flipping through an atlas.

The premodern era of warfare is discussed in two articles. The first is by John Guilmartin and concerns the development, impact, and limitations of light troops in classical armies, while the second, by Dennis Showalter, concerns the impact of gunpowder on regional military systems. As a sociologist interested in type constructions and model building, I found Guilmartin's presentation of a tetrahedron model of combat effectiveness quite interesting. I was particularly struck by the discussion concerning mounted archery, cavalry, and shock troops in the classical age and their limited effectiveness due to the lack of the invention of the stirrup. I would have thought that it would have been a fairly quick invention after the initial use of horses for warfare or even for simple transportation. Apparently, inventions are only obvious after their development.

Showalter's article definitely needs subheadings and a map or two. Basically he examines the idea that in the late Middle Ages, Europe began to develop regional military systems based on a building-block approach, which was determined by what kinds of units (archers, pikemen, etc.) could be secured. In turn, these various types of units were organized along lines of family, clan, guild, and so forth. Organizational structure was often tailored to engender the optimal loyalty and efficiency from this medieval "plug and play" capability. The implication is that there are historical lessons of value for modern international force construction.

Three contributions concern Western conquest of the new world: two concern the cultural confrontations between native North American tribes and the cavalry forces of the post-Civil-War Army, while a third examines the Spanish experience in Argentina. Here, too, several maps would have been very helpful. It was here that I found myself reading the article on Argentina with an atlas at my side.

The principal theoretical conclusion of Robert Utley's piece, "Cultural Clash on the Western North American Frontier," was that at the microlevel the native American forces were more successful when they practiced traditional methods of warfare based on mobility, expertise, and speed. The United States did better when it modified organizational structure and process so as to match the enemy, but this was often difficult because of the careers at stake in the military bureaucracy. At the macro social level, demographic forces of population, migration, and industrialization were becoming so overwhelming that the Indian wars became a sideshow.

John Bailey's article concerns the attitudes of the US generals commanding the efforts on the Western frontier. He postulates two basic types: glory seekers and humanitarians. Certainly it cannot be a coincidence that one type succeeded the other. In the latter stages of the Indian wars, it was obvious who was going to win; thus, the generals could afford to be the "humanitarian" type.

Richard Slatta affords readers an interesting article about Spanish conquest on the Argentine frontier. He notes that strategy moved from defense to offense over the three-hundred-year period in ques-

tion. It is a study in miserable civil/military relations and military disorganization. Some interesting points concerned how the manpower shortage that impeded the development of successful campaigns was exacerbated by the negative quality of service life and the class conflict among the settlers. Also, the political, economic, and demographic forces and factors constituted the landscape upon which the general strategy against the native populations floundered. These included civil war with Spain, internal civil conflict among the provinces of Argentina, and the war with Paraguay. Finally, as in North America, it was the cumulative and overwhelming nature of technological change that determined the victor. It was the development of (1) the telegraph and railroad system, which provided communications and mobility, and (2) the introduction of Remington rifle firepower that finally defeated the native population.

Two articles concerning French military/colonial involvement in North Africa and the US effort in the Philippines cover the twentieth-century perspective. The first, by Douglas Porch, "French Colonial Forces on the Saharan Rim," is a lengthy discussion of the disparity between the theory and practice of colonial war. Here again we see the familiar tale: agile indigenous forces initially outmaneuvering the conventional forces of the West. According to Porch, the French answer was a scorched-earth policy, which created a consequence of negative public opinion at home. The response by the generals was the marketing of a theoretical proposition that included a heavy "civilizing mission" component. Yet, more important global factors involved the notion of the colonial race among the great Western powers; the modern-day parallel may be the race for nuclear capability among second-tier nation-states.

The second, Carol Petillo's article, "Leaders and Followers: A Half Century of the U.S. Military in the Philippine Islands," offers a type construction of five characteristics impacting perceptions between culturally different forces: race; size; attitudes toward sex, gender, and religion; and attitudes toward work. The article focuses on the leadership of generals John J. Pershing, Leonard Wood, and Douglas MacArthur. While I certainly agree that there is a place for the perspective developed here, I found the analysis a bit too psychological. Certainly, ethnocentric cultural positions directed the attitudes of the Western forces, but it was the economic interests that established the policy.

The summarizing and concluding article by Robin Higham, "Reflections on an Inter-Cultural Command," postulates that intercultural activity takes place at three levels that parallel the present military rank structure. Thus, there are three sets of attitudes and perceptions: one for the common enlisted types, another for the career NCOs and junior officers, and a third for senior officers. In addition, the author advances a typology of five types of cultural exchanges among allies. This leads to a conclusion that successful intercultural command requires multicultural familiarity among the leadership. I found this interesting in that he mentions the Gulf War coalition as a subtype of a dominant partnership and describes the US forces there as being an "Anglo-American bible belt Army and Air Force." Also, I am not sure I would agree with this separation of attitudes on perspectives, as it seems to mirror military class too conveniently. More importantly, he does not pursue the logical questions that follow from these two points: (1) Is our professional military in danger of becoming too culturally narrow to embrace the growing trend of coalition endeavors? and (2) Is our military potentially in danger of becoming too estranged from its own citizens?

In conclusion, I would say that of the several topological constructs offered, Guilmartin's was the most developed. Yet, as the reviewer, I should mention my penchant for graphs and charts. Thus, I suspect I would have been more receptive to the others had they included some maps, charts, and/ or tables. With the exception of the Petillo article, which seemed somewhat speculative, each article contained solid documentation. I certainly would recommend the book for any extended reading list.

Dr. Paul R. Camacho
Boston, Massachusetts

The Lebanon War by A. J. Abraham. Praeger Publishers, 88 Post Road West, Westport, Connecticut 06881-5007, 1996, 216 pages, $55.00.

Lebanon was a political, economic, and cultural center for the Arab world until the middle of the 1970s. This flourishing country was called the

Switzerland of the Orient, and its capital, Beirut, was known as the Paris of the Middle East. The leaders of the various denominations that composed the Lebanese population were able to maintain a delicate balance of power and to overcome crises, such as the first civil war at the end of the 1950s. However, the second civil war, which broke out in 1975, terminated that relatively peaceful period. This was due to new actors who joined the scene, primarily the Palestine Liberation Organization (PLO), which, by its violent approach, shattered the country and created total chaos. The Lebanese turmoil changed the entire strategic situation in the Middle East since it caused a growing interference by foreign countries, mainly Syria and Israel. The conflict among the PLO, Syria, and Israel expanded into a war in 1982—the Bekaa Valley campaign.

The history of Lebanon is extremely important for any American scholar since US diplomats and military forces have been deeply involved, directly and indirectly, trying to solve the crises and restore peace. Besides, Lebanon can serve as a very good case study from which one can derive many lessons and implement them in future conflicts.

Abraham gives the reader a very broad perspective of the situation and processes, using his special inside-out look. His relations with many individuals in the area enable him to add new and valuable information to what has been written before. The descriptions are very rich in detail, yet there is a very clear line which can be followed by readers who are trying to comprehend the complicated story of Lebanon.

Numerous books and articles have been written about Lebanon because of its importance to the understanding of developments in the area. Abraham's book is much more than just another volume on the Middle East since it puts new light on one of the most complex periods of the Middle East—and Lebanon in particular.

Brig Gen Ephraim Segoli, Israeli Air Force, Retired
Israel

A Forgotten Offensive: Royal Air Force Coastal Command's Anti-Shipping Campaign, 1940–1945 by Christina J. M. Goulter. Frank Cass & Co., Inc., 5804 NE Hassalo Street, Portland, Oregon 97213-3644, 1995, 366 pages, $47.50.

Maritime air operations in the European theater in World War II tended to focus on the anti-submarine campaigns that were waged against U-boats in the North Atlantic and Bay of Biscay. However, Royal Air Force (RAF) Coastal Command was established for the express purpose of satisfying Admiralty requirements for air support. Since the establishment of the RAF, the Royal Navy (RN) had been fighting for its own air arm, the Fleet Air Arm, and attempting to get the RAF to recognize the need for air support outside of traditional strategic bombardment and pursuit aviation. With the outbreak of World War II, RAF Coastal Command started an antishipping campaign that would not show overwhelming success until the command was reequipped with modern aircraft in 1943 and 1944. At first the strikes were aimed at shipping in the Channel and North Sea.

In order to give the reader an understanding of why the RAF had a difficult time with maritime operations in World War II, Goulter opens the book with Royal Navy Air Service operations in World War I. At the conclusion of the war, the interwar period is marred by interservice rivalries that left the maritime force of the RAF without an effective torpedo bomber and no long-range fighter for escort and general reconnaissance purposes. Not only did these equipment shortfalls hamper operations, but the lack of navigator training made operations hazardous. At the outbreak of World War II, the British government had plenty of economic intelligence on the German need of high-quality Scandinavian iron ore. However, while the Royal Navy felt that an economic blockade was necessary, it no longer possessed the required number of ships for such an operation. An air blockade had never been considered during the interwar years, and thus Coastal Command was not able to carry out the necessary operations at the outbreak of the war. One problem was the continuing lack of equipment because Fighter Command and Bomber Command were getting all the aircraft resources. An additional problem in attempting to interdict Swedish iron ore was that trans-Baltic trade could not be touched by RAF or RN assets.

Coastal Command also had devoted a large amount of the war to fighting off amalgamation with either the Royal Navy or Royal Air Force. Equipment was also drawn off for operations in the Far East and the Mediterranean, especially the Beaufighters, useful long-range fighters that were in constant demand in other theaters. The lack of navigation aids and air-to-surface radar also restricted early operations. By 1943, however, the Gee navigation aid system developed for Bomber Command and radar developments were helping

Coastal Command. As attacks on coastal convoys mounted, the Germans outfitted most of their merchant ships with up to three 37-millimeter (mm) guns, and some special flak ships were built with heavy 105 mm guns. Coastal Command crews suffered appalling losses (up to 20 percent losses on single sorties), leading to calls for flak-suppression fighters to operate with torpedo bomber squadrons during attack runs. By 1943, things had improved, and operations combining up to three squadrons (28 to 32 aircraft) would attack convoys of the Norwegian and Dutch Frisian islands. In order to find these convoys, reconnaissance flights and high-grade signals intelligence (SIGINT) such as Ultra were being used to find where German convoys were operating. In the case of Norway, there were also coastal watchers who reported ship movements to the British Admiralty. The arrival of 25-pound and 60-pound warhead rockets gave both fighters and bombers an advantage. German flak crews would now abandon their guns as rocket hits near or below the waterline caused an increasing number of sinkings.

German postwar reports revealed that by 1944 and 1945, sinkings were causing the ore trade to drop to dangerous levels. The hunt for miniature submarines and E-boats (German PT [patrol torpedo]) vessels prior to and during the Normandy landings was another successful part of Coastal Command operations. Missions in the Maas and Schelde estuaries also ensured that German small combatant units could not cause any harm to Allied naval operations in Northwest European waters. With the war's end came rapid demobilization; and within two years, the RAF once again had no offensive maritime aircraft in its inventory. (The author of the book considers antisubmarine operations as defensive in nature.) This is certainly one of the excellent texts of maritime air operations in Northwest Europe. Coastal Command never had an official history written about its convoy operations; this book fills that void.

Capt Gilles Van Nederveen, USAF
Maxwell AFB, Alabama

Luftwaffe Fighter Aces: The Jagdflieger and Their Combat Tactics and Techniques by Mike Spick. Greenhill Books, Lionel Leventhal Limited, Park House, 1 Russell Gardens, London NW11 9NN, 1996, 248 pages, $54.95.

Luftwaffe Fighter Aces is a fine attempt by Mike Spick to show the reader many of the techniques, tactics, and methods used by the most successful German fighter pilots in World War II. To this end, the author accomplishes his objective and makes everything easy for even the layman to understand. By explaining the reasons for the success of the known German aces, the *Experten,* Spick removes some of the mystery behind these extremely successful combat pilots. The author is careful to leave fanciful delusions of alleged natural German superiority where they belong, while at the same time giving credit where it is due. Unlike many books of this type that try to depict the German aces as supermen, *Luftwaffe Fighter Aces* explains in simplified detail why they were successful. These aces remained in combat longer, flew against more enemies, and had more opportunities to score victories, in addition to being very experienced. Spick also does a good job of chronicling the decimation of the Luftwaffe fighter force in 1944 as a result of Allied tactical air ascendancy, which accounted for the loss of many *Experten.*

Spick discusses the German fighter pilots' contributions to the air war in Spain, early invasions of 1939–40, Battle of Britain, Mediterranean, defense of the Reich, Eastern Front, and night air war against the Royal Air Force's Bomber Command. Within each of these areas, Spick details the general conditions found in that theater, the types of aircraft flown on both sides, significant armament, and—most importantly—techniques that specific *Experten* used in that theater, which is perhaps the greatest value of this book.

Mike Spick is a well-known military-aviation author who has over 30 books to his credit. *Luftwaffe Fighter Aces* is of the same caliber as one of his previous works, *The Ace Factor: Air Combat and the Role of Situational Awareness.* In completing *Luftwaffe Fighter Aces,* the author used many secondary sources but doesn't mention the use of any primary documents or interviews. Because of this, much of the information in this book can be found elsewhere in many other sources. The author, however, has done a good job of extracting the information from several sources to make a single volume covering the tactics of the most successful combat pilots in history.

Overall, the book is quick reading, interesting, and presented well with charts, graphs, tables, and 25 pages of photographs. Most of the photographs, however, can be found in other books on the subject. The author has also provided detailed appendices. Perhaps the most valuable of these outlines the strike rates for Luftwaffe pilots with a rate higher than that of Erich Hartmann, the war's top-scoring ace with 352 kills. (One arrives at the strike rate by dividing the total number of sorties

flown by the total victories.) When viewed in this manner, much of the mystery behind the victories of the Germans becomes clearer. By comparing the strike rates of top Allied aces, one finds a close correlation between Allied rates and the German rates.

This book does make a significant contribution to World War II aviation, and I do recommend it, despite the high price. Dedicated students of the Luftwaffe will likely want to add this to their library. If not, I still recommend buying it in paperback. It is well worth the money.

Maj Robert Tate, USAF
Maxwell AFB, Alabama

The Invention That Changed the World: How a Small Group of Radar Pioneers Won the Second World War and Launched a Technological Revolution by Robert Buderi. Touchstone Books, 1230 Avenue of the Americas, New York, New York 10020, 1997, 575 pages, $16.00 (softbound).

The terms *military technological revolution* and *revolution in military affairs* are popular in Air Force and Department of Defense journals. Many pundits subscribe to a belief that revolutions drive rapid increases in military capability. Others rely on the position that all technological changes are merely evolutionary in character. For readers of either disposition, it is indisputable that the invention of radar and its incorporation in air combat in World War II was a significant, if not pivotal, step in changing the nature of warfare.

The Invention That Changed the World does a fine job in tracking the creation and integration of a rather remarkable device frequently taken for granted: radar. Buderi, a former technology editor for *Business Week* and author of articles found in a variety of magazines, wrote this book with a style that reads more like a story than a detailed historical analysis. This makes his work, though containing an extensive bibliography, difficult to cross-reference due to the lack of footnotes. However, it remains an enjoyable and a rich account of scientific history that is accessible to a variety of audiences.

Most interesting for airmen and military enthusiasts alike is Buderi's tale of the personalities and innovations that led to successful integration of radar into combat applications. Featured prominently in his World War II discussion of radar development were the scientists of the Massachusetts Institute of Technology's Radiation Laboratory, the "Rad Lab." Tracing the interactions of the principal scientists, Buderi illuminates an interesting historical case study for civilian-military cooperation in the development of war-fighting technologies. Unfortunately, he tends to oversell their impact on the war effort with his assertion that this "small group of radar pioneers won the Second World War." Although a significant contributor to the greater war effort, neither the quality nor the quantity of radars in World War II supports the absoluteness of Buderi's bold proposition that the "Rad Lab" scientists won the war.

Buderi better supports his proposition that the radar scientists helped launch a technological revolution. If a military technological revolution is a terrific leap in war-fighting capability, the institution and operational testing of radar in World War II certainly showed hints of an emerging "revolution." In World War II, night-radar intercepts, early radar warning, and pathfinder bombers blazed the trail for more dramatic contemporary capabilities. For example, radar has made possible all-weather flight, stealth, terrain-following at night, and a host of other military and aerospace applications that arguably have now changed the nature of war to truly be a 24-hour-a-day enterprise. Moreover, the civilian spin-offs have had tremendous impact in scientific and commercial applications.

Overall, Buderi's *The Invention That Changed the World* is a well-written and entertaining story of technology development with many implications for Air Force readers. He blends his tale of history, civil-military affairs, and human interaction in an entertaining yet not oppressively academic fashion. Though a bit oversold, many of the individuals whose stories are recounted in this book truly made an outstanding and long-lasting impact. Was radar a harbinger of a technological revolution—or was it simply a product of evolution? You decide.

Maj Merrick Krause, USAF
Alexandria, Virginia

The Air Force Integrates, 1945–1964, 2d ed. by Alan L. Gropman. Smithsonian Institution Press,

470 L'Enfant Plaza, Suite 7100, Washington, D.C. 20560, 1998, 237 pages, $29.95.

The story's been told many times over the past 20 years—how an intensely racist American society entered into a war under a banner of justice against a racist tyrant. The contradiction between values and reality forced the American government and its military to incorporate America's benighted black community into the war effort. Separate but equal, African-Americans made the most of their opportunity. The wartime performance of black fighters, especially the Tuskegee Airmen, should have dispelled racist misperceptions of African-American capabilities. But during and after the war, studies "proved" the unworkability of the experiment. Harry Truman did the right thing in moving to desegregate the armed forces.

The Air Force beat the politicians to desegregation. Its motivation was efficiency; there was no room for inefficient use of resources in a new service seeking to make itself into a first-rate fighting machine. Integration went quickly and smoothly, with most airmen accepting it either passively or willingly. But Air Force integration was on base only. Racism and segregation remained alive and well in the civilian community outside the gates, North as well as South. Changing the off-base environment, the Air Force claimed, would disrupt community relations and, potentially, weaken readiness. Half-heartedness characterized the Air Force integration effort until radical change occurred on the outside during the late 1960s and early 1970s. In the aftermath of the 1971 Travis AFB, California, riot, the Air Force (and the other services) got busy on community relations.

This monograph was extremely good when it first appeared in 1977; it's even better now. And, as Gropman notes, its message remains pertinent 20 years later. African-Americans are leaving the military at the highest rate in 20 years even though society at large is experiencing deteriorated race relations. It is time to review the past for what it can teach about both success and failure.

The success is obvious. Despite history, despite postwar studies rationalizing segregation, despite the other services' demonstration that foot-dragging was a viable tool against discrimination—despite all this, the Air Force moved out smartly to desegregate, moved well ahead of the other services and of society in general in the late 1940s and early 1950s. The failure bears consideration as a message for today: complacency, sitting on laurels, is hazardous.

The second edition retains most of the original, with subtle changes in interpretation and a brief update of progress over the past 20 years. New tables show increasing percentages of blacks in the Air Force and greater percentage increases in noncommissioned officer and officer ranks, including general officers. And Gropman brings his bibliography up to date.

This small work was valuable 20 years ago. It is equally valuable today. It serves as a serious reminder that we must always guard against complacency and must always be aware of where we have been and how easily we can slide back there again. Anyone wishing to understand the Air Force and its times should add this work to his or her reading list.

Dr. John H. Barnhill
Oklahoma City, Oklahoma

Fighting with the Soviets: The Failure of Operation Frantic, 1944–1945 by Mark J. Conversino. University Press of Kansas, 2501 West Fifteenth Street, Lawrence, Kansas 66049-3904, 1997, 284 pages, $35.00.

I remember the popular refrain repeated frequently during the cold war: "The Soviets are just like us." Mark Conversino disagrees in his rich historical study, *Fighting with the Soviets.* Recalling a particularly interesting but relatively obscure experiment in Soviet-American cooperation, *Fighting with the Soviets* describes the story of US aircraft, pilots, and support personnel operating shuttle-bombing missions from Ukrainian air bases during World War II. Operation Frantic attempted to accomplish military objectives, particularly bombing the Nazis, and political objectives, including opening the way for American air to fly from Siberian air bases in support of the war in the Pacific. Conversino describes mixed results for the operation. However, first-person accounts of Soviet life, values, and the omnipresent bureaucracy sustain his argument that "we were not like 'them' in terms of values and social mores."

Mark Conversino is an active duty USAF lieutenant colonel, squadron commander, and former military history professor at the School of Advanced Airpower Studies. *Fighting with the Soviets* emerged from Conversino's doctoral studies. However, the book reads more like an informal narrative than a dry academic treatise. It is extremely well documented, with an extensive bibliography. I found the interviews particularly interesting, while other primary sources are accessible for further

study from the Air Force Historical Research Agency at Maxwell AFB, Alabama, and the Military Records Division at the National Archives in Washington, D.C.

The concept of Operation Frantic was as intriguing as the interaction of US soldiers with their Soviet counterparts was disturbing. Gen Henry H. "Hap" Arnold wanted to open another front against the Germans—in the air—after suffering massive losses in unescorted bombing during the Combined Bomber Offensive. This front was to begin with strategic bombing missions flown from the Ukraine while encouraging Soviet support for American Far Eastern operations against the Japanese and improving cooperation and communications between the United States and the Soviet Union. Unfortunately, distrust and Soviet bureaucratic roadblocks severely reduced the potential of the American air operations from the Ukraine. In the end, Soviet-imposed constraints led to their judgment that Operation Frantic was "a mere footnote to the Great Patriotic War."

However, details related by Americans serving in the Ukraine regarding relations with the Soviets were more disturbing than the discussion of bureaucratic roadblocks. Stories of Soviet guards who would freely accept cigarettes from an American "guest" and then "shoot that American's pet dog for sport" embodied the Soviet value system described by Conversino. For example, Conversino recounts that the Soviets removed mines after a German aerial attack by lining up Soviet servicemen and marching them across the airfield with rifles. When they saw mines, Soviet soldiers shot at them. When mines exploded, men in the line were injured. Impossibly, their partners ignored them as the line slowly proceeded. In addition, Conversino's reported stories of Soviet men beating Ukrainian women for fraternizing with Americans starkly contrast with Soviet claims of treating women as equals. Particularly disappointing, from a war fighter's perspective, were tales of Soviet liberators mistreating or neglecting American prisoners of war because of Soviet contempt for prisoners of the Germans. These stories, if related truthfully by Conversino's sources, cumulatively paint a terribly grim picture of the Soviets' lifestyle and their low regard for human rights.

Indeed, *Fighting with the Soviets* provides political and military details of an important chapter in US-Soviet relations that should be common knowledge to airmen. Ultimately, it is up to the reader to decide if the "with" in *Fighting with the Soviets* means "beside" the Soviets in the war against the Nazis or "against" the Soviets in personal and political confrontations. I heartily recommend this thought-provoking book to those with interests in cooperative and combined military operations, World War II studies, Soviet studies, and the historic use of American airpower in combat.

Maj Merrick E. Krause
Alexandria, Virginia

Eye in the Sky: The Story of the CORONA Spy Satellites edited by Dwayne A. Day, John M. Logsdon, and Brian Latell. Smithsonian Institution Press, 470 L'Enfant Plaza, Suite 7100, Washington, D.C. 20560, 1998, 303 pages, $29.95.

An extraordinary chronicle of military and National Reconnaissance Office (NRO) history, *Eye in the Sky* lays out the early years of CORONA, America's first photoreconnaissance space program. The book is a compilation of 11 articles, each focusing on a different aspect of the now declassified spy satellite program. Proceedings from a conference declassifying CORONA, held at George Washington University in May 1995, formed the genesis for the book. The description and chronology of the program—its struggles and successes in directly affecting national policy—go beyond enlightening to extraordinary.

Following World War II, RAND published a series of studies, and among them were several that described possible uses of space systems for the military. These studies combined to form the technological basis for the first military space system, dubbed Weapons System 117L. The satellites were to use a televised broadcast of imagery, in real time, from a satellite. Not long after the program started, the ability to develop this new technology came into doubt, and the much more practical, film-return CORONA system was added to WS-117L. CORONA was meant to be a stopgap until the satellite and missile observation system (SAMOS) came on-line, but SAMOS never materialized. Given that, and the amazing success the project achieved, CORONA prospered.

CORONA's first success, mission 13, was in August 1960, although it carried no film. The first 12 flights had been failures, but the pressure to launch was so great that the teams fixed what they could and launched again, often with very incomplete data on the previous failures. Mission 14 returned film successfully on 19 August 1960. The flight's film contained more coverage than all the

previous 24 U-2 flights combined, and soon after, the "missile gap" was discounted, just as the U-2 had debunked the "bomber gap." The age of space intelligence had finally come.

Responsible for running the efforts of CORONA, the NRO, an agency run jointly by the Central Intelligence Agency and the US Air Force, was not acknowledged until 1992, 31 years after it was formed. Prior to that moment, arms verification, which was done almost entirely from space, was attributed to "national technical means," a nice way of saying, "We're not going to say, but it's technical." Thus, in addition to strategic targeting, arms-control verification became a key role for the CORONA satellites. Without the satellites, the outcome of the cold war could have been dramatically different.

In all, CORONA was a huge success. Out of 145 launches, 120 were successful. When you consider that the first 12 failed during the startup of the program, these statistics are impressive even today. CORONA's technologies were valuable and had lasting effects on other fronts as well. For example, CORONA cameras and sensors found their way to the Apollo spacecraft and the lunar orbiters. Other subsystems were engineered back into the U-2 and SR-71, still in use at CORONA's end.

Eye in the Sky bombards the reader with many details about the early space-intelligence programs, as well as the politics and challenges of the day. Perspectives and recollections of some of the actual pioneers in the space-intelligence field are combined with fascinating descriptions of the satellites and their out-of-this-world cameras. The reader is also treated with a description of the Soviet space reconnaissance program. In short, the book serves as an excellent chronicle of early military space, its secret battles during the cold war, and its significant effects on world events.

Anyone interested in space or military history will be fascinated with this book. New light is shed on many events that shaped our nation and modern military. Airmen will better understand the relationship between strategic reconnaissance and national policy and gain a better understanding of modern world and military history. The book provides a good look at the cold war and its high-technology warriors. Of particular benefit is the thoroughly depicted disclosure of those previously taboo subjects, the "black" space programs, previously known only in rumor and conjecture.

Capt James W. Hardy, USAF
Kirtland AFB, New Mexico

MacArthur's Jungle War: The 1944 New Guinea Campaign by Stephen R. Taaffe. University Press of Kansas, 2501 West 15th Street, Lawrence, Kansas 66049, 1998, 312 pages, $35.00.

Fire and maneuver. No two words better describe the American way of war, but perhaps the order should be changed to "maneuver and fire." And possibly no better campaign exists to display this American way of war than Gen Douglas MacArthur's New Guinea campaigns. Author Stephen Taaffe, who teaches at Nashville's Trevecca Nazarene University, uses a study of MacArthur as a metaphor for US/joint operations. Taaffe holds that in New Guinea, MacArthur used his limited resources brilliantly at the strategic level but sometimes stumbled at the operational and tactical levels. Luckily for the Allies, the Japanese understood joint warfare much less than did MacArthur. This book is an excellent examination of a theater commander, the American way of war, and a dazzlingly risky joint campaign.

It is no secret that MacArthur was willing to take risks in "his" war because he was in a race with the Navy. With fanatical determination, the general pursued his objectives of returning to the Philippines and vindicating the humiliation of Bataan and Corregidor. For the Navy, however, the humiliation to be corrected was not in the Philippines but Pearl Harbor. The Navy wanted a campaign designed to lure the Japanese navy into a great Mahanian battle—thus, the island-hopping Central Pacific thrust. This thrust and the war in Europe drained forces away from MacArthur although he saw it more as a conspiracy to relegate him to a secondary theater. To prevent this perceived threat from becoming a reality, MacArthur had to wrap up his New Guinea operations before Adm Chester Nimitz could advance across the Central Pacific to take Formosa.

In order to win this race, MacArthur fell back on the time-honored American tactic of maneuver. At the time, journalists hailed the campaign as one that would "go down in history" (page 1). Unfortunately, MacArthur's New Guinea campaign has been largely ignored, perhaps because as the campaign was reaching its climax, the Allies finally captured Rome; the long-awaited invasion and liberation of Northwest Europe began; and Nimitz's island-hopping Central Pacific campaign roared to life. In the space of nine months, MacArthur's forces advanced over thirteen hundred miles; isolated hundreds of thousands of enemy troops, de-

stroying them wherever they met them; and poised themselves to cut across Japan's lifeline. By constantly maneuvering and outflanking the Japanese, MacArthur minimized casualties with overwhelming firepower from air, land, and sea assets. This kept the enemy off balance and maintained the momentum on his fanatical drive to the Philippines. Of course, MacArthur gambled that the enemy would react exactly as predicted. Otherwise, the whole campaign would have been in jeopardy because the Allies did not have the forces to fight an attritional war.

Rather than fight a long, grueling campaign along the northern coast of New Guinea, MacArthur realized he needed to capture only a few strategic points in order to control the entire island. In effect, these strategic points were islands. Instead of islands separated by hundreds of miles of ocean, however, they were separated by hundreds of miles of almost impenetrable jungle. MacArthur's "Navy" and "Air Force" gave his infantry mobility of which the Japanese could only dream. This mobility, coupled with "jointness," acted as a force multiplier. The Army Air Forces and Navy isolated and immobilized the Japanese garrisons and allowed MacArthur to maximize his relatively small infantry by placing it at what Jomini would call "decisive points." To borrow from the phrase attributed to Confederate general Nathan Bedford Forrest, "MacArthur got there furstest with the mostest."

The campaign was a sophisticated ballet—or waltz. Once Gen George Kenney's airmen secured air superiority, the Army Air Forces and Navy would interdict the area while the Navy landed Gen Walter Krueger's infantry and engineers. The Army would capture and improve the invasion objective—an airfield. In fact, the limiting factor to the Allies' advances was the range of land-based fighters and the existence of airfields. (With carrierborne fighters, MacArthur could have advanced further and faster, but the island-hopping offensives absorbed those aircraft and ships.) Once the airfield was secure, Kenney would station fighters there, and the next waltz would begin.

Although ingenious, this strategy had its operational and tactical risks. Taaffe emphasizes that as the ground forces seized the airfield and secured the beachhead (but before the actual land battle was over), MacArthur's attention shifted to the next objective. The theater commander seemed to think that capturing an airfield equated to the end of the battle, when in fact the tactical battle was just beginning. This shortsightedness often stretched his meager forces to the limit. In effect, MacArthur retained the strategic and operational initiative but sometimes surrendered the tactical initiative to the enemy. The Army had to guard the beachhead and wait for the enemy to attack rather than seek him out. During the invasion of Biak, a relatively small island northwest of New Guinea, the Army could pummel but not defeat the Japanese defenses. Moreover, MacArthur had no reinforcements for the operation because all the other Allied troops were busy guarding or mopping up Japanese garrisons far to the rear. Biak is perhaps as close as MacArthur came to the breaking point. But one must remember that he was in a race and was willing to gamble men's lives, for the potential rewards were great (i.e., his triumphal return to the Philippines). Luckily for MacArthur, in the end his forces proved sufficient to capture all the key positions in New Guinea. Thus, the campaign became a brilliant display of the American way of war instead of total disaster. Such is the case with much of American military history.

Taaffe's look at the New Guinea campaign sheds new light on one of America's most loved and hated generals; it also documents one of the most successful joint operations in history. The New Guinea campaign deserves more attention from scholars, for, as Taaffe illustrates, it brought out the best and worst traits in the American way of war.

Capt Jim Gates, USAF
Washington, D.C.

Aide de Camp 2: The Universal Boardgame Conversion and Play-by-Email Assistance Utility. CD-ROM. HPS Simulations (http://hpssims.com), P.O. Box 3245, Santa Clara, California 95055-3245, December 1997, $49.00. Minimum system requirements: Windows 95 and 486/66 processor, eight megabytes (MB) RAM (16 recommended), and 20 MB hard-disk storage. Full-installation version of the program (requiring 80 MB storage) reviewed on a personal computer (PC) with a 200 Mhz Pentium chip, Windows 95, 32 MB RAM, and a 24x CD-ROM drive.

Although it's not a war game, *Aide de Camp 2 (ADC2)* allows you to create and play war games on your home PC. (Actually, the program is flexible enough to create just about any board or card game, but this review focuses on war games and their use in the professional development of military officers.)

Thus, if you have never had any interest in war gaming, *ADC2* isn't likely to change your mind. However, if you are a war gamer or have any interest in getting started, *ADC2* is worth a look. If you're a "former" war gamer—one who lacks the time, space, or ability to find an opponent to play war games—*ADC2* might just rekindle your interest.

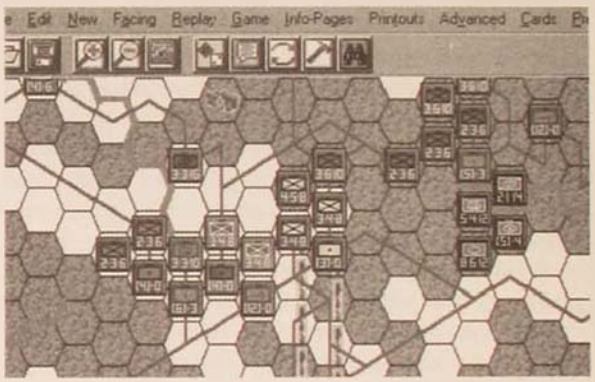
The typical war game has three parts: a map, counters, and rules. The paper or board-mounted map is usually 20 by 30 inches or larger and has some type of grid system (hexagons are common) to regulate movement. Counters generally consist of tens to hundreds of cardboard squares, which denote forces or status. The number of rules can range from those contained in a few pages to a book-length collection. Games also normally include charts and/or tables as well as some means of randomizing outcomes (often accomplished by rolling a die or dice). You can find a war game for just about any environment (land, sea, air, or space), level (tactical to grand strategic), or period (the ancient past to hypothetical futures) you can imagine.

For people who grew up before the age of the PC, the war-gaming experience itself was an effort in planning and logistics. You had to find an opponent and a place to get together, agree on a game, set it up, and then finish in one session or find a way to "defend" your game-in-progress from kids, pets, and so forth. The truly determined gamers might have tried playing via regular mail, but a game of any complexity would take longer to complete than a real war.

Enthusiasts who began war gaming—or rediscovered it—via the PC already know the advantages of having a computer host the game and usually serve as the opponent: it is always willing to play and is never a sore loser. The downside, however, is that the computer doesn't learn. It can play certain games only in certain ways (although the variety and sophistication are growing) and may produce unrealistic or unchallenging strategy or tactics. Some games address the latter problem by allowing an option for humans to play each other.

A small number of enthusiasts and companies have gone a different route by excluding a programmed enemy or even any computer-based rules. The computer simply hosts the map and counters, and performs some amount of bookkeeping and support in an effort to supply the challenge of a human opponent, the flexibility of old-fashioned war games, and the convenience of the virtual environment. These products range from low-cost and austere to *ADC2*—probably the "Cadillac" of the genre.

Available on a single CD-ROM, *ADC2* includes a small booklet covering installation and basic functions. The CD also has several games that nicely demonstrate the program's flexibility. One is *Ardennes*, a Battle of the Bulge game designed specifically for *ADC2*. I imagine we can expect more of these in the future, although for now most are conversions of paper games. (Regarding copyright, commercial game publishers seem to be of two minds: some produce *ADC* versions and wish to be the exclusive source for those game sets, while others do not seem to object to enthusiasts producing and circulating their own conversions. However, in all cases you are expected to own a copy of the original game.)



Screen shot from ADC2's Battle of the Bulge game

Installation on my Windows 95 machine was no problem (as was a later test using Windows 98). As recommended, I went to the publisher's web site and downloaded the latest patch. I also took a look at the impressive support that HPS Simulations provides for all its products and noted the links to other sites that have *ADC* game sets.

I experienced some difficulty trying to play a game without reading the manual. For all its functionality, the interface isn't always intuitive, and terminology is important. Fortunately, the on-line manual answered all my questions (although I think a tutorial would be a nice addition). From that point on, play seemed pretty straightforward with the program assisting, but not regulating, movement and combat. Depending on the game, *ADC2* support includes such functions as die rolls, line-of-sight calculations, and flipping or changing the facing of counters. The program supports play by E-mail, an important feature for gamers looking for opponents. (Some of the *ADC2* web sites even help to match players.)

Loading new game sets was also relatively easy, but, depending on how they are packaged, some knowledge of file manipulation may come in handy. Because *ADC2* includes a utility for converting game files to the current format, any game sets created by earlier versions of the program remain usable.

Finally, I took a look at the design program, supplementing some experiments of my own with an examination of components from sets currently available. Apparently users can build a *functional* game in a reasonable amount of time without being an artist (trust me). Exactly how long this takes depends on the game's size, complexity, and the gamer's ability to reuse or modify components. Obviously, some sets—particularly those involving original designs—are real labors of love.

I don't know that I will start my own design anytime soon, but from my work with flight simulators, I can promise you that it would be a learning experience. Building an original conflict simulation not only would require a detailed study of a military era (past, present, or some hypothetical future) and event (the specific circumstances of a battle, campaign, or war), but also would force designers to decide what's important to war fighting and why.

As professionals, we should study war thoroughly in the hope that we will practice it infrequently. Along with reading, discussions, and experiences such as museum and battlefield visits, war gaming can serve as an important tool in any personal plan for professional development. *Aide de Camp 2* makes war gaming more accessible. Consider adding it to your collection of professional materials.

Maj Pete Osika, USAF
Maxwell AFB, Alabama

Politics and arms seem unhappily to be the two professions most natural to man, who must always either negotiate or fight.

—Voltaire

I Can Write Better than That!

OK, THEN DO IT! *Aerospace Power Journal* is always looking for good articles written by our readers. If you've got something to say, send it to us. We'll be happy to consider it for publication.

The *Journal* focuses on the operational and strategic levels of war. We are interested in articles that will stimulate thought on how warfare is conducted. This includes not only the actual conduct of war at the operational and strategic levels, but also the impact of leadership, training, and support functions on operations.

We encourage you to supply graphics and photos to support your article, but don't let the lack of those keep you from writing! We are looking for articles from twenty-five hundred to five thousand words in length—about 15 to 25 pages. Please submit your manuscript via electronic file in either MS Word or Word Perfect format. Otherwise, we need two typed, double-spaced draft copies of your work.

As the professional journal of the Air Force, *APJ* strives to expand the horizons and professional knowledge of Air Force personnel. To do this, we seek and encourage challenging articles. We look forward to your submissions. Send them to the Editor, *Aerospace Power Journal*, 401 Chennault Circle, Maxwell AFB AL 36112-6428.

. . . But How Do I Subscribe? EASY . . .

- Just write New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh PA 15250-7954.
- Say that you want to subscribe to AFRP 10-1, *Aerospace Power Journal*, stock number 708-007-00000-5.
- Enclose a check for $24.00 ($30.00 for international mail).
- Spend a year enjoying four quarterly issues mailed to your home or office.

Basis of Issue

AFRP 10-1, *Aerospace Power Journal*, is the professional journal of the Air Force. Requirements for distribution will be based on the following:

One copy for each general officer on active duty with the US Air Force and Air Reserve Forces.

One copy for every five (or fraction thereof) active duty US Air Force officers in the ranks second lieutenant through colonel.

One copy for each US Air Force or Air Reserve Forces office of public affairs.

Three copies for each Air Reserve Forces unit down to squadron level.

Three copies for each air attaché or advisory group function.

One copy for each non–US Air Force, US government organization.

One copy for each US Air Force or US government library.

If your organization is not presently receiving its authorized copies of the *Aerospace Power Journal*, please contact our staff to verify your address. To obtain the latest information or to contact us, visit our web site at http://www.airpower.maxwell. af.mil.

The Editor

OUR CONTRIBUTORS

Lt Gen Norton A. Schwartz (USAFA; MBA, Central Michigan University) is deputy commander in chief of US Special Operations Command, MacDill AFB, Florida. Immediately prior to this assignment, he served as director of strategic planning, Deputy Chief of Staff for Plans and Programs, Headquarters USAF, Washington, D.C. He is a command pilot with more than forty-two hundred hours in such aircraft as the C-130E/H, MC-130E/HIP, and AC-130H/U. General Schwartz, a Seminar XXI Fellow at the Massachusetts Institute of Technology, is a graduate of Squadron Officer School, Armed Forces Staff College, and National War College.

Col Robert B. Stephan (USAFA; MA, University of Belgrano [Argentina]; MIPP, Johns Hopkins University) is deputy chief of the National Defense Review Division, Headquarters USAF, Washington, D.C. He is also the lead Air Force action officer on the J-8-led Joint Urban Working Group and is leading a comprehensive study of Kosovo air operations. A master parachutist and combat diver, Colonel Stephan is a graduate of Squadron Officer School, Defense Language School, Air Command and Staff College, Air War College, and Interamerican Defense College.

Maj Gen Roger A. Brady (BA, University of Oklahoma; MA, Colorado State University) is director of logistics, Headquarters Air Mobility Command, Scott AFB, Illinois. The general provides policy and guidance to train, equip, and organize aircraft maintenance, transportation, supply, contracting, and logistics-plans units at 14 major air installations in the United States and at 17 en route locations throughout the globe. He formerly served as director of plans and programs, Headquarters US Air Forces in Europe, Ramstein AB, Germany; support-group commander; director of personnel at a major command; flying-wing commander; vice commander of an air logistics center; and director of logistics at a major command. General Brady is a graduate of Squadron Officer School, Air Command and Staff College, and National War College.

Maj Chip Thompson (USAFA; MAS, Embry-Riddle Aeronautical University) is chief, F-16 Weapons Programs, Office of the Assistant Deputy Undersecretary of the Air Force, International Affairs. Previous assignments include F-16 pilot, 613th Fighter Squadron, Torrejon AB, Spain; F-16 instructor pilot in the 69th Fighter Squadron, Moody AFB, Georgia, and at the USAF Weapons School, Nellis AFB, Nevada; and F-16 weapons officer 310th and 425th Fighter Squadrons, Luke AFB, Arizona. He flew 62 combat missions in Desert Storm in 1991 and is a 1998 graduate of Air Command and Staff College.

Lt Col Cynthia A. S. McKinley (BA, Moorhead State University; MS, Troy State University; MAAS, School of Advanced Airpower Studies) is commander of the 21st Operations Support Squadron, Peterson AFB, Colorado, which provides mission support to Air Force Space Command's (AFSPC) worldwide network of attack warning and space surveillance units. Prior to assuming command, she was the deputy director of the commander's action group at AFSPC. A graduate of Squadron Officer School and Air Command and Staff College, Colonel McKinley has published articles in *Aviation Week and Space Technology*, *Space News*, and several symposia proceedings, as well as an essay in *Beyond the Paths of Heaven: The Emergence of Space Power Thought* (Air University Press, 1999). She has also been a guest lecturer at Air War College and space war games.

Maj Howard D. "Dave" Belote (BA, University of Virginia; MBA, Embry-Riddle Aeronautical University; MAAS, School of Advanced Airpower Studies) is chief of strategy, plans, and doctrine for Seventh Air Force and chief of the Air Component Command Synchronization Cell, Osan AB, Korea. He serves as the primary advisor to the theater combined force air component commander on airpower courses of action and writes the strategy documents that guide the theater aerospace planning and targeting processes. Previously, he served as a fighter operations inspector in the Office of the Inspector General at Headquarters Air Combat Command and flew F-16s and F-111s in tours at Hill AFB, Utah, and RAF Lakenheath, United Kingdom. He is a distinguished graduate of both Squadron Officer School and Air Command and Staff College. His articles on military theory and airpower theory have been published in *Strategic Review* and *Airpower Journal*, and his monograph *Once in a Blue Moon: Airmen in Theater Command* is forthcoming from Air University Press.

Col J. Douglas Beason (USAFA; MS, National Defense University; MS, PhD, University of New Mexico) is commander, Phillips Research Site, and deputy director, Directed Energy Directorate, Air Force Research Laboratory, Kirtland AFB, New Mexico. Previous assignments include senior policy analyst in the White House Science Office; chief, Lawrence Livermore National Laboratory Detachment, Defense Special Weapons Agency; director of faculty research and associate professor of physics at the US Air Force Academy; and deputy director of Advanced Weapons and Survivability, Phillips Laboratory. Recipient of the National Defense University President's Strategic Vision Award, he has published 12 books and over 80 scientific, technical, and commercial works. A distinguished graduate and research fellow of the Industrial College of the Armed Forces, Colonel Beason is also a graduate of Air War College and Air Command and Staff College.

Dr. David R. Mets (BS, USNA; MA, Columbia University; PhD, University of Denver) is a professor at the School of Advanced Airpower Studies, Maxwell AFB, Alabama, and was once the editor of *Air University Review*. He spent a 30-year career as a Navy sailor and as an Air Force pilot and navigator. He flew more than nine hundred C-130B sorties in Vietnam, and his last flying tour was as commander of an overseas AC-130 squadron. He had teaching tours at both the US Military Academy and the US Air Force Academy. Dr. Mets has published four books.

Order Processing Code:
*5679

United States Government INFORMATION

❑ YES, please send me ____ subscription(s) of the ***Aerospace Power Journal*** (AURE) for $24.00 each ($30.00 foreign).

The total cost of my order is $_____. Price includes regular shipping and handling and is subject to change. International customers please add 25%.

Company or personal name (Please type or print)

Additional address/attention line

Street address

City, State, Zip code

Daytime phone including area code

Purchase order number (optional)

Charge your order. It's easy!

MasterCard

VISA

For privacy protection, check the box below:

❑ Do not make my name available to other mailers

Check method of payment:

❑ Check payable to Superintendent of Documents

❑ GPO Deposit Account ☐☐☐☐☐☐☐–☐

❑ VISA ❑ Master Card

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

☐☐☐☐ (expiration date)

To fax your orders (202) 512-2250

To phone your orders (202) 512-1800

Thank you for your order!

Authorizing signature 11/95

Mail To: Superintendent of Documents
P.O. Box 371954, Pittsburgh PA 15250-7954

Important: Please include this completed order form with your remittance.

Want a Subscription to the *Aerospace Power Journal?*

Detach this card, fill it out, and mail it along with a check, VISA, or Mastercard number to

Superintendent of Documents
P.O. Box 371954
Pittsburgh PA 15250-7954

Make all checks payable to Superintendent of Documents

Superintendent of Documents
P.O. Box 371954
Pittsburgh PA 15250-7954

AEROSPACE POWER JOURNAL COMMENT CARD

We are always interested in hearing from our readers. Please use this card to comment on this issue _____.
Issue Article

_____

_____

_____

_____

_____

PLEASE PRINT

Rank/Title First Name Initial Last Name

Street City State/Country Zip Co

AEROSPACE POWER JOURNAL SURVEY CARD

Please help us serve you better by completing and mailing this card.

1. How well is the *Aerospace Power Journal* meeting its mission of being an open forum for officers to express their views
   ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 (1 = extremely poorly, 5 = extremely well)

2. How well is the *Aerospace Power Journal* staff shaping the professional dialogue?
   ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5

3. Comments:

_____

_____

PERSONAL DATA (Optional)
PLEASE PRINT

Rank/Title First Name Initial Last Name

Street City State/Country Zip Cod

FEEL LIKE SPEAKING UP?

Fill out the attached cards and drop in any mailbox.

AEROSPACE POWER JOURNAL
401 Chennault Circle
Maxwell AFB AL 36112-6428

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY LABEL
FIRST CLASS PERMIT NO. 200

POSTAGE WILL BE PAID BY ADDRESSEE

AEROSPACE POWER JOURNAL
Airpower Research Institute
401 Chennault Circle
Maxwell AFB AL 36112-8930

AEROSPACE POWER JOURNAL
401 Chennault Circle
Maxwell AFB AL 36112-6428

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY LABEL
FIRST CLASS PERMIT NO. 200

POSTAGE WILL BE PAID BY ADDRESSEE

AEROSPACE POWER JOURNAL
Airpower Research Institute
401 Chennault Circle
Maxwell AFB AL 36112-8930

The *Aerospace Power Journal* (ISSN 0897-0823), Air Force Recurring Publication 10-1, is published quarterly. Subscriptions may be ordered from New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh PA 15250-7954. Annual rates are $24.00 domestic and $30.00 outside the United States. The GPO stock number is 708-007-00000-5. See *Aerospace Power Journal* on-line. Visit *Aerospace Power Chronicles* at http://www.airpower.maxwell.af.mil/.

The *Journal* welcomes unsolicited manuscripts. Address them to Editor, *Aerospace Power Journal*, 401 Chennault Circle, Maxwell AFB AL 36112-6428. E-mail or submit your manuscript via electronic file in either MS Word or WordPerfect format. All submissions will be edited in accordance with the standards set forth in the *Air University Style Guide for Writers and Editors* (available on-line in the *Aerospace Power Journal* section of *Aerospace Power Chronicles* at http://www.au.af.mil/au/oas/aupress/style). *Journal* telephone listings are DSN 493-5322 and commercial (334) 953-5322.


apj
THE PROFESSIONAL JOURNAL
OF THE UNITED STATES AIR FORCE
AU PRESS

AEROSPACE POWER JOURNAL

Summer 2000