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Net Assessment

Mission Debrief

The Revolution in Terrorism

THE "WORLD WAR III" that people have feared for 50 years is upon us. Terrorism is global. It is growing from terror tactics to terrorism as a strategy and from terrorist interests to terrorist ideology. This fundamental shift is revolutionary but not in the sense of a revolution in military affairs (RMA)—just the opposite. The terrorism revolution is anti-RMA or, more accurately, a countermilitary revolution. Terrorism works to eclipse military use of ultimate weapons like stealth aircraft, precision-guided munitions, and nukes. Instead, it uses nonweapons, other weapons of mass destruction, and high-octane media. In this setting, the Air Force is a key player in the world war to kill the terrorism revolution.

Terrorism has been around centuries longer than airpower. There are biblical and other religious references to terrorism. Early military history records how combatants employed terror tactics, and the long record of counterterrorism's failure is not encouraging. Yet, never before in history have technologies existed as they do in today's Air Force. The struggle is to make them effective against such a complex enemy.

The terrorism hydra is dialectic in nature. It has become both means and ends. It defies logic but is the epitome of logic—both a cognitive and affective parasite. It abuses emotion from zenith to nadir. Terrorism is both infinitely cheap and expensive. It can take on myriad forms and speeds. Currently, global terrorism blends the classical concepts of tactics, operations, and strategy. It adulterates military theory, art, and science; it is obscure in the writings of Clausewitz and Jomini but prevalent in those of Machiavelli and Douhet.

It jams together attrition and annihilation. Ultimately, it is an ancient but now revolutionary new paradigm in warfare that requires genius to obliterate it. This enigmatic war portends an Armageddon between humankind and machine.

The most technologically sophisticated system in terms of chemistry, structure, and electrical synapses is still the human body. It is not ironic, therefore, that terrorism so inexorably hinges on human factors, and its hopeful demise will require not only victorious technologies, but also the steel of morality over nefarious martyrdom and cowardice. Thus, the role of airpower in the war on terrorism involves both the latest mechanistic technologies and the traditional human qualities of airmen.

Since its inception, airpower, in essence, has been linked to terrorism. Remember that initial observations of aircraft struck fear and terror into the hearts of the bewildered. Recall the terror bombings of cities like London during both world wars. Consider classic deterrence theory, which basically relies on the principle of terror—the deterred side in effect being terrorized while anticipating dire consequences of one act versus another. A fundamental state of terror from springloaded intercontinental aircraft and missiles may have kept the Cold War cool. As for today, readers need no reminding of the contemptible "airpower" used to spread terror to America this past September. Yet, military airpower's impressive counterstrikes against terrorism are writing new history and, at the same time, raising new questions. What are the ways to use airpower other than fighting terror with terror? Hence, airpower can be

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venom or antidote, and quality airmen are paramount to the desired effects of the latter.

For airmen, the terrorism revolution has proliferated the fight. No longer are flyers the only ones in contact with the enemy, but all members of the force are directly in the fight and in harm's way. Hence, the logistical "shaft of the spear" is now increasingly critical to the overall effort. This is why the two themes in this issue of *Aerospace Power Journal*—logistics and homeland security—have an appropriate and timely linkage. There is no way aerospace power can help extinguish global terrorism without a stalwart, efficient, and quick logistics infrastructure.

Just as airmen, sailors, marines, and soldiers are reacting with deadly effect wherever they are needed, so must the shaft of the spear engage with a great sense of urgency and commitment as "the force behind airpower and space power." That force is technological and human. Both must come through to help exterminate the revolution in terrorism.   □

Ricochets and Replies

COMPLIMENTS ON *CGO VOICES* WEB PAGE

Thanks for the great article by 1st Lt Tracey Richardson ("A CGO Look at the Commander in Chief," posted to *Air Chronicles* on 18 December 2001). I know the author personally as a previous commander, and it is inspirational to see outstanding ideas and commentary coming forth, especially from someone who is very busy doing warrior's work by keeping the C-17 fleet moving and not just sitting around in a pure academic environment. Her efforts should be commended and *are* from where I sit (stuck in the Pentagon). Thanks for providing an outlet for our many fine company grade officers.

Col Jay T. Denney
Arlington, Virginia

SILVER FLAG CONCEPT: A REAL OPPORTUNITY

I read Col Bobby J. Wilkes's article "Silver Flag: A Concept for Operational Warfare" (Winter 2001) with interest and proffer some comments. The reason we have attrition-model war games is that people with an Army mentality wrote them. The Army's method of war has always focused at the line of contact (regardless of how deep the line was), and attrition of enemy equipment and forces was the order of the day. Additionally, it was easier to model, and most of the analysts who wrote the models thought in terms of destruction of the enemy in battle; also, successful battles lead to a successful conclusion called "winning the war."

The Air Force fought hard to turn it around, but Tactical Air Command (TAC) was more interested in getting into bed with the Army's Training and Doctrine Command and minimizing the political turmoil in Washington. Budgets were at stake, you know. Additionally, the Air Force had little understanding of warfare and the employment of airpower at the corporate level. We couldn't

articulate a viable alternative with a recent history of success. We had people who understood the employment of airplanes, but the air operations center (AOC) was still a "support" function and not seen as the medium through which you squeezed airplanes, munitions, and men to focus on a target set to achieve certain effects. Check out Haywood Hansell's book *The Air Plan That Defeated Hitler* (Washington, D.C.: Government Printing Office, 1975). That was the first "effects-based" war plan. We had lost sight of what we were about because all that expertise was behind the green door of the intelligence mafia, and they were focused on supporting the national level and the Single Integrated Operational Plan (a national war-planning tool). Today, Maj Gen Dave Deptula has successfully articulated the Air Force way of war in a very coherent manner, but it was scripted by the efforts of Chuck Link, me, Willy Rudd, John Vickery, Jack Warden, and a captain of intel who was a targeteer. I focused on getting into NATO air doctrines because we were blocked by TAC from working it with the Army directly. The rest of the crew extracted the fundamentals of what we knew as "operational art" from the Soviet literature. That ferment was down in Checkmate. The Gulf War was the application of that "doctrinal ferment." Worked pretty well, didn't it? It took only 12 years to bear fruit.

At another time and place, I engaged my old director of operations, Moody Suter, in a conversation at US Air Forces in Europe (USAFE) about why we don't network the USAFE/NATO AOCs to the Warrior Prep Center at Ramstein Air Base, Germany, and play war games from the bunkers where the European war would be fought. Even if the war-game models were attrition oriented, we would still train the staffs in how to make the apparatus work and call into question the underlying principles of war on which decisions were being made—nothing new there.

Gen Tony McPeak wanted to improve the training of his brigadiers in handling large formations of disparate aircraft and get rid of some of the tribal thinking. I suspect that he figured he would produce leaders who would think in terms of airpower instead of just airplanes. The problem is, he didn't go far enough. The colonels should still run the wings, and the brigadiers should run the organizations through which the resources are focused. Gen John Jumper made that connection by declaring the AOC the main course, not support. Over time we have been trying to circumvent the intelligence mafia by linking the sensor to the AOC directly. We were successful with national assets—U-2s, Global Hawk, satellites, and Predators—but not at the tactical level, the one that supports the joint force air component commander. General Jumper also correctly noted that the focus of intelligence, surveillance, and reconnaissance is to link the sensor to the shooter directly in real time and to have persistence over the battle space.

There is a picture of a night refueling of a B-2 on the cover of *Armed Forces Journal International* with the caption "RELENTLESS" in bold yellow letters. It sums up the nature of war: never give the enemy an even chance. It is more moral to make him die for his country than for you to die for yours. The latter part of that sentence is the principle of war known as "economy of force." It also sums up the American way of war that we have been driving towards since Vietnam.

The organization that runs the air war, the combat air operations center (CAOC), through which airplanes become airpower, should be run by the brigadiers who will one day employ the forces as three-stars. Such an organization should have not only the command-and-control computer support, but also own the civil engineering and communications support that completes the hookup. That is a big package! There should be more than one or two, and they should be mobile and deployable—and exercised regularly. To me, Silver Flag is a smaller part of this entity. It is the basic-training entity from which a brigadier is graduated—or flunked—to command air forces at one of the CAOC locations. The

Solving the Great Air Force Systems Irony

LT COL STEVEN C. SUDDARTH, USAF

Editorial Abstract: Why has the Air Force lost the lead in technology development that it held over industry in the 1950s and 1960s? Colonel Suddarth believes we can find the answer in the shift in emphasis from product to process management that began in the early 1960s. Since that time, the Air Force has moved from the simple management of complex systems to the complex management of simple systems—and has gained little in the process.

IT IS HARD to think of a more decisive element of the American military than its technology base. In the past century, the United States has perhaps been involved in more military actions than any other power and has sustained a surprisingly low casualty rate while achieving remarkable military success. Is this a consequence of "warrior spirit" alone or the result of unprecedented, long-term preparations—particularly in technology? Dependence upon technology as an asymmetric advantage underscores the need to constantly improve the advancement process of war-fighting systems. Technology evolves rapidly, and the challenge lies in always staying ahead of it, trying to ensure that some unknown enemy will not gain a deadly advantage. Yet, such efforts to improve the pace at which we create and deploy technology have generally accomplished little. Further, they have not controlled costs and schedules. Increasingly, Americans rely on advancements

from decades past and count on facing unsophisticated opponents. Some people would argue that we are less competent at building complex military systems today than we were decades ago. This assertion leads to a great irony: the Air Force has moved from the simple management of complex systems to the complex management of simple systems—and has gained little in the process.

During the 1950s, the United States faced a strategic military challenge of historic proportions. The nation responded with an impressive array of technologies, including jet aircraft, radar and computer systems, command and control (C^2) centers, fusion bombs, missiles, and spacecraft. Even existing technologies were perfected at an unprecedented rate out of fear of what our sophisticated adversary, the USSR, was doing. Perhaps no development better exemplifies this trend than our intercontinental ballistic missile (ICBM) capability. It began in earnest in 1955 yet had developed three generations of systems (an improved Atlas, Titan, and the solid-fueled Minuteman) in a mere seven years. The effort did not stop with missile development but included the construction of hardened silos, automated command centers, early warning capabilities, and even a nascent space-based surveillance system—all on alert and functioning in time for the Cuban missile crisis of 1962.

In contrast, a recent upgrade to the Minuteman III missile is now under way for 500 missiles. The effort began in 1993 with the objectives of ensuring their continued reliability and rapid reprogramming. The new guidance capability was not demonstrated until 1998, and some upgrades took two more years.[1] Furthermore, these upgrades apparently shortened the range and reduced the accuracy of the missile.[2] Understandably, this upgrade was a complicated activity, costing $2.3 billion. It is difficult, however, to compare the complexity of an upgrade to the daunting challenges that the original builders faced, which included having to design systems from scratch with only vision and science to go on.

A brief review of developments during the early Cold War period discloses an impressive array of combat-relevant technologies, including drones, cruise missiles, hydrogen bombs, optically based intelligence satellites, weather satellites, radar-guided weapons, and many more. Technology continues to advance, but innovation today is often limited to continuous improvement of existing capabilities. Even stealth capability, the current flagship of Air Force technology, came into being only because the first such system (the F-117) violated most acquisition rules.[3] Subsequent systems that followed the rules (the B-2 and F-22) took much longer to build into practical aircraft. Furthermore, stealth is almost entirely based on research from the early Cold War period.

One can explain the slowdown in technological development in many ways. The great discoveries in modern physics and the industrial boom of the early twentieth century preceded the aerospace-technology boom of the 1950s and 1960s. Some people argue that we don't have the confluence of discovery and technology now to sustain the rate of progress that we previously knew. Furthermore, the United States no longer has the fearful incentive of its traditional adversary. The USSR, tenacious and technologically sophisticated, drove the United States to go farther in space, as well as become more precise with nuclear weapons and smaller with communications technology; we always needed to be better and get there first. The "Red Scare" was particularly acute in the 1950s and early 1960s, but as time progressed, the fear (and, eventually, the adversary as well) went away. Indeed, our situation has changed, but it is difficult to blame our lack of innovation on the waning Cold War, particularly with so many new and unpredictable military challenges today.

The past two decades have seen unprecedented growth in information technology, an area in which the military once led but now barely follows. Biotechnology is rapidly growing and becoming increasingly relevant to the military, yet it can do little to catch up. The confluence of aerospace technologies and high-technology information systems allows for entirely new ways of fighting—advanced small, unmanned aerial vehicles and cruise missiles;

laser weapons; and direct links from sensors to shooters. The military pursues all of these but with disappointing progress. Why is it so far behind industry and academe in areas so critical to its "revolution in military affairs"? Bureaucracy has grown, and the military seems to have lost focus on how to do this essential task. In fact, the seeds for this slowdown in military capability were planted long ago and have taken root for over 35 years. Thus began the slow move from the simple management of complex systems to the complex management of simple ones.

The Great Shift in Management Philosophy

Since the man in charge of the work himself determines what he needs as his work progresses, reviews at higher echelons of his detailed requirements are meaningless; such reviews make sense only when they are directed at the effectiveness of his work as a whole.

> —Air Force Scientific
> Advisory Board, 1947

Whereas the general trend in large private and public organizations has been towards a small staff focused on identifying large issues for the consideration of the senior leadership, in [the Department of Defense] a large staff identifies relatively small issues. . . . Today's [Office of the Secretary of Defense] staff bores into small issues regarding weapons inventories or stockpiles and conducts numerous analyses that are frequently inconclusive and contradictory. Too many of these analyses often involve issues that in isolation are too insignificant for senior leadership interest or action, and do not lend themselves to meaningful aggregation. And it is by no means clear that the senior leaders of the department in recent years have encouraged the development and serious consideration of potentially troublesome major issues.

> —*Tooth to Tail Report on the Planning,
> Programming and Budgeting System,*
> 2000

How did the process get so enamored with analyses, stockpiles, or, for that matter, cost and schedule details that hide the real issues? Many opinions exist. Fundamentally, however, a clear shift in management philosophy took place during the mid-1960s.

Between 1962 and 1965, Secretary of Defense Robert McNamara began a new trend in the Department of Defense's (DOD) systems development. These reforms focused on quantifiable management metrics, decisions based on up-front analysis, centralization of authority, and end-to-end reliance on contractors for delivery. McNamara desired considerably more oversight across service-oriented acquisitions than did his predecessors. He directly attacked this issue on many fronts but always with extensive planning and centralization. He first organized a position of assistant secretary for systems analysis, held by Alain Enthoven, one of his first "whiz kids." Enthoven's group examined strategy, need, cost, and a host of other factors along with technical feasibility.[4] Soon, all DOD actions were examined in light of systems analysis, an outgrowth of the game theories developed at RAND to model the unpredictable nature of nuclear war and bombardment.

The lengthy process of systems analysis removed decision-making authority from technologists and centralized it in the offices of Pentagon analysts. McNamara also implemented the Planning, Programming, and Budgeting System (PPBS), the detailed, multiyear planning process still used by DOD. This system further centralized decision making within the Office of the Secretary of Defense, reducing service autonomy and program-management flexibility. Finally, McNamara segregated the conceptual design and planning phases from the engineering and production phases under his Total Package Procurement Concept (TPPC), which drove a wedge between government technologists and contractors. The government undertook massive studies to define mission areas, specify performance measures, analyze feasibilities, and estimate costs. Essentially, the contractor pursued engineering development

and production with little involvement or oversight from the government. Under TPPC, the government began to divest itself of its hard-won technical competence.

Reliance on prime contractors, up-front technical studies, and planning, however, did little to avoid costly and time-consuming technical problems. McNamara created several flagship programs to demonstrate the benefits of his improved approach, all of which produced mixed results at best. The TFX fighter (later known as the F-111) ran into a decade of engineering problems concerning variable-geometry wings and engine intakes. Engineers discovered both of these concerns late, despite extensive preplanning and analysis. In the absence of prototyping, such problems could emerge only as unpleasant surprises.[5] Similarly, gross underestimates of empty weight and overestimates of wing-spar strength for the C-5 transport limited its initial usefulness to less than that of the outdated C-141, at least until it could undergo expensive modifications. The government's technical oversight proved sorely lacking in both programs because they were just too complex to manage from contracts and plans alone.

Numerous other reforms have followed McNamara's, each seeking to satisfy his original intent while simultaneously restoring the system to the level of lean competence that existed in the early Cold War. However, most have failed to restore agility, and many have worsened the bureaucracy and have further constrained program managers. For example, the Packard Commission reviewed weapons-system policy under Secretary of Defense Melvin Laird (1968–72), concluding that power needed to be decentralized to reverse many adverse effects of McNamara's reforms. These reformers also wanted a better handle on cost growth, a comparison between the "as built" cost and some earlier cost estimate. Consequently, they created an elaborate set of review boards, including the Defense Systems Acquisition Review Council and service-level equivalents such as the Air Force Systems Acquisition Review Council. Furthermore, in light of an increased

desire to control costs, specific reporting requirements were levied upon program managers to report to higher headquarters, DOD, and Congress on significant changes to cost, schedule, or requirements.[6] Over the years, several other reformers, including Frank Carlucci (secretary of defense under President Reagan) made reforms in terms of dollar ceilings, numbers of critical milestones, and so forth, but the trend of management-centered acquisition reform has continued undaunted with little real change in theme: "There was a widespread belief . . . that 'better management' would solve the problem. 'Better management' had a tendency to be translated into 'more management' with an accompanying increase in rigidity, delay, and the suppression of initiative."[7]

The Packard Commission of 1986 and the Goldwater-Nichols Department of Defense Reorganization Act of 1987 continued the process, increasing the number of reporting chains that programs had to go through. Program Executive Offices (PEO) were created along product lines to "streamline" the management of programs under the service secretaries. Keeping personnel and facilities under the uniformed services in traditional commands created two lines of authority, each with its own reporting requirements and bureaucracies. Although done in the name of streamlining, these actions have created the opposite effect. Goldwater-Nichols also set off a series of acquisition-reform movements that have revived a stronger version of McNamara's TPPC concept under a new name—Total System Performance Responsibility (TSPR).

The Fundamental Nature of the Management Shift

Generally, a belief has spread throughout DOD that has also been embraced by American society at large—that advanced planning and detailed processes lead to good decisions. Therefore, the focus on management reforms has usually involved reorganizations, the creation of new committees, or reporting requirements. Often, this belief in planning and process transcends the vision for the

products themselves—or even the quality and preparation of the workforce that produces them. Rather, the new faith believes that a good manager knows how to set up the right procedures that will always lead to good decisions and project success. In *The Death of Common Sense,* Philip Howard discusses a generally worsening American trend of bureaucratic processes.[8] He makes a strong association with earlier legal traditions and a shift toward increased management-oversight process that is deceptively rational but seldom delivers the desired results. Following this tradition, Americans are too quick to add one more management step or convene one more committee. With the increased management overhead, planning horizons keep getting longer, and opportunities are squandered.[9] Recently, an Air Force laboratory was asked to plan its technological thrusts for the next 10 years. Einstein once said, "If we knew what it was that we were doing, it wouldn't be research, would it?"[10] There is little room for an Einstein in a laboratory with a 10-year planning horizon.

The process has become extremely cost-centered. Much of the current view of how to manage war became focused on developing a theoretical "science of war" in the form of two-person zero-sum games. To simplify the cost-benefit analysis, one needs a single, straightforward metric. Nearly all processes in place today for management of the defense-technology establishment entail seeking funding from Congress, distributing it to the services, reporting on its expenditure, and so forth. Tools such as earned-value management focus on expenditures and their tracking against targets. Technical alternatives and risks (even schedules) generally take a backseat to financial issues. In the past two decades, the desire to mimic industry has further reinforced the cost-centered point of view. We keep trying to quantify the cost of our outputs even though we can't really quantify the outputs themselves. (For example, how many F-4s equal a B-2 bomber?)

In the management-centered organization, systems analysis was promoted from being a tool that provided data to a decision maker to being tantamount to the decision itself. A principal goal of systems analysis involved considering all other factors in extensive planning before embarking on a technological pursuit. "Crash programs" essentially stopped, as did a lot of prototyping and research. The pressure to subordinate innovation to other factors has remained constant. In the 1950s, the bomber generals, particularly Curtis LeMay, fought research and development (R&D) for ICBMs, believing that they were an expensive and unnecessary adjunct to manned bombers. Today, under the Goldwater-Nichols Act, funding authority for all major programs resides in operational commands that understand how to fight with current weaponry but may not appreciate the impact of new technologies that don't resemble current inventories. Users, including war fighters, tend to think in evolutionary terms and generally start with the development of a concept of operations (CONOPS). However, it is nearly impossible to develop a CONOPS for systems that no one has imagined yet. Those without the necessary background who try such development tend to write science fiction about things that can't be built. Scientific and engineering innovators must perform this function. We must give them the freedom and resources to do it, but the subordination of technology has hindered military innovators from developing capabilities that do not fall neatly into current force structures.

Finally, and perhaps most destructively, the new management ceased to understand the importance of human capital and replaced it with process. This management took a minimalist approach: don't hire the best; hire only whom you need, and use the process to ensure that whomever you hire can do the job. Although great strides were taken to make the Air Force a pleasant place to work during this time, little occurred to ensure that key components of the technical workforce remained ready. A recent (and exhaustive) survey indicates that fewer than 15 percent of today's Air Force officers in program offices have their highest degree in a technical specialty. In 1974 these officers made up well over half of the population—technical people

for technical jobs (fig. 1). Today, we have shifted from technical qualifications to the Acquisition Professional Development Program (APDP)—essentially process indoctrination, which reinforces the idea that process, not people, will solve our problems. Furthermore, it encourages advancement by "ticket punching," which at times reaches the level of absurdity. For example, an otherwise unqualified officer replaced an experienced physicist as chief technologist simply because the officer had APDP "Level-III" certification. Without proper tailoring, Developing Aerospace Leaders (DAL)—a new Air Force career-management system—might also endorse ticket punching by adding new breadth-of-experience requirements for officers seeking advancement. Those formalized requirements include professional military education, staff assignments, assignments within other specialties, and so forth. Under the constraints of DAL, technical officers might have only two or three assignments (6–9 years) within their technical specialty in an entire 20-year career. Even if the Air Force can live with such a short period of technical contribution from technical officers, they will lose their skills during

the "broadening" assignments and become unable to bear fruit when their service needs them most. In short, if the Air Force wants technical leadership, it must not fail to nurture both the leadership and technical qualities of the individual. It must then use the abilities of a properly trained workforce. Process is a poor substitute for quality people.

Did the Management Shift Bear Fruit?

Proponents touted that the preplanned, rational, process-oriented approach would ensure that systems were effective—that is, that they would accomplish their intended purpose. How about the management shift itself? Was it effective?

System Effectiveness and Cost Efficiency

McNamara's triad of reforms (PPBS, systems analysis, and TPPC) focused first and foremost on improving effectiveness and efficiency. Developments were not to begin until paper studies demonstrated their effectiveness in advance. Further analyses sought to show cost
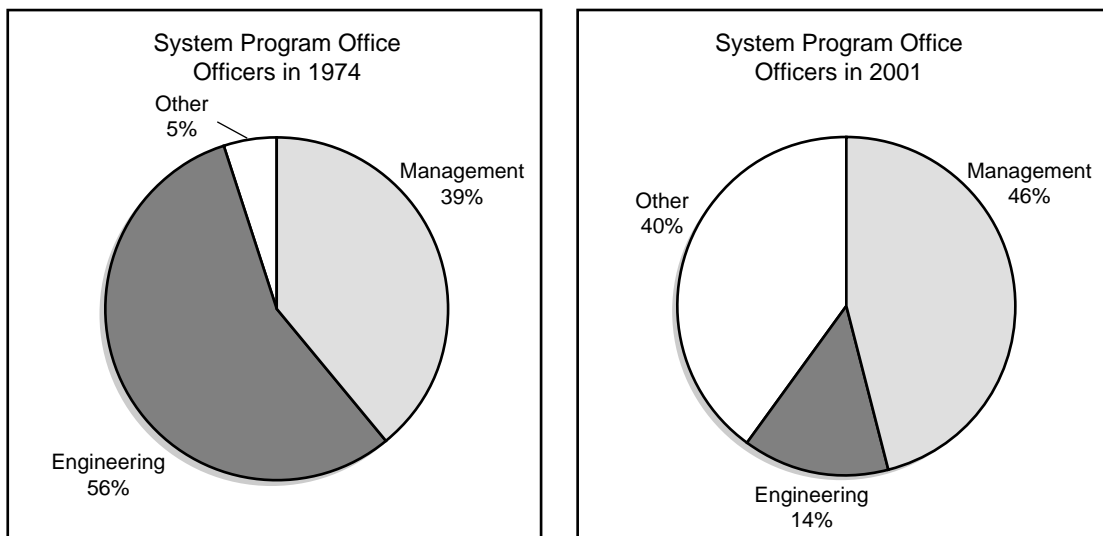

Figure1. Highest Academic Specialty Data, 1974 and 2001

efficiency by means of measures such as maximum enemy harm inflicted per dollar spent. Unfortunately, in spite of detailed studies, the effectiveness and efficiency of systems untried in battle are always difficult (if not impossible) to assess properly. Untold resources have been spent since the institution of these reforms, particularly on simulations and mathematical modeling intended to show the relative merits of one system over another. At best, the merits of these studies are debatable because politics plays a substantial role in establishing rules for the analyses. In the end, a leader must make a decision, often basing it on "gut feeling." Prior to the advent of the systems-analysis approach to project selection, the Air Force built some enormously successful programs such as the B-52 and Minuteman missile, systems that remained operational with revolutionary peacekeeping capabilities which lasted for many decades (and are still in use). After the advent of the systems-analysis approach, we also constructed systems such as the F-15 and F-16, which proved quite effective in the Gulf War. (Interestingly, F-16 plans and analyses identified air superiority as its optimal use. In reality, it performed best as a ground-attack aircraft.) Did these studies make a difference? Does a metric exist?

Cost Control

Similar centralizing reforms aimed at reducing cost growth, a curious metric for military systems, quickly followed McNamara's reforms. The ultimate and important metric is final cost. Since we have no way of really knowing what a system *should* cost, however, we assume that the original estimate will determine the "should-cost" baseline. Yet, because systems are so diverse, it is hard to compare whether a missile should cost more than an airplane, a satellite, or a computer system. Therefore, it is very difficult to know what the original estimate should be, and most prudent program managers pad costs or weaken requirements to deal with uncertainty. This situation did not deter reformers, however, who made idealistic claims. The Goldwater-

Nichols reformers made bold plans in the early 1990s for what they might do with the enormous savings they forecast from their management-oriented approach. In the words of Jacques Gansler, "To pay for our Revolution in Military Affairs, we must wage a Revolution in Business Affairs in all areas and simultaneously."[11] The fact that it is nearly impossible to know what a particular development should cost does not mean that the exercise is entirely meaningless. One must use some basis of estimation for planning purposes. Yet, the point is that one gives more importance to these estimates than they deserve. After all, they are just estimates.

The reformers claimed that they would control cost growth. Unfortunately, the record is disappointing. In a 1993 RAND study, Jeffrey Drezner and others sought to characterize cost growth (variance between initial and final contract baselines) against a wide variety of factors. In general, they found that during the time period between McNamara's reforms (1965) and 1990, cost growth hovered at around 20 percent, on average. This percentage is more or less constant, and "no substantial improvement has occurred in average cost growth over the last 30 years, despite the implementation of several initiatives intended to mitigate cost growth."[12]

In the last 15 years, we have seen another round of reforms (the Packard Commission of 1986, Goldwater-Nichols Act of 1987, and Acquisition Reform movement). In spite of claims that these reforms would lead to cost reductions, Air Force cost overruns grew another 9.9 percent![13] If control over cost growth was a goal of these reforms, they have not delivered.

Quality of System Integration

Another justification for our burgeoning management structures is that they lead to more effective integration. Armies of managers, configuration specialists, quality-control engineers, logistics staffs, and others will assure that our systems work more effectively with each other. Since success or failure in these areas is substantially subjective, one finds it difficult to fully

assess any potential gains from the growth of management. Although some people claim that Air Force systems have improved since the shift in philosophy, today's capabilities do not compare favorably with those of the past. Early developers accomplished spectacular things, including the entire ICBM system, Distant Early Warning, the air defense network, and the Air Force Satellite Control Network. All of these were megasystems with tremendous integration challenges, yet their developers tackled them without the "benefit" of today's enormous bureaucracies.

Audacity of Development

The Air Force's R&D establishment exists to ensure that, technologically, our service is second to none. From 1950 to 1965, the Air Force undertook an unprecedented series of developments that will probably occupy a special place in world history. Capabilities that no one thought possible at the beginning of the period became operationally routine by the end. In *Rescuing Prometheus,* Thomas Hughes describes this era as "far more complex than that populated earlier by heroic inventors such as Thomas Edison and firms such as the Ford Motor Company."[14] After World War II, Americans (and most of the world) came to expect an unrelenting, even accelerating, technological progress as a simple fact of life. Much of this optimism is directly tied to aerospace and related technologies in the short 15-year period from 1950 to 1965. Indeed, the stuff of high technology is rooted in aerospace development, which includes jet fighters and bombers, thermonuclear weapons, intercontinental missiles, radar- and infrared-guided missiles, drones and cruise missiles, computerized C^2 centers, microelectronics, early warning radar, optical space surveillance, weather satellites, and the fastest airplane ever made. All of these aerospace developments shared several attributes: they were intellectually sophisticated, they were highly complicated to manage, they involved large workforces, and, not surprisingly, they were tremendously expensive.

From 1966 to the present, the Air Force entered into a phase that certainly improved and optimized prior developments but could hardly be considered revolutionary in the same sense. These evolutionary developments also involved large workforces and were tremendously expensive. They improved upon basic capabilities to make more versatile and capable aircraft, missiles that carried more payload, secure C^2, and so forth. Innovation continued, and the list includes laser-guided and other precision weapons, stealth technology, real-time space intelligence, and satellite navigation—all of which represented considerable advances in the state of the art. However, one has difficulty comparing favorably the fruits of the last 36 years in the area of military innovation to those of the preceding 15 years, particularly considering that the money spent in modernization has remained roughly constant over that time period.

Many possible explanations exist as to why the early Cold War years were more productive than our recent past. Certainly, our competition with the Soviet Union created a sense of urgency that cut through much of the politics and red tape that characterize government-led developments. In fact, Hughes regularly points out that the more audacious projects, such as Atlas and Minuteman, probably would have failed had it not been for the times and the sense of urgency that they generated.[15] Gen Bernard Schriever, head of missile development and a prime architect of the early Air Force technical establishment, claimed that the entire space and missile activity got a tremendous boost from the fear generated by the Soviets' launch of sputnik—an opportunity for which he was ready. As time went on, fear of the USSR went away. Eventually, the USSR itself went away. Another possible reason for the disparity in development audacity is that the critical fundamentals had just been discovered. Rockets, turbines, computers, solid-state electronics, and nuclear and thermonuclear devices were all relatively new to members of the early Cold War generation. Just about anything they did was innovative. One might make similar arguments today. The potential for innovation in technology continues if we properly

exploit biotechnology, polymer electronics, new device-fabrication techniques, optoelectronics, lasers, and many more fundamentals.

Innovation: Straightforward but Difficult

Restoring simplicity to the management of complex systems requires a shift back to the timeless quality of leadership, beginning with the leadership to remove massive portions of the complicated management edifice built over decades. The military has attempted many streamlining initiatives in recent decades, from Total Quality Management to Acquisition "Lightning Bolts." Although most of these initiatives could have been effective, they often made only minor revisions to the large, bureaucratic infrastructure. We need leadership to reimplement the timeless principles. Early Air Force technologist-leaders understood these principles even though they talked about them relatively little.

Principle No. 1: Put the Most Important Things First

Sometimes these are obvious, such as the importance of technology in combat. Our early leadership clearly understood this—witness Gen Henry "Hap" Arnold's claim that "World War I had been won on brawn, World War II through superior logistics, but any future war would be won by brains."[16] Given the significance of just two atomic bombs in ending the largest war in history, we should not shrug off the importance of technology in our mission, and we must boldly advance aerospace technology.

Principle No. 2: Leadership Must Focus on Results More Than Process

For system builders, results come in the form of successfully used products. Process must be a tool to generate results—not the other way around. Many successful corporations are quick to point out that although processes are helpful and sometimes elaborate, they are only tools to elucidate decisions. Ultimately,

people make decisions. Leaders make decisions. If the process gets in the way, the leader must decide to put the product first. This is often difficult when processes are sometimes codified in regulation. Leaders must use their maximum latitude and stand up for their results and for their people. One sees this principle at work in the way General Schriever handled aerospace contractors who accused him of violating competition laws and regulations by serving as systems integrator for ICBMs. The general vigorously defended his decision as a successful promotion of competition: "The assertion which I have heard a number of times is that the present management approach eliminates competition. The fact is that the opposite is true. We are opening up the program for competition. The top electronics companies have been invited to compete for the development of the radar tracker, and the same applies to the computer and inertial guidance system. . . . In other words, we are going to the industries where the greatest competence exists for each [of] the major components of the system."[17]

Good systems are made out of good components. In a 1955 memo, General Schriever answered aerospace industry's criticism of his decision to use the government as system integrator.[18] He stated that the best components, part by part, tended not to come from a single integrating contractor since the latter tended not to favor the best design. Rather, such contractors promoted their own developments, even if they were inferior. Schriever clearly understood the importance of having the best propulsion system, the best guidance and control, the lightest booster shell, and so forth. His intention was to build a quality missile system.

One must manage good developments from a whole-system perspective. When they build a new car, automakers are just as concerned about the manufacturing process, service, and parts as they are about design. Military systems have the same fundamental need although the variables differ since quantities are much smaller and the market dynamics are different. For example, some military systems can have "bugs" worked out downstream. Man-

ufacturing efficiency is less an issue for one-of-a-kind systems, such as some spacecraft. Still, the system perspective remains. For example, ICBM pioneers understood that their system had to be a military system. It had to be hardened, redundant, and fail-safe with robust C^2. They insisted on including a substantial cadre of government (including military) scientists and engineers to ensure that the system was not only the best that it could be, but also militarily relevant and useful.

A third corollary holds that the customer cannot always choose the best product in advance. Early leadership in technology saw a host of audacious developments, from hydrogen bombs to missiles to pilotless air vehicles, as being critical to our war-making capabilities. But before they could begin, they needed sufficient authority to serve as their own advocates. Initially, nearly all developments in the late 1940s and early 1950s were direct consequences of war-fighter requirements, resulting primarily in bombers of increased range and envelope. A shift took place in the early 1950s: "developmental planning offices" pursued the development of systems not driven by war fighters (or "pulled" by requirements). Rather, they focused on "technology push"—systems that should be built merely because they could be built and because they would be significant in battle. Perhaps the most notable of these was the ballistic missile program. Missiles were particularly unpopular among the bomber generals, and, at the time, they had no operational organization to advocate their use. The engineers and scientists who proposed them had to serve as their own advocates.[19]

Principle No. 3: Be Good at What You Do

Steve Jobs of Apple Computer often claimed that the success of his company was based on its personnel policy: hiring people "insanely great" at what they did.[20] Early Air Force leaders clearly understood this to mean that the service's technical personnel should have excellent *technical* skills. Perhaps Louis Ridenour put it best in his Scientific Advisory Board report of 1949: "Under no circumstances should a highly technical job carrying responsibility and authority be filled by anyone except a fully qualified technical man."[21]

Our current philosophy of substituting APDP's process indoctrination for in-depth qualifications falls far short of the kind of excellent workforce known for stellar output. The Air Force must learn to expect contributions on the job—the kind that come only from technically savvy people with the necessary experience and education.

Principle No. 4: Use Leaders Who Can Lead and Earn Respect

Early technical leaders in the Air Force had strong scientific or engineering credentials from top institutions, and they surrounded themselves with similar people. Membership of the Scientific Advisory Board read like a "who's who" of science at the time, featuring such prominent people as Theodore von Kármán (leading aerospace scientist), Ridenour, and John von Neumann (primary inventor of the digital computer) at the head. When General Schriever was standing up the ballistic missile program, he chose two well-published, prominent engineers (Simon Ramo and Dean Wooldridge) to head the effort. He intended to attract talent under skilled leadership, and the approach appears to have worked. Jobs described a similar situation at Apple in the mid-1980s, when the company replaced its technical-managerial staff with "professional" management. In his words, these people "knew how to manage, but they didn't know how to *do* anything."[22] Apple had to hire back much of the technical talent as managers to produce systems as innovative as the MacIntosh. Air Force technical leaders must be technically qualified and respected by their workforce. Our service must not use technical-leadership jobs as mere "broadening" opportunities for officers from other areas unless they also have the required background and command respect.

Principle No. 5: Don't Outsource Your Thinking

Early Air Force R&D centers were very active in prototyping, developing, and testing. General

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Schriever created both a coordinated team of government personnel and his integrating contractor, Ramo-Wooldridge Corporation (later known as TRW). "Military engineers worked all the way down to the subsystem level at every phase of development from basic research to mass production."[23] Using a government-centered team, the general could always trust his people to choose the best components from a myriad of providers, rather than restricting themselves to a single aerospace contractor, who often provided substandard options. He also used military engineers to ensure that the systems could stand up to combat conditions. For example, the Atlas ICBM (developed by Convair) at first had no shelter to protect it from enemy attacks. General Schriever and his military/Ramo-Wooldridge team corrected that deficiency through the design of the silo-based Minuteman system. In his article "The Need for Technical Warriors," Col J. Douglas Beason outlined the importance of having a brain trust of technical officers within the military to manage contractors with insight, organize efforts, and define requirements.[24] Successful organizations take control of their own destiny.

What Can Be Done?

Although PPBS is mandated, the Air Force could take a minimalist approach and use the process as a formality in the budget cycle. At a minimum, the service could stop creating its own corollary additions to the bloated bureaucracy, such as innovation steering groups (which "plan" future innovation activities). To the maximum extent possible, the Air Force could encourage its organizations to work within flat funding lines and submit a simple annual budget. The Air Force did this before with great success and could do so again. Generally, PPBS has not changed the bottom line of most organizations anyway, so we could assume something approaching flat funding and consolidate program elements (PPBS line items).

Increasingly, we need to focus attention on managing in conditions of uncertainty by using a changing technology base in a fluid, often chaotic, world. Doing so requires restoring human judgment and leadership as the guide, as opposed to plans that quickly become obsolete. Judgment requires skill, and there is no substitute for it. People, not plans, really are the most valuable asset. Quite simply, the Air Force must stop the death spiral of technical talent. Fixing this problem requires investment and a culture change. The only alternative is to continue down the current, unfruitful path. Furthermore, education and recruiting alone cannot fix our personnel problem. We must match the work environment to an appropriately skilled workforce. For example, we could work the short-turnaround budgets through a process that more closely resembles the marketplace of ideas rather than multiyear advanced planning. This change would allow the most innovative people to quickly get the resources they need to pursue their ideas and would remove the layers of checkpoints they must currently navigate. In the place of planning and budgetary controls, the workforce could be managed through incentives. Although promotion is clearly a key incentive, often the mere growth of a program, based upon its own success, is incentive enough for the kind of excellence-driven employee we need. Maximizing the authority of local leaders to promote people locally within their workforce goes far in this regard, and Air Force Materiel Command has already seen successful results from two pilot programs that delegate promotion authority to the lowest levels for civilians. Even though military members are promoted through a central board, local procedures could be used to differentiate between performers and nonperformers much more effectively.

This kind of change is a massive culture shift, and it may require reexamining other sacred cows within the Air Force. For example, the service has the opportunity to redefine the boundaries between laboratories and program offices. Currently, those offices must do the unstructured, creative work of conceptual design, followed by the disciplined management of a detailed build with all of the con-

figuration management and support issues this process entails. Perhaps it would be better to move the conceptual-design activity and associated resources into the laboratory, where a culture of high-technology innovation is more easily fostered, and keep the downstream activities in a more disciplined program-office environment.

Another option entails relocating certain activities where they are more likely to prosper. For example, locating laboratories in "high intellectual capital" areas such as the West Coast or Boston may be expensive and politically difficult, but these are the logical places for laboratories since they have the necessary academic and industrial infrastructure to feed a leading R&D center. All of these suggestions are difficult, but we cannot continue to wallow in the current bureaucratic state.

Conclusion

Recent decades of scientific management have born little fruit in military-system development, and this situation comes with a very high overhead in terms of direct cost as well as loss of flexibility and initiative. Currently, "agile acquisition" is a hot topic within the Air Force, but one cannot restore agility without reducing the management choke hold that requires years of questionable, up-front analyses and a minimum budget turnaround of two years. We need to perform these analyses and plans more quickly, and the organization must learn to accept the uncertainty that lies beyond. Agility requires a restoration of the subjective elements to decision making as well as rules that allow the timely pursuit of opportunity. Much can be done to restore the Air Force to a position of technical prominence. □

Notes

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7. Frederic M. Scherer, quoted in Bennett, 49.

8. Philip K. Howard, *The Death of Common Sense: How Law Is Suffocating America* (New York: Random House, 1994).

9. For an excellent discussion on the overuse of strategic planning and its ill effects, see Henry Mintzberg, *The Rise and Fall of Strategic Planning: Reconceiving Roles for Planning, Plans, Planners* (New York: Free Press, 1994). Mintzberg discusses the fact that long-term plans seldom come to fruition and that planning sometimes causes organizations to make suboptimal decisions for a variety of reasons. He singles out the government's PPBS system as an example of a planning system gone wrong and quotes a leading scholar (Aaron Wildavsky in *The Politics of the Budgetary Process* [Boston: Little, Brown, 1974]) as saying, "PPBS has failed everywhere and at all times" (121).

10. *Einstein Quotes and Sayings: Famous Einstein Quotations,* on-line, Internet, 30 January 2002, available from http://home.att.net/~quotations/einstein.html.

11. This particular quotation came from a statement of Dr. Gansler to the Senate Subcommittee on Readiness, 4 March 1998, on-line, Internet, 30 January 2002, available from http://www.senate.gov/~armed_services/statemnt/980304jg.htm. Numerous high-level DOD leaders have made many similar statements, including former secretary of defense William Cohen. Perhaps the best discussion of the subject can be found in Gansler's book *Defense Conversion: Transforming the Arsenal of Democracy* (Cambridge, Mass.: MIT Press, 1995).

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The Management Margin

Essential for Victory©

DR. ROBIN HIGHAM
DR. MARK P. PARILLO

Editorial Abstract: While generalship and technology tend to grab the headlines, an equally important and often overlooked con tribution to victory is the effective manage ment of means *(forces and materiel) that en ables an insightful* grand strategy *to satisfy* ends *(national objectives). Professors Higham and Parillo give us a brief history and analy sis of this most important topic of warfare.*

G ENERALLY VICTORY IS attributed to generalship, esprit de corps, greater resources, and so forth. Too rarely is tribute paid to grand strategy and management.

These latter two factors are perhaps more important in the limited wars of the present than in the major wars of the past. Whether that will be so depends upon the philosopher-kings at the top of Plato's pyramid and upon their military advisers charting a wise course and providing for the execution of policy decisions. Ends (strategic objectives) must be connected to means (resources) by an appropriate grand strategy.

The management pattern has to include both the downward dissemination and following of orders and an upward flow of understanding, constructive criticism, and obedience. As an example, in 1993 the chief of the air staff of the Netherlands Air Force had to explain to the civil leadership that in order to keep 72 F-16s operational, he needed 124 machines.

Management and leadership are not the same. The former impersonally carries out business affairs and makes submissions. The latter personifies command or authority. Too often, unfortunately, it is assumed that military leadership includes administrative talents, but this is often not so. Lord Hives,

chairman of Rolls-Royce, could still pick up any tool on the shop floor and demonstrate its proper use. How many air marshals can do that? Indeed, until after 1945, how many understood the complexities of the bamboo basket of supply? Or even of the barbed-wire-strand decision pattern? Marshal of the Royal Air Force (MRAF) Sir Arthur Harris's despatch on Bomber Command, 1942–45, makes it clear how much vision and management skill was needed to bring that force to the level of the 1939 dream.

> *War requires the organization, management, and efficiency of the invisible infrastructure in peace as well as in war.*

Not only bards and historians, but also businesses themselves have neglected the need to publicize what it took to ready successful armed forces. Ever since the mid-nineteenth century, ever more complex weapons systems have required parallel organizations to make and care for them. The emphasis upon staff work that was made visible by the Crimean War and the struggles of the 1860s–1870s, including the introduction of the telegraph, railways, steamships, and the enormous capacity of the Industrial Revolution, demanded skilled management planning and execution by general staffs from well before mobilization. Yet, both navies in the nineteenth century and air forces in the twentieth resisted the necessity to encompass grand strategy in visions of the future. At the same time, careerism swung in and out of favor, critically damaging technical management by the emphasis upon rank and sometimes irrelevant activities, versus the benefits of long-nurtured experience.

War requires the organization, management, and efficiency of the invisible infrastructure in peace as well as in war. And wars may occur because an underpinning is not in place upon which politicians can confidently erect their grand strategies for stability and peace.

As a direct result of the naval scouring of the Baltic in the Crimean War, the Russians built a railway line to Europe, unreachable by blockade, and also launched 95 new steam warships for ocean raiding against the vulnerable British merchant fleet. At the same time, the British and the French, concerned with their own rivalries, concentrated on the new battleships and so ignored the Baltic in 1863. Thus the Polish Rebellion was crushed. The legacy of *La Gloire* and *Warrior* (the first of the new ironclad battleships) was a dockyard revolution which saw private companies building and the navies managing the new technology while neglecting grand strategy. This period also pointed to the risks of waiting until technology was ripe for use, a period we might call "waiting to want," which may extend as long as 40 years.

An analogous case occurred with the development in the commercial world of mainframe and personal computers. At first only corporations could afford the mainframes, but then personal computers appeared that were so powerful that many could use them. Similarly, miniaturization has gone from the Loran of 1945 to the Global Positioning System of today. In the process, companies like IBM, which pioneered the electric typewriter, made their own servicing force obsolete—was this an unintended consequence of progress?

In the airline business it was more efficient to hand-sort reservations until the global computer systems came in the 1960s, bringing with them both a technical-commercial and a social revolution, just as the first of the big jets enormously increased capacity. Yet, historical knowledge of travel patterns by destination, season, and routes remained indispensable. Airlines are a very useful model since they are constantly in competitive war and in combat with nature and humans. These daily struggles give them rapid-march experience of equipment, methods, and merchandising. The military, in contrast, operates in a peace-and-paucity norm, interrupted episodically by peak activity in crisis or war.

The basic difference between business and military environments has led to contrasting management strategies. On the one hand, businesses—and airlines again are an excellent example—operate on the barbed-wire strand of a straight-line progression with regularly spaced change nodes. By the time facts have become evidence and a decision has been made, the facts have all changed. The military, however, has to live with a wave theory, where peacetime is the norm and war the exception. While both operate under the money sign, business aims to make as much as possible to enhance investments, attract the public, and pay for modernization, while in peacetime the military is constantly pressed for money, staff, and preparatory procurement. The result is that when the military is suddenly confronted with hostilities, everything has to be rapidly and wastefully expanded, stocks have to be consumed before replacement, and the whole managed by amateurs at many levels. Except in the case of linked wars, the professionals lack the practical experience of running the establishment at maximum power. Thus military management is heavily tasked to plan for all contingencies so that for want of a nail the horse will not be lost.

Before World War II the Germans knew that they had to win with blitzkrieg and planned accordingly. But when by 1942 that no longer worked, it took—like the contemporary new jet engines—too long to spool up to full power. In contrast, the French had failed to settle upon policy, envisage time scales, understand the challenges and needs, and attune themselves to modern war. The result was that the French had already defeated themselves before 1940 by the inability to create a grand strategy to suit the times because of a riven political-social climate.

The Battle of Britain was won in part in 1917 when Parliament created a single air force and in part because of the linkages between the two world wars. The bamboo basket would not be functioning at full speed until 1943, but at least manpower and manufacturing were in sync. On the other hand, the Air Staff was undermanned, and ends and means were not harmonized until late 1942, in spite of having prepared tables for wastage and consumption by 1934.

But at least planning started in 1932, and the political decision was taken to give priority and money to Home Defence in 1936, whereas the French Air Force (FAF) did not get a desirable budget until 1938. Moreover, Air Chief Marshal Sir Hugh Dowding's strenuous refusal to fritter away his fighter assets in falling France and his meticulous attention to technical detail, as in his air exercises of the late 1930s, just enabled him to win in 1940. During World War II the key to success was manpower allocation, especially in those countries such as Britain which were scraping the bottom of the barrel by 1944.

The epitome of American management skill was embodied in Lt Gen William H. Tunner, who ran the "airline" over the Hump from India to China in World War II and then in the 1948–49 Berlin airlift. Parallel to those airlifts were the convoys that carried the lifeblood of the Allied forces across the Atlantic and the Pacific in World War II, to Korea (1950–53), to Vietnam (1965–72), and to the Gulf (1990–91). The Battle of the Atlantic was the exception in that it was also a naval operation, which then went on continuously throughout the six years of the conflict.

What in the twentieth century vastly complicated matters for management was technology. For the first 60 years until the plateau was reached in the early 1970s, change was the constant. Quantum leaps outdated materiel. In aviation there were the revolutions of 1934–45 in airframes, engines, fuels, electronics, production, airfields, weapons (including the atomic bomb), computers, and jets. Those changes had stabilized by the 1970s, when management began to realize slowly, and then by 2000 definitely, that miniaturization of electronics and computers and reworking of airframes would mean that some airframes might have at least double the older 25-year life while periodically being internally refitted. This has brought a new approach to the planning of funds and personnel amidst constantly altering challenges. The geometric increases in production

and costs since 1935 have now plateaued in real terms for some aircraft types.

> ***What was forgotten was that the object of war should be peace and trade.***

In the past, management has had to cope with the cycle of revolutionary developments followed by a plateau after three generations—or 60 years—followed again, later, by new technological revolutions. International competition, combined with the inability of leadership to understand and forecast the impact of change, led, amongst other things, to World War I and again to World War II when the offensive edge became highly critical with the chimera of the "air menace" (bombing) and the reality of blitzkrieg. But the Germans shot their edge by failing to understand the nature of their opponents and the possible consequences of an illusive victory.

The radical changes in the twentieth century came from the advent of the internal combustion engine and electricity, both of which had political, economic, social, and ideological consequences, not to mention the military ones. In the latter case, change tended to be in the charge of junior officers commanded and managed by senior officers who were unattuned to its potential and ultimate significance.

While many agree that the Great War of 1914–18 developed into a stalemate because of the inability of governments to manage such vast industrial, military, and social enterprises, we suggest that the very occurrence of both world wars can be blamed on the paucity of management skills. The legacies of the past all fostered an inability of governments to grasp the depth and breadth of the issues and delayed their making effective responses. These effects produced both a sense of the inevitability of conflict and a lack of comprehension as to how it might be averted. The prewar secret treaties were a legacy of monarchical absolutism and peacetime lethargy and

complacency, a balance that had been upset by the emergence of the new powers—the United States after 1865, Japan after the Tokugawa period (1603–1868), and Germany and Italy following the wars of unification in Europe (1871 and 1860, respectively). Each of these powers flourished in a Mackinder heartland (the core area of Eurasia) and saw its destiny in mercantilist imperial expansion.

Like their mercantilist predecessors, the "imperialist" managing elite, including those in the older powers—Britain, France, and Russia—failed to take into account the impact of medicine, population growth, urbanization, and the mechanization of agriculture. Underlying the new age was the rapid spread of scientific knowledge. All of these developments accelerated growth when coupled to the steam and telegraphic evolutions, which in their turn spawned fresh management techniques and new methods of feeding the urban masses.

The management of World War I required the reinvention of the medieval planned economy, the mobilization of all of the society's resources, and the establishment of additional ministries to order and control the necessities or sinews of war. And these new bureaucracies tended to be staffed and led by an influx of amateurs and professionals bringing such methods as cost accounting. The war also demanded imaginative financing. The Germans disdained paying for the war as they went and suffered ultimately through hyperinflation and bankruptcy. The British followed the precedents of the Napoleonic Wars and accumulated an enormous bonded indebtedness, including that to the United States. What was forgotten was that the object of war should be peace and trade. Unfortunately, the legacy of military ineffectiveness was inflation, depression, and unemployment. The Treaty of Versailles of 1919 exacerbated the situation and indicated that the leadership of the victors did not understand business management and, accordingly, was not apt to demonstrate competence in matters of national economy and grand strategy. This led to vast unemployment throughout the industrialized world. Ironi-

cally it can be argued that in Britain, for one, greater spending upon national security would have pumped money into the economy, the ripple effect of which would have led to recovery, while at the same time providing the strength to impose a nonappeasing diplomacy. That would have been a true deterrent. Unfortunately, the political-psychological effect of weakness led to the very expensive World War II.

As new ministries came into being and as technology became more complex, so Parkinson's Law of a six percent per annum growth of bureaucracy came into effect. Examination of the British Air Ministry's *Distribution of Duties* shows that the size of the bureaucracy was relatively stable from 1917 to 1934 but that it grew exponentially thereafter. The ultimate effect of this technological expansion was that by 1944 when RAF Bomber Command at last reached its planned strength of 100 heavy bomber squadrons, it had a rising unserviceability rate due to a shortage of radar mechanics in a society which had had few wireless sets before 1939.

It should also be noted here that when the British prime minister Neville Chamberlain appeased Hitler at Munich, he did so for military technological reasons as well as personal weakness and ignorance. He was fully aware of how weak his country was because he had been financing the defense requirements since 1932, two years before the Geneva disarmament talks collapsed in 1934. An industrialist himself, he understood that change took time. He was also aware in September 1938 at Munich that in the midst of change in fighters, RAF Fighter Command was impotent and Britain defenseless against the air menace.

Japanese leadership was similarly myopic, especially in the matter of reserving experienced pilots, as they flew until they were killed or incapacitated. Thus their hard-earned lessons were not passed on to the neophytes. At the same time, the indiscriminate drafting of able-bodied men, regardless of their skills, is a classic example of Japanese managerial shortsightedness, which sacrificed long-term productivity for short-term military manpower increases. In the case of the longshoremen, the army took

stevedores and then had to clear the consequent backlogs in the ports using a larger number of draftees lacking in the skills needed for efficiency. This meant that the army's combat power actually declined. At the same time, direct military supervision of industrial facilities, because officers mistrusted the profit motive, further reduced production efficiency and left a legacy of mistrust of the military in the *zai batsu* management, whose skills were challenged by junior officers placed in command of their complexes.

The whole quarrel within air forces and governments over grand-strategic bombing versus tactical air forces can be seen as a struggle for efficient management of resources of all sorts. Victory through airpower was possible, but only in cooperation with surface forces able to defeat the enemy on land and at sea. Ironically, while in the West the Allies carried the air war home to Germany and impressed upon Hitler's followers that in modern war no one was immune to attack, the Soviets saw grand-strategic bombing as the greatest postwar imperialist threat and reacted accordingly.

When the Germans attacked in 1941, the Soviets were able to display their managerial understanding of the nature of modern war. They were on their third five-year plan, had the experience of wars in Spain and Finland, and had the perspicacity to start moving their industrial base east of the Urals. Thus they could field air armies of up to 4,000 aircraft on any front. They had leapt from the Middle Ages to modern war by unhorsing the aristocrats.

At sea, naval officers lacked not so much technical abilities as they did strategic and tactical perceptions. But naval management was unable to think of the consequences of the new unconventional undersea and air weapons they reluctantly championed, either dismissing them or overrating their effectiveness. In World War I, Adm Sir John Jellicoe, one of the technical leaders of the Royal Navy, knew so much that he made himself into a pessimist who was forced to readopt convoys as the requisite counter to U-boats. In 1939 the Admiralty once again adopted convoys but lacked (until 1943) the necessary

escort vessels both to protect the merchant-men and to hunt and kill the predators. The grand-strategic management battle in London was over the allocation of resources—to build escorts in Britain to defend the convoys or bombers to obliterate the submarine

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The war at sea required the management of all resources from raw materials to finished products.

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building yards in Germany. It was simply a question of destroying U-boats before they could put to sea and hide in the vast reaches of the oceans, or of bombing cities. In the meantime, the Germans had refined the basic Type VII World War I design into a true Type XIX submersible, which employed the German chemical genius for torpedoes, engines, and even the health of crews.

The war at sea required the management of all resources from raw materials to finished products. A part of this was the development of successful shore-based antishipping strikes, an offensive in which the new operational-research scientists (the boffins) played a key role in achieving effectiveness. Both the Germans and Italians deployed antishipping strike forces. The former in the landlocked Mediterranean were countered by conquest and the latter by employing escort carriers on the Murmansk convoy routes.

The very vastness of the Pacific with its few atolls created a very different war. The Japanese attack on Pearl Harbor knocked out the US Navy's battleship force, while allowing much of it to be salvaged and rearmed for the new judo blitzkrieg carrier and amphibious conflict. The May–June 1942 Battle of Midway showed that carriers were both potent and vulnerable. The decline of the Imperial Japanese Navy started off the China coast in the late 1930s, when carrier operations were so successful that naval management did not foresee the need to prepare for a long-term training pro-

gram to provide replacement aircrews. The result was that in contrast to the US Navy's thoughtfulness in accumulating a pool of aircrews, the Japanese lost their first team and had neither the time nor the fuel to replace them. And when the ultimate air assault on the "Home Islands" came, enough planes existed to have made a more effective resistance if trained pilots had been available.

The Japanese had for a long time bifurcated management at the top because of two political realities: the army and the navy were intense rivals, and no agency, institution, or individual proved strong enough to prevent military predominance in matters of national policy. And even each service was divided so that, for example, one of the principal commands in China, the Kwantung army, was independent of Imperial headquarters in Tokyo and chose its own course, including open hostilities with the Union of Soviet Socialist Republics (USSR) at Khalkin Gol in 1939, while Japan was already embroiled in a struggle with China. Yet, one of the basic prerequisites for management is to know both the limits of the organization and of oneself. Strengths and weaknesses should be both a guide and a limitation when matching means to ends.

The Japanese also failed to recall the lessons of their destroyers in escort duties in the Mediterranean in World War I and so, like the Royal Navy, neglected the commerce-raiding submarine threat, which eventually brought the island kingdom to its knees before the air attacks began. In other words, the Japanese high command mismanaged key assets so that they became the Achilles' heel of their expansionist grand strategy. They ignored the advice of their sometime Harvard business school graduate and former naval attaché Adm Isoruku Yamamoto that the United States would be a fatal nemesis.

In the cases of Germany and Japan, the top management became so hypnotized by their early successes that they took on too many enemies at once, partly through an arrogant misappraisal of their enemies' weaknesses. They overlooked the fact that in war, victory needs to come quickly and be complete for

very sound political, diplomatic, military, economic, scientific and technological, medical, social, and ideological reasons. Ultimately, in a long war, victory is likely to go to those who have the greater economic, intellectual, and manpower stamina and who make the fewest managerial mistakes, a point not to be overlooked in the twenty-first century.

In many ways 1945 marked a sharp division between the Victorian age and the modern. A great many technological revolutions had taken place by the end of World War II, innovations which had vastly increased the costs of war and readiness and complicated the reliability of military devices, thus spreading the impact and cost worldwide. This was epitomized by the nuclear revolution, though the extent of the changes wrought by this phenomenon was parleyed out of context by airmen continuing their crusade both for independence and their belief that bombing or its threat could end all conflicts. In fact the opposite has transpired, as minor wars continue to occur. These have been harder to handle, as there has not been the jingoism at home to support them since the massive losses of life in both world wars. More recently the stakes have not been victory but return to the *status quo ante bellum* by means of a limited struggle. And in a place like Bosnia or Kosovo, planning and managing an airpower response faces pesky little problems, such as multiple 23 mm cannon or shoulder-fired missiles.

In Korea the conflict followed so closely after 1945 that experience and expertise were readily available, while two new developments on the technical side were the unusable atomic bomb—checkmated by the Soviet development of one—and the jet aircraft. The result was a contest more like an American football game of controlled violence limited by many lines and fine rules. The no-win situation led to paranoia at home and the election of yet another soldier president, Eisenhower. The Cold War was the dominating grand-strategic theme from 1947 to the collapse of the Soviet Union in 1991, a failure caused by massive mismanagement.

The Cold War made for a complex scenario or business plan rather akin to earlier US foreign policy with two notable differences—NATO and forward American deployment in Europe, and enforcement of the Monroe Doctrine of 1823, now by the United States instead of the Royal Navy. Part of the deterrent force was the US Navy's Polaris submarine fleet created by Adm Hyman Rickover, a man with business and political acumen coupled to engineering and scientific skills and drive, which paralleled that of Rear Adm William A. Moffett in his creation of US naval aviation in the 1920s.

Ultimately, in a long war, victory is likely to go to those who have the greater economic, intellectual, and manpower stamina and who make the fewest managerial mistakes, a point not to be overlooked in the twenty-first century.

On the Soviet side, the managers in the Kremlin were driven by fear of capitalist strength and bellicose statements about the USSR, as well as by the need to recover from the Great Patriotic War of 1941–45 and to maintain full employment. The Kremlin did little cost accounting and no cost-benefit analysis, maintaining instead monolithic forces which rotted from the top down until Afghanistan destroyed them in 1979–89.

In the meantime, sales of arms abroad allowed various minor countries to defend themselves. However, many turned into ongoing guerrilla contests, which sopped up used arms from various sources, delivered by devious routes and means, sometimes as parts of the East-West struggles and complex financial schemes. In many ways, walking into such conflicts, particularly "people's wars," is like going to a North American mall, where the staff and the customers all dress alike. For bureaucratic military machines such as the US armed services, fighting an antiguerrilla war was ex-

tremely trying, as in Vietnam with all the complexities of operating seven different air forces in one war—a management headache.

These difficulties could be traced back to Washington's fear of the domino effect and to instant communications, which allowed micromanagement. Lack of understanding of the nature of the war, omission of a cost accounting of body counts, and the like led to a wasteful expenditure of American resources (estimated at $465,000 US for each dead enemy). It would have been far cheaper to have opened giveaway supermarkets and seduced the enemy with goods.

What makes the Israeli management of conflict successful is its efficiency. Wars with the Arabs, of which the Gulf was an adjunct, have been swift and clean, demonstrating the flexibility of airpower and the benefits of combining all the assets of the state to achieve victory by matching means to ends and ends to means. Hours and just-in-time resupply have always been critical for the Israelis. Maximum benefits have been derived from both training and leaving out complexities for simplicity and serviceability.

In the future only a higher direction with either its own or vicarious historical experience will have the breadth to manage conflicts. Many of the important human factors will remain constant, in spite of the differences between the generations, and while classic weapons will change very slowly now, new technologies will be weaponized. Nuisance wars may involve more intensely human operations in strange and inhospitable territories, unless a major war breaks out between civilized powers. Bosnia, Afghanistan, and other places present situations of internecine, national-religious hatreds and problems of arms supply and sequestration. Management of conflict in such cases involves a supraregional view in which political overtones will likely rule.

In the past, war was the business of the State, and it generally remains so today, even if under a UN flag or directed against non-state terrorists. It is a complex but irregular activity which requires flexible planning, cost-benefit accounting, manpower, prescient management, and total awareness of political nuances.   □

Some Suggested Readings on the Management of and for War

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Operation LUSTY
The US Army Air Forces' Exploitation of the Luftwaffe's Secret Aeronautical Technology, 1944–45

DIK ALAN DASO, PHD

Editorial Abstract: The bewildering pace of development in aerospace-power technology immediately follow ing World War II was no accident. The author's account of the highly successful efforts of Army Air Corps leaders to exploit German technology at the end of the war is a story that still has lessons for us today.

USAF photo

Caltech professor Theodore von Kármán, the "dean of American aeronautics"

IN *NEW WORLD Vistas,* the US Air Force's science and technology (S&T) study of 1995, Dr. Gene McCall wrote about the relationship of technology to the Air Force after almost 50 years as an independent service: "It was clear in 1945 that the technology gains of the first half of the twentieth century should be consolidated to create a superior, technology- and capability-based Air Force which could respond to threats not yet imagined. The world which emerged from the destruction of World War II could not have been predicted in 1945, but the emphasis on technology and capability rather than on assumptions about future geopolitical scenarios served us well as we entered the Cold War."[1]

Technology is fundamental to the culture of the US Air Force. For the most part, this technology culture appeared at the same time as the air service itself, due to the nature of heavier-than-air flight. For nearly a century, technological progress has occurred in starts and fits as well as leaps and bounds, ex-

USAAF photo

Dr. Kármán (right) wears the uniform of an Army Air Forces colonel (sans eagles) during Operation LUSTY.

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ploding geometrically as it accompanied the visionary efforts of key individuals and programs. In conducting analyses of technological efficiencies in anticipation of tomorrow's complex threat environment, one would do well to consider the past successes of some of these key players in technological development. In particular, a seminal turning point occurred on the heels of World War II as part of a plan to exploit German scientific advancements. The plan was called Operation LUSTY (for Luftwaffe secret technology).

Technological change during World War II proceeded at a frightening pace. Developments in aircraft design, propulsion, weapons, and electronics contributed vitally to the outcome of events in the global conflict. At the heart of these developments were scientists, largely civilians, who worked to produce military equipment that would turn the tide of the war. Among them was the youthful Hungarian aerodynamicist Dr. Theodore von Kármán. Since his arrival in the United States from Europe, having obtained Guggenheim funding and hoping to avoid rising nationalism and Nazism, he had become acquainted with several Army air officers, among them a young major named Henry "Hap" Arnold, who would later command the US Army Air Forces (AAF) throughout World War II.

Since their first meeting at the California Institute of Technology (Caltech) in the early 1930s, Arnold had witnessed the professor's skilled use of mathematical equations to solve complex aerodynamic problems. After inheriting command of the Army Air Corps in 1938 and driven by a near-obsessive belief in the efficacy of scientific approaches to Air Corps problems, Arnold called civilian scientists to a meeting at the National Academy of Sciences building in Washington, D.C., in 1939. Among the visitors was a team from Caltech, including Kármán. At that meeting, Arnold doled out scientific projects, such as finding a solution to high-altitude windshield icing and developing aircraft radios and jet-assisted takeoff (although the term *jet* was a misnomer). Kármán assigned the difficult rocket project to his most senior students at Caltech, the

"suicide club." From that small project grew what is today the Jet Propulsion Laboratory near Pasadena, California. More importantly, Arnold's trust in Kármán grew as the Caltech program continued to tackle the most difficult projects without hesitation. Arnold did not tolerate a "no-can-do" attitude.

By war's end, General Arnold had decided that the AAF was in a position to capitalize on World War II's many technological developments. He also realized that the United States and its Allies by no means led the world in military aeronautical development. He used his influence with Kármán, convincing him to head a task force of scientists who would evaluate captured German aeronautical data and laboratories for the AAF. As the Allies advanced into Europe during the spring of 1945, Kármán's team, close on the heels of the advancing wave, scoured German laboratories. For the AAF, Operation LUSTY began during a supersecret meeting between General Arnold and Dr. von Kármán on the runway at LaGuardia Airport, New York.[2]

Only after D day and the realization of several key elements in wartime operations did Arnold believe that Allied victory in Europe was a foregone conclusion. The air war had become a deadly routine. At that point, it was merely a numbers game—Allied air strength versus dwindling Axis air capability.

The Normandy invasion occurred under the umbrella of air supremacy. The P-51 had operated successfully with drop tanks for several months with encouraging results. Additionally, B-29 production had increased to acceptable levels. For the operational needs of combat, this long-range, heavy bomber became Arnold's Pacific trump card. He had devoted a great deal of personal effort to ensure its development, despite severe engine problems initially. Only after assuring himself that these production and procurement programs were succeeding did the general set his sights on developing S&T for the AAF.[3]

General Arnold and Dr. von Kármán stayed in "continual conference" after the LaGuardia encounter. Kármán recalled that he was "more impressed than ever with Arnold's vi-

sion,"[4] and Arnold insisted that Kármán ex-
amine everything and let his "imagination
run wild."[5] This challenge fitted perfectly into
Kármán's philosophy, including the belief
that imagination was a vital part of the inven-
tion process.[6] To ensure the excellence of this
crucial task, Arnold imposed no completion
deadline (a luxury he later rescinded) and in-
sisted that Kármán's group travel to many for-
eign countries, assess their aeronautics pro-
grams, and then fashion a bold final report—
a viable forecast for maintaining future Amer-
ican air supremacy.[7] Arnold's establishment
of the forecasting group itself was totally se-
cret—almost "cloak and dagger."[8] To accom-
plish his mission, Kármán officially became
an AAF consultant on scientific matters on 23
October 1944.[9]

Kármán's first, unofficial AAF report was
organizational in nature, naming as his deputy
Dr. Hugh L. Dryden, long-time head of the
National Bureau of Standards. November 1944
saw endless conferences and establishment of
"relations with the various agencies in the
labyrinth of military and scientific aviation."[10]
Arnold drafted official, written instructions
on 7 November, solidifying the LaGuardia
Agreement, a four-page letter that set the
boundaries for the report of Kármán's group.
They were not very restrictive: "Except per-
haps to review current techniques and re-
search trends, I am asking you and your asso-
ciates to divorce yourselves from the present
war in order to investigate all the possibilities
and desirabilities for postwar and future war's
development as respects the AAF. Upon com-
pletion of your studies, please then give me a
report or guide for recommended future AAF
research and development [R&D] pro-
grams."[11] Initially, Kármán's group was called
the AAF Consulting Board for Future Re-
search, but apparently *AAFCBFR* proved too
long an acronym, even for the Army. Redesig-
nated the Scientific Advisory Group (SAG)
on 1 December 1944, it reported directly to
General Arnold.[12]

Germany's last, desperate attempt to end
the war at the Bulge occurred as the scientists
gathered, anticipating their chance to exploit

the work that German scientists had done over
the last five to seven years. In January 1945, Kár-
mán's handpicked, scientific team of "thirty-
one giant brains" congregated in Washington
to begin the monumental task Arnold had
given them. Initially, Kármán met internal re-
sistance to a few of his choices for the group—
for example, Sir William Hawthorne, an En-
glishman. Col Frederick E. "Fritz" Glantzberg,
Kármán's military assistant, voiced his objection
to having any "foreigners" in the group. Kár-
mán reminded the colonel that Arnold wanted
the best people, regardless of their origins.
Glantzberg relented, conceding that "the
British were, after all, our Allies." Kármán also
insisted upon adding a naval officer, William
Bollay (a former Caltech student). When the
colonel insisted that the professor had gone
too far, Kármán responded with the simple
question, "But Colonel, the Navy are surely our
Allies too?" After considering this for a mo-
ment, Glantzberg finally agreed that they were:
"Not as close as the British, but a damn sight
closer than the Russians."[13] For administrative
reasons, neither of these men served in the
group until 1949, but Arnold wanted the best
and did not care how Kármán carried out that
order. Arnold envisioned and enacted the con-
cept of "jointness" long before the term was for-
malized in the Pentagon almost half a century
later with the enactment of the Goldwater-
Nichols Department of Defense Reorganiza-
tion Act.

A five-star general since December 1944,
Arnold insisted that the group throw conser-
vative thinking to the wind. Kármán then re-
minded the scientists in his quiet, broken
English that they had to deliver on their
promises. Unsurprisingly, the younger mem-
bers of the team found working in the SAG
the "equivalent of a semester of grad school
each day."[14] In mid-January 1945, Arnold suf-
fered a severe heart attack and retreated to
Florida to recuperate. Fortunately, he had al-
ready given Kármán his marching orders.[15]

SAG meetings held during the first weeks
in February, March, and April accomplished
the basic research and finalized the general
format for the report. Kármán emphasized

that these spring meetings had a threefold purpose: (1) the SAG would search for ways to secure "scientific insight in a standing Air Force"; (2) it would ensure the continued interest of American scientists in the future of the Air Force; and (3) the group would educate the American public in the necessity of maintaining a strong Air Force.[16] These objectives may have seemed remarkably vague, but specifics in design and engineering were not really part of the SAG's overall task. Actually, this sweeping view predated America's entry into the war. In the *Pasadena Star News* of 24 February 1941, reporters quoted Kármán as saying, "So rapid has been the development of military aircraft during the present war, it is impossible to forecast what performance limits will be obtained by warplanes before the war ends."[17] For reasons such as this, a broad approach to technology forecasting remained uppermost in Kármán's mind, and he convinced Arnold of the same.

USAAF photo

A camouflaged German aeronautics laboratory seen from the air

As mentioned above, in late April 1945, SAG members departed for Europe to inspect liberated enemy laboratories. Operation LUSTY, a name that the cosmopolitan, unmarried young professor sardonically suggested was "unlikely but pleasant," fulfilled Arnold's insistence that the SAG investigate the most advanced S&T aeronautical infor-

Dickey Collection, US Air Force Historical Research Agency

Caches of technical documents were hidden, along with assembly locations for V-1 and V-2 rockets, in underground tunnels such as this one.

mation available worldwide.[18] LUSTY was the code name for a much larger operational, exploitation expedition of European technologies initiated by the US Army, of which the SAG represented only one small part. Arnold's instructions to Gen Carl "Tooey" Spaatz, commander of US Strategic Air Forces in Europe, were crystal clear: "May I ask . . . in view of the importance of this project that you give it your personal attention."[19] Already alerted to Arnold's belief in science, Spaatz did just that. In September 1944, while traveling to the second wartime Quebec Conference, Arnold had informed Spaatz of his belief in the "value and the importance of these long-haired scientists."[20] Already, Arnold had secretly established the SAG as proof of this commitment. Spaatz's immediate cooperation was vital to the success of the SAG's contribution to Operation LUSTY.

After the scientists arrived in Paris on 1 May 1945, one member of the team, H. Guyford Stever, observed the critical nature of timing during the Allied advance. He recalled that, although local looting often presented a problem, the advancing Russians were the real concern. More significantly, Stever mentioned that "until this von Kármán mission, we [scientists] had to piece the enemy's facts together. Now

we had the advantage of actually talking to the German scientists and engineers, seeing their laboratories, and hearing them describe their total programs."[21] Dr. Dryden echoed Stever's conclusion: "I think we found out more about what had been going on in the war in a few days [*sic*] conversations with some of these key German leaders, than all the running around and digging for drawings and models . . . could bring."[22] Only after Kármán arrived did the group discover the scope of Germany's S&T efforts.

To preserve that scientific picture, the American teams boxed up everything they could and immediately shipped it to Wright Field, Ohio, the AAF's center for aeronautical R&D. First on the scene at one location, Navy exploitation teams quickly boxed up the hardware and technical data in large crates and labeled them "US Navy." Two days later, Army teams made it to the same location, whereupon they crated the Navy boxes in larger crates and relabeled them "US Army."[23] For these reasons—some good, some ridiculous—immediate access to targets became crucial. Spaatz provided the transportation capability to meet these requirements.[24] His personal involvement in the early days of the SAG's visit to Europe helped strengthen his own understanding of its capabilities during his tour as the first chief of staff of the independent Air Force.

Among the discoveries in Germany during the "scientists' invasion" were rocket-propelled fighter planes, radio-controlled bombs, guided antiaircraft missiles, and practically every type of fighter aircraft in the Luftwaffe inventory. The most surprising ones included a jet-powered helicopter built by Doblhoff, swept-back wings hung in high-speed wind tunnels, hidden assembly locations for V-1 and V-2 "vengeance" weapons, and plans for V-3 (intercontinental) rockets capable of reaching targets on the east coast of the United States; many of these rockets were deep below ground in hidden caves. Under the watchful eye of American scientists, including Kármán, German technicians launched several of the V-2 rockets from test sites during the summer and fall months.

Perhaps of even greater significance were thousands of linear feet of data and documents that accompanied these projects—the teams shipped more than 100,000 tons to a London clearinghouse that spring. Upon close examination, many of these German studies confirmed the path that American science had already taken. Some, the jet-powered helicopter for instance (the fourth modification of the original autorotator design), came as a total surprise.[25]

Rocket construction was well advanced, and test equipment was a frequent find. This Feuerlilie was not even completely assembled.

After six weeks of traveling throughout the devastated European countryside, the professor met Arnold—now recovered from his January heart attack—in Paris on 13 July 1945 to discuss the team's initial findings. General Arnold, who was traveling to join President Truman at Potsdam, Germany, and did not have much time, asked the professor to prepare a report that summarized the SAG's discoveries. Kármán submitted *Where We Stand* on 22 August, satisfying that request.

This summary of the exploitation of German S&T that Kármán's men had unearthed began by listing a set of eight aspects of aerial

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This autorotator variant used a jet engine for propulsion. Exhaust was expelled and ignited through the tips of the helicopter rotors (insert).
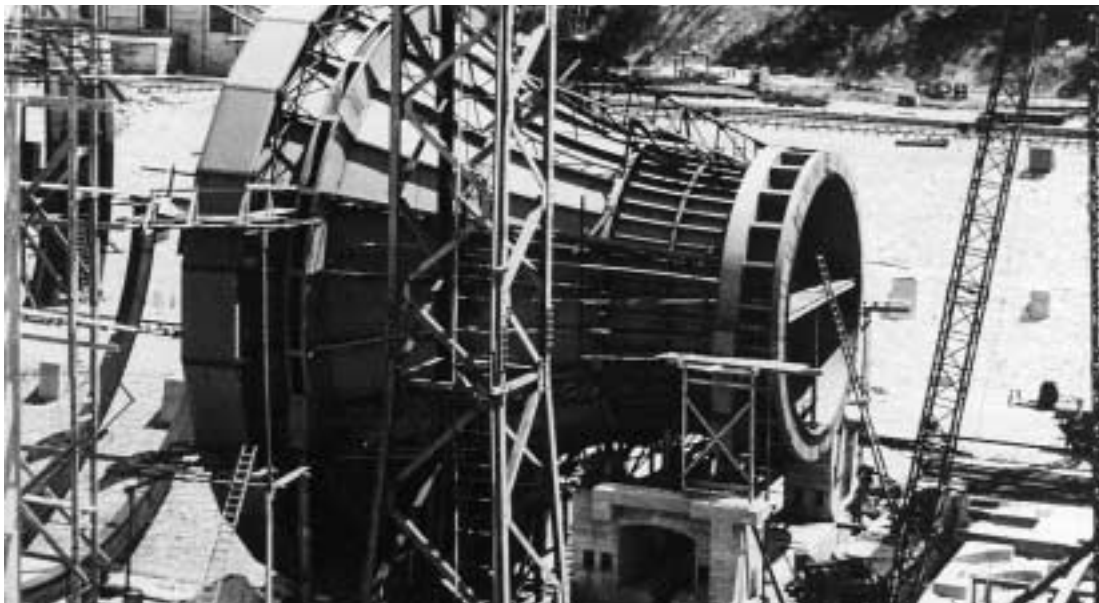
Dickey Collection, US Air Force Historical Research Agency

Enormous wind tunnels like this one, under construction, housed advanced aeronautics facilities.

warfare which, Kármán believed, had become "fundamental realities":

1. Aircraft—manned or pilotless—will move with speeds far beyond the velocity of sound.

2. Due to improvements in aerodynamics, propulsion, and electronic control, unmanned devices will transport means of destruction to targets at distances up to several thousand miles.

3. Small amounts of explosive material will cause destruction over areas of several square miles.

4. Defense against present-day aircraft will be perfected by target-seeking missiles.

5. Only aircraft or missiles moving at extreme speeds will be able to penetrate enemy territory protected by such defenses.

6. A perfect communication system between fighter command and each individual aircraft will be established.

7. Location and observation of targets; takeoff, navigation, and landing of aircraft; and communication will be independent of visibility and weather.

8. Fully equipped airborne task forces will be enabled to strike at far-distant points and will be supplied by air.[26]

Additionally, the report sought to explain why Germany was more advanced in some areas but lagged in others. The title itself reflected Kármán's evaluation of US posture in regard to foreign scientific developments.

For example, the report did not attribute German achievements in aeronautics to superior scientists but to "very substantial support enjoyed by their research institutions in obtaining expensive research equipment such as large supersonic wind tunnels many years before such equipment was planned in this country."[27] These tunnels supported development in the field of transonic and supersonic wing design to the point of "practi-

Dickey Collection, US Air Force Historical Research Agency

Still hanging in the wind-tunnel test sections were advanced wing designs—most notably, "swept-back" wings that would increase speed and maneuverability.

Dickey Collection, US Air Force Historical Research Agency

cal application," whereas advanced design ideas were only at the discussion stage in America, spearheaded by Kármán and others after the Volta Conference of 1935.

Kármán's summary added a warning: "We cannot hope to secure air superiority in any future conflict without entering the supersonic speed range." Additionally, the report stated that "V-2 development was successful not so much because of striking scientific developments [but] because of an early start, military support, and boldness of execution."[28] An early start, unlimited funding, and bold execution of German scientific plans became a recurring theme throughout the report.

However, the United States held substantial leads over the Axis in some areas, such as radar development:

> It must be realized that radar is not a facility of attachment which will occasionally be used under bad conditions. Rather, the Air Force of the future will be operated so that radar is the *primary* facility, and visual methods will only occasionally be used. . . . Hence, in an all-weather Air Force, radar must be the universally used tool for bombing, gunfire, navigation, landing, and control. The whole structure of the Air Force, the planning of its operations, its training program, and its organization must be based on this premise. The development and perfection of radar and the techniques for using it effectively are as important as the development of the jet-propelled plane (emphasis in original).[29]

Today, this realization appears the most prescient of all those made during a period when the AAF's primary doctrine (in Europe certainly)—that of precision, strategic, daylight bombing—was based largely on the ability to acquire the intended target visually.[30] Kármán also pointed out that the Germans had failed to keep stride with the rest of the world because "most of the development took place in industrial laboratories . . . but the very brilliant group of German physicists in universities were never called in to participate. Consequently, while engineering design was good, imaginative new thinking was lacking." Kármán could detect the absence of imagination and individual brilliance—whether in his stu-

dents or in notable scientists. Further, he predicted that "the ability to achieve Air Force operations under all conditions of darkness and weather contributes more than any other single factor to increasing the military effectiveness of the air forces. Hence, any research program designed to overcome the limitations to flight at night and in bad weather will pay big dividends." Aware of the rapid improvements in radar technology, the professor suggested that the Air Force "be alert in swiftly utilizing any new developments."[31]

By emphasizing radar, Kármán also indirectly assured that the Massachusetts Institute of Technology (MIT) would share in future military research projects. During the war, the MIT Radiation Laboratory led the development of American radar. Generally, just as Caltech held the reins of AAF aeronautical science, so did MIT direct AAF radar programs. In fact, the addition of Dr. Edward Bowles to Arnold's staff in 1943 linked radar and electronic programs to the AAF, much as Kármán's association had linked aeronautics in earlier years. The rivalry that developed between these schools was friendlier than Caltech's rivalry with the National Advisory Committee for Aeronautics (NACA). Both schools held particular expertise in different areas of technological development, and, for the most part, each respected the other's accomplishments.[32]

After publication of this initial report, Kármán began the arduous task of compiling the SAG's detailed work. Suddenly, the deliberate pace normally associated with scientific research was replaced by a great sense of urgency to complete the project. Fearing radical budget cuts at war's end, Arnold cabled Kármán, still in Europe, wondering if the report might be finalized by 15 December 1945. To accommodate the general's request, Kármán canceled an inspection of Japanese aeronautical laboratories (which he had helped to establish at Kobe in 1927) and sent a few of his team members to the Orient instead. From October through December, work proceeded at a frenetic pace. After many sleepless nights, Kármán had the draft version of the final

report, *Toward New Horizons,* delivered to Arnold's desk on 15 December 1945.[33]

Kármán's summary volume, *Science: The Key to Air Supremacy,* introduced the classified 12-volume report.[34] In essence, this volume amplified the tenets of the August report with a few significant additions. It addressed the problems associated with "research and development from the point of view of the technical requirements which the Air Force must meet in order to carry out its task, securing the safety of the nation." The third chapter elaborated upon correcting the organizational and administrative problems addressed in *Where We Stand.* Most notable of these was a plea for government authority to "foster," not "dictate," basic research.[35] This long-range, extremely detailed study was the first of its kind in American military history. Along with *Where We Stand,* it would serve as the blueprint for building the Air Force during the next two decades.

General Arnold was so interested in the possibilities of future airpower development that, based upon Kármán's preliminary report, he offered his personal perceptions of the SAG's importance to General Spaatz. Arnold reminded Spaatz, his successor, that

the AAF had no great scientists in its ranks. Military R&D labs had stagnated during the war, largely due to increased production requirements and personnel shortages. The AAF had required civilian help during the war to solve aircraft power-plant and structural-design problems. Only with civilian assistance had the service been able to realize its S&T potential. Arnold reminded Spaatz that "these men did things that the average Army officer could never have accomplished. We must not lose these contacts."[36] Today, through organizations such as the Scientific Advisory Board (SAB), the Air Force continues this tradition through a variety of contacts in civilian industry and academia.

Spaatz took Arnold's advice to heart and established the SAB as a permanent group; it met for the first time on 17 June 1946. It was not, however, attached to the commanding general, as Kármán had suggested, but was relegated to Gen Curtis E. LeMay, deputy chief of the Air Staff for R&D.[37] Nevertheless, the SAB survived postwar cuts by providing scientific advice to higher levels of Air Force leadership. The imperfection of the new system was eventually repaired.

USAF photo

In June 1946, the secret Scientific Advisory Group met officially as the Scientific Advisory Board, an organization that still exists. Kármán (at the head of the table) ran the show until the mid-1950s.

The Arnold/Kármán team, although it existed officially only from November 1944 to February 1946, created the plan that has since evolved into the S&T infrastructure of today's Air Force. Gen Bernard Schriever, father of the Air Force's missile program, once said of Arnold, "There's no question, his greatness was that he created the infrastructure. He visualized the kind of infrastructure that the Air Force needed to really get into the technology age."[38]

In addition to the SAG, Arnold established Project RAND and the Office of Scientific Liaison and funded dozens of guided-missile programs before postwar demobilization and inevitable budget cuts slowed the procedure. Kármán and the SAG assumed the strenuous task of traveling the world in search of the most advanced technologies, constantly mindful of how these advances might be applied to American airpower. In the end, Arnold's recognition of the need for such a study and Kármán's unique ability to apply scientific findings to the practical, technological needs of the Air Force—helped along by lifelong associates at opportune times and places—produced a report that had great potential for long-term success.

Such success, however, carried no guarantees. Initially, funds were scarce, and leadership was in constant flux. The reorganization of the National Military Establishment into the Department of Defense only added to the quagmire. Somehow, by the nature of his association with both officers and scientists, Kármán prevented the newly formed SAB from stalling. He nurtured its structure and function in the face of misunderstandings, opposing agendas, and, at times, lack of interest until the board was capable of independent growth. By 1954, a decade after the process began, Kármán's vision—guided by his own perseverance—proved directly responsible for sustaining the SAB. Yet, Arnold's ghost was never far away. During this period, the general's lifelong associations with officers, industrialists, and scientists continually surfaced. Such people as General Schriever, Lt Gen Laurence Craigie, Lt Gen Benjamin Chidlaw,

Larry Bell, Donald Douglas, and Dr. Bowles were all vital to the eventual institutionalization of *Toward New Horizons.*

Only after Kármán was certain that the SAB would thrive did he resign his chair. Similarly, just as Arnold's influence continued to be felt, so did Kármán's. Former students, colleagues, and friends who had been educated by or employed with the professor carried his broad-based, practical-applications approach to problem solving as part of their own methodology—in several cases, into the mid-1990s. Arnold's drive and Kármán's method, embodied in the institutionalized SAB, had become the Air Force's foundation for S&T matters.

Airpower institutions have evolved erratically since World War I. In *Ideas and Weapons,* I. B. Holley concluded that "the postwar [World War I] Air Service made use of only a relatively small portion of the experience of the war regarding the problem of weapons."[39] One lesson learned, however, was that quality was preferable to quantity as far as weapons were concerned. Arnold had internalized that lesson. Unfortunately, administrative organizations that might have assured high-quality weapons development during those years had been neglected. Another lesson learned—perhaps the most significant one—concerned unity of command. According to Holley, "the available evidence shows that after the war the Air Service learned the importance of organization for decision and established channels of command for unified, decisive, and authoritative action in contrast to the dispersed, ill-defined, and overlapping channels that existed during the war."[40] This very development allowed Arnold to act as a stopgap, ensuring that the lessons of the Great War had not fallen on totally deaf ears. Arnold acted as the AAF's tangible link between the lessons of World War I and the institutionalization of S&T that became reality after World War II. Ordering the blueprint that became the S&T cornerstone of American airpower is one of Arnold's legacies—creating it is one of Kármán's.

General Arnold looking skyward at soaring AAF aircraft

As hundreds of American military soldiers and CIA operatives rummage through caves in war-torn Afghanistan in search of enemy documents and leaders, we are reminded that we have accomplished similar missions before. The intelligence retrieved during Operation LUSTY was part of the process by which the US Air Force entered its technological infancy. Over the past 60 years, developing air and space technology has created the means to improve the human condition or to bring devastating destruction to unsuspecting enemies anywhere in the world. Lines have become blurred between military and civilian aviation and space technology, just as it is difficult to distinguish among those who utilize these technologies for their own purposes.

Today, it remains clear that technology developments made during the twentieth century should be consolidated to create a superior technology- and capability-based twenty-first-century Air Force that will be able to respond to threats not yet imagined. What is unclear is the kind of world that is emerging from the rubble of the World Trade Center and Pentagon. The emphasis placed upon technology and capability that has been the hallmark of the Air Force over the past half century must be molded more and more by future geopolitical scenarios.

As much as ever before in Air Force history, national aerospace power faces difficult challenges in its quest to achieve desired effects against complex, ruthless, and elusive enemies both at home and on foreign soil. Fortunately, because of the efforts of people like Arnold and Kármán, the Air Force now has many technological tools that contribute to achieving national-security objectives and attaining global stability. Today's perceived technological superiority is forcing the Air Force and the nation to reassess how best to apply these technologies during the uncertainties already developing during this new millennium.   □

Notes

1. Gene H. McCall and John A. Corder, *New World Vistas: Air and Space Power for the 21st Century: Summary Volume* (Washington, D.C.: Scientific Advisory Board, 1995), iii. For an examination of the technological culture of the Air Force, see Carl H. Builder, *The Icarus Syndrome: The Role of Air Power Theory in the Evolution and Fate of the U.S. Air Force* (New Brunswick, N.J.: Transaction Publishers, 1994). See also my article "*New World Vistas:* Looking toward the Future, Learning from the Past," *Aerospace Power Journal* 13, no. 4 (Winter 1999): 67–76. The author wishes to thank the USAF Historical Research Agency and Air University Press, both at Maxwell AFB, Ala., for their support early in the development of this article.

2. The LaGuardia meeting holds a quiet, yet legendary, place in the history of the Air Force's S&T development. In his later years, Kármán recalled the meeting but not the details. Arnold's plane arrived, jostled by the rough winds of a passing cold front, and Kármán, recovering from recent abdominal surgery, was transported by Army staff car to the end of the runway, where the general joined him after deplaning. Arnold dismissed the military driver and then, in total secrecy, discussed his plans for Kármán and his desires for the exploitation project. Arnold spoke of his concerns about the future of American airpower, and he wondered how jet propulsion, radar, rockets, and other "gadgets" might affect that future. "Vhat do you vish me to do?" Kármán asked with a thick Hungarian accent. "I want you to come to the Pentagon and gather a group of scientists who will work out a blueprint for air research for the next 20, 30, perhaps 50 years," Arnold replied. After promising to give all of the orders on Kármán's behalf (the professor insisted on that caveat), Arnold hopped back in his plane, the deal done. Kármán, flattered and excited, was impressed that General Arnold had the vision to look beyond the war, seeking the help of university scientists. The timing of Arnold's request was not accidental. See Theodore von Kármán with Lee Edson, *The Wind and Beyond: Theodore von Kármán, Pioneer in Aviation and Pathfinder in Space* (Boston: Little, Brown, 1967).

3. Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II,* vol. 6, *Men and Planes* (1955; new imprint, Washington, D.C.: Office of Air Force History, 1983), 218–19.

4. Kármán, *The Wind and Beyond,* 267–68; and Clark Millikan to William Knudsen, letter, 3 October 1944.

5. Gen H. H. Arnold to Gen Carl Spaatz, letter, 6 December 1945; and Arnold to Gen Ira C. Eaker, letter, 22 May 1945, both located in the Hap Arnold Murray Green Collection, USAF Academy Library, Special Collections (hereinafter MGC). See also Craven and Cate, vol. 6, 234; and Thomas A. Sturm, *USAF Scientific Advisory Board: Its First Twenty Years, 1944–1964* (Washington, D.C.: USAF Historical Division Liaison Office, 1967), 37.

6. "Disney Folder," Kármán Papers, California Institute of Technology, no. 59.2.

7. Henry H. Arnold, *Global Mission* (New York: Harper and Brothers, 1949), 532–33, reinforced by a cable sent to Spaatz toward the end of the war, 15 April 1945, in MGC.

8. On 25 October, in a reply to a letter from Lt Gen George Kenney concerning future planning, Arnold detailed more than 30 specific actions pertaining to aircraft production and design, but he did not mention the Kármán project, already under way. Arnold added only a brief clue in a postscript: "There is still more that is being prepared now but will not be actuated until the Post-War Period." In a speech to the Aeronautical Research Laboratory of the National Advisory Committee for Aeronautics (NACA) on

9 November 1944, Arnold cryptically told the gathering of scientists and engineers that when the AAF got stuck in a development problem or when it looked toward the future of aeronautics, "*normally* we go to the NACA and ask you people to do that work for us." But Arnold would not go to the NACA this time. Just as he had secretly given the Whittle jet-engine-development problem to the Bell/ General Electric team in 1941, he now gave the critical task of forecasting the requirements for obtaining future air supremacy to Kármán and his scientists.

9. Scientific Advisory Board (SAB) Office, 1944–1945 file, Pentagon, Washington, D.C.

10. Kármán's first report for the Scientific Advisory Group (SAG), 23 November 1944, in MGC; Kármán to Clark Millikan, letter, 4 November 1944, Kármán Papers, California Institute of Technology, no. 73.6; and Michael H. Gorn, *The Universal Man: Theodore von Kármán's Life in Aeronautics* (Washington, D.C.: Smithsonian Institution Press, 1992), 99.

11. Arnold to Kármán, letter, subject: Instructions for Forecasting Group, 7 November 1944, SAB Office, 1944–1945 file, Pentagon, Washington, D.C.

12. SAB Office, Pentagon, Washington, D.C.; Kármán's first report for the SAG, 23 November 1944, MGC, ref. L/C box 79; Gorn, 99–100; H. H. Arnold Papers, Headquarters Office Instruction 20-76, MGC, L/C box 40; and Arnold to Kármán, letter, 7 November 1944, SAB Office, Pentagon, Washington, D.C.

13. Kármán, *The Wind and Beyond,* 269–70; and William Rees Sears, *Stories from a Twentieth Century Life* (Stanford, Calif.: Parabolic Press, 1993), 219.

14. Kármán, interviewed by Shirley Thomas, cassette tape, University of Indiana Library, 1960; T. F. Walkowicz, "Von Kármán's Singular Contributions to Aerospace Power," *Air Force Magazine,* May 1981, 60–61; and Gorn, 47.

15. Arnold to Lois Snowden, letter, 22 February 1945, MGC. The general described his condition to Lois, his daughter, in mechanical terms: "Apparently one of my cylinders blew a gasket and I had to get down here to have an overhaul job done. . . . While I was here they checked my lubrication, ignition, and gasoline system and they said they were working alright."

16. Sturm, 5.

17. "No Way to Predict Future of Warplane Performance," *Pasadena Star News,* 24 February 1941, Kármán Papers, California Institute of Technology, no. 157.2.

18. Kármán, transcript of oral history interview, n.d., US Air Force Academy Library, Colorado Springs, Colo.; Chester Hasert, National Academy of Sciences, Washington, D.C., interviewed by author, 10 November 1994; and Operation LUSTY folder, Air Force Historical Research Agency, Maxwell AFB, Ala.

19. Lt Gen Barney Giles (for Arnold) to Spaatz, letter, 19 April 1945, Kármán Papers, California Institute of Technology, no. 90.2; Kármán, *The Wind and Beyond,* 272; Gorn, 103–5; and Kármán, oral history interview.

20. In a reply to an earlier letter praising radar developments, Arnold wrote Spaatz on 12 September 1944, affirming his trust in scientists, MGC, roll 12.

21. H. Guyford Stever, Washington, D.C., interviewed by author, 18 May 1995.

22. Hugh L. Dryden, Columbia University Oral History Review, 24.

23. Dr. Homerjoe Stewart, Pasadena, Calif., interviewed by author, 21 July 1995.

24. Stever interview. Dr. Stever was working with the British radiation laboratory as part of the MIT exchange team when LUSTY operations began. He was attached to Kármán's group in place of Dr. L. DuBridge, who was unavailable. Stever is a former chairman of the SAB from 1962 to 1964 and a former presidential science advisor.

25. Ibid.; Dr. Richard P. Hallion, interview for *New World Vistas,* videotape, Office of Air Force History, Bolling AFB, Washing-
ton, D.C.; summary of memo from Kármán to Arnold, 30 July 1945, which documented the group's travels to that point, MGC, roll 12; and "History of Operation Lusty, 6 June 1944–1 February 1945," US Air Force Historical Research Agency, Maxwell AFB, Ala., file 570.650A.

26. Theodore von Kármán, "Where We Stand: First Report to General of the Army H. H. Arnold on Long Range Research Problems of the Air Forces with a Review of German Plans and Developments, 22 August 1945," typed manuscript (Wright-Patterson AFB, Ohio: Air Force Materiel Command History Office, August 1945), 1–2. Sturm's *USAF Scientific Advisory Board: Its First Twenty Years* includes the evolution and decline of the group through 1964. Alan Gropman has nicely summarized the report itself in "Air Force Planning and the Technology Development Planning Process in the Post–World War II Air Force—The First Decade (1945–1955)," in *Military Planning in the Twentieth Century: The Proceedings of the Eleventh Military History Symposium, USAFA, 10–12 October 1984* (Washington, D.C.: Office of Air Force History, 1986), 154–230. Kármán's reports may be found in the appendices of my book *Architects of American Air Supremacy: Gen. Hap Arnold and Dr. Theodore von Kármán* (Maxwell AFB, Ala.: Air University Press, 1997), the only publication in which the Kármán reports are published together and in their entirety.

27. Kármán, *Where We Stand,* 5.

28. Ibid., 8, 12, 21.

29. Ibid., 75–76.

30. Maj Gen Haywood Hansell Jr., to author, letter, 4 October 1979. Although the AAF did accomplish a limited number of area-bombing missions in Europe, these were supplemental to precision attacks in almost every case.

31. Daso, *Architects of American Air Supremacy,* 283–85.

32. Jack H. Nunn, "MIT: A University's Contribution to National Defense," *Military Affairs,* October 1979, 120–25.

33. Kármán, *The Wind and Beyond,* 290; and Gorn, 113–14.

34. Theodore von Kármán, *Science: The Key to Air Supremacy,* summary vol. to *Toward New Horizons: A Report to General of the Army H. H. Arnold, Submitted on Behalf of the A.A.A. Scientific Advisory Group* (Wright Field, Dayton, Ohio: Air Materiel Command Publications Branch, Intelligence, T-2, 15 December 1945), 1.3.

35. Kármán, *Toward New Horizons,* commemorative version (Wright-Patterson AFB, Ohio: Headquarters Air Force Systems Command History Office, 1992), 69–84. Although future attempts were made to repeat the forecast, none made such a monumental impact on the structure or the vision of the US Air Force. Originals of the Kármán report are located in both the Arnold Papers and Spaatz Papers in the Library of Congress as well as at the Air Force Materiel Command Archives at Wright-Patterson AFB, Ohio.

36. Arnold to Spaatz, letter, 6 December 1945, MGC.

37. Sturm, 14–15.

38. Bernard A. Schriever, Washington, D.C., interviewed by author, 10 November 1994.

39. I. B. Holley Jr., *Ideas and Weapons: Exploitation of the Aerial Weapon by the United States during World War I: A Study in the Relationship of Technological Advance, Military Doctrine, and the Development of Weapons* (1953; new imprint, Washington, D.C.: Office of Air Force History, 1983), 176. The following discussion is based on Dr. Holley's summary and conclusions.

40. Ibid., 177.

Between Two Worlds
Fodder for Your Professional Reading on Global Reach and Air Mobility

Dr. David R. Mets

Editorial Abstract: Since fighters and bombers get most of the attention in our Air Force, where can an officer go to learn about the equally important topic of air mobility? In the lat est installment of his popular "fodder" series of articles, Dr. Mets gives an excellent synopsis of the history of air mobility and provides another useful reading list for more in-depth study.

FOR SOME YEARS now, *Aerospace Power Journal* has published a series of articles designed to provide tools for Air Force mentors to employ in local efforts to stimulate professional reading and even writing.[1] Inspired by Col Roger H. Nye's

The Challenge of Command: Reading for Military Excellence (Wayne, N.J.: Avery Publishing Group, 1986), a classic work designed to achieve similar purposes for Army forces, each article is designed to provide a brief overview of the history and status of a partic-

ular area of the Air Force's core competencies. Each one also includes a sampler list of books that might enhance the reader's professional knowledge. Previous articles in the series have dealt with air superiority, strategic attack, airpower at sea, the Gulf War, and World War II in the Pacific. Here, we turn to the subject of air mobility—the connection between the logistical base in the homeland and the soldier on the battlefield.

The article begins with a summary of air mobility before Pearl Harbor and then takes a quick look at how the aerial movement of goods and people changed during World War II, noting the existence of a dichotomy in the culture of air transportation. In large part, this story involves the evolution of distinct subcultures into a single mobility culture that has aspired to incorporate both efficiency and combat effectiveness. One element concerned itself with the logistical use of air transport, and the other saw its primary role as the employment of airlift aircraft for the movement of forces directly into combat. These two cultures coexisted under Military Air Transport Service (MATS) and Tactical Air Command (TAC) through the Eisenhower years and beyond.

Before the end of the 1950s, however, a movement had begun—partly at the instigation of Gen William Tunner—to better distinguish military airlift from commercial aviation. Combat became the most important discriminator—airlift would go into dangerous, austere areas where commercial aviation had no desire to tread. This resulted in a blurring of the lines between tactical and strategic airlift in a long effort to merge the two under one command. The first step entailed the creation of Military Airlift Command (MAC) in the 1960s, followed by the initial transfer of tactical airlift forces from TAC to MAC in the 1970s. No one had given much thought to incorporating air-refueling functions into MAC in the early years. But the consolidation of lethal airpower in Air Combat Command (ACC) in the early 1990s resulted in the transfer of most tankers from the disestablished Strategic Air Command (SAC) to MAC—renamed Air Mobility Command (AMC) to account for the acquisition of the new air-refueling function. The article then addresses the status and future of air mobility at the dawn of the twenty-first century and closes with the customary sampler of books designed to enhance the professional study of air mobility.

An Air Mobility Timeline

1915	Aerial-resupply attempt during siege of Kut, Iraq
1918	Billy Mitchell's plans for infantry drop
1919	First transatlantic flight—NC-4, US Navy
1923	First aerial refueling
1926	Founding of Air Corps
1929	Seven-day refueling flight of *Question Mark*
1934	Airmail fiasco
1935	First flight of DC-3 (C-47)
1940	German airborne operations in Low Countries

1942	Establishment of Air Transport Command (ATC)
1942–45	Hump operations supplying China
1943	Allied airborne drops in Sicily
1943	Airborne drops at Normandy, France
1944	Airborne drops at Arnhem, Netherlands
1945	Operation Varsity drops across Rhine River
1947	Founding of US Air Force
1948	Establishment of MATS
1948–49	Berlin airlift
1952	Founding of Civil Reserve Air Fleet (CRAF)
1956	First production model of C-130
1964	First operational C-141
1966	Army/Air Force agreement on theater airlift
1966	Renaming of MATS to MAC
1968	Aerial resupply at siege of Khe Sanh, South Vietnam
1973	Aerial resupply of Israel during Yom Kippur War
1974	Transfer of all C-130s to MAC
1990–91	Gulf War
1992	Disestablishment of SAC
1992	Establishment of ACC
1992	Renaming of MAC to AMC
1992	Transfer of C-130s from AMC to ACC
1997	Transfer of US C-130s back to AMC
1999	Air war over Serbia

Mobility and the Air Corps

Even before the airplane became a practical proposition, dreamers envisioned movement through the air—and immediately discovered diverse purposes. From the beginning, they saw the airship in multiple roles. It promised to be much cheaper than a cruiser for scouting at sea and seemed to represent a new mode of transporting goods and people over long distances and all sorts of obstacles, quickly and at a low price. Even before the zeppelins came on the scene, people speculated that a new kind of warfare was at hand—bombardment from above at very long ranges. Aircraft attempted aerial resupply, with 50-pound sacks, at the siege of Kut in World War I, and Billy Mitchell had plans to deliver troops via parachute in

Lt Gen Frank M. Andrews, here at the controls of a C-47, commanded General Headquarters Air Force when Gen Henry "Hap" Arnold was assistant chief of the Air Corps. Andrews tried hard to have transports assigned to his command so that his bomber and fighter units would have mobility.

1919, but the end of the war prevented that—fortunately for the troops.[2]

In the American interwar context, the military did not do much with what has come to be known as air mobility. The Air Service successfully experimented with air refueling in 1923 and again in 1929.[3] The Air Corps tried to develop organic airlift to support the mobility of its striking forces but did not get very far in that age of austerity. It also experimented with regular logistical runs by air to improve mission-ready rates and lessen the costs of inventorying high-value parts.[4]

World War II and the Roots of Air Mobility

Before the onset of war, the Air Corps did most of the thinking about air transport—for the Air Corps. But after Pearl Harbor, two other major inputs emerged: mobilization by the airline people for wartime service, and our experience with the Luftwaffe's airborne-assault units, which prompted us to take action.[5] The former event laid the foundation for ATC, and the latter stimulated both the British and American armies to follow the Germans and the Russians into troop-carrier kinds of operations. Notwithstanding some giant fiascoes in the airborne experience and generally sound air-logistics operations, both modes of movement came out of the war with powerful followings.[6] They led to two distinctly different cultures within the American airlift tradition.

Air Transport and Troop Carrier

One can place much of the blame for the wartime airborne fiascoes upon the inferior technology of gliders. The helicopter made a few appearances in the war, but not many people foresaw its great utility in tactical air mobility.[7] Most airmen felt that conventional aircraft optimized for airborne delivery would provide the most practical solution; for example, the C-123 started out as a glider design to which engines were added. This line of thinking led to the organization of dedicated troop-carrier units assigned to TAC, entrusted with the primary mission of airborne operations and aerial resupply and the secondary mission of logistical support.

Meanwhile, the other line of thinking resulted in the organization of what came to be known as a strategic airlift force—MATS. It grew out of the wartime Air Transport Command (labeled "Allergic to Combat" by troop-carrier wags) and assumed the stereotypical burden of being just another airline. Within a month of the creation of MATS (from merging the old ATC and the Naval Air Transport Service), the Berlin airlift commenced, adding a great deal of prestige to the logistical use of air transport. Tunner, then a major general experienced in the logistical world of the Hump operation, deployed from MATS to Europe about a month after the blockade began. He came home with the major share of credit for the success of the airlift, which had become an exercise in scheduling and air-transportation efficiency among well-developed air terminals.

Maj Carl A. Spaatz, who became the first Air Force chief of staff in 1947, commanded a refueling experiment in 1929, during which the Question Mark *aircraft and its five-man crew stayed airborne for 150 hours.*

The Emergence of Military Airlift

The Berlin airlift led to the notion that sometimes the nonlethal forms of airpower could directly achieve national objectives, which helped greatly with the building of MATS in its early years. The troop-carrier function remained a part of TAC during those years but only as a secondary mission in a command dominated by fighter pilots and some light-bomber crewmen. This force competed with MATS for funding and other support. In those days, MATS flew the C-54, C-97, C-118, C-121, and finally the C-135, all of them designed for airline or air-transport operations. The exception was the C-124, designed for Army mobility but flown by many other commands (including troop-carrier units) as

well. Thus, the airline industry, feeling that its profits were being undermined by the military flyers, became another source of competition for MATS.[8] Meanwhile, TAC acquired a number of airplanes optimized for airborne and assault operations, including the C-82, C-119, C-123, and, above all, the C-130 Hercules, built to TAC requirements at a time when its design could benefit from the lessons of the Korean War.[9]

General Tunner spent the early and mid-1950s in important assignments outside the air-transport world but returned as the commander of MATS in 1958. He had a hand in stimulating the change of the institutional culture from air transport to airlift, highlighting the notion that the functions of military airlift—particularly its important combat ele-

The C-17, here deploying infrared missile countermeasures, can enter environments too dangerous and austere for airliners.

ment—were distinct from those of civilian airlines. The military also moved away from modified airliners to specialized airlifters quite different from commercial craft—specifically, the C-141, followed by the C-5 and then the C-17. All three exceeded the capability of commercial aircraft in terms of going into harm's way and operating in austere environments. The turboprop C-130 already had many of the design features of its jet-powered counterparts, but the latter retained the advantage in terms of size and range. To a degree, these aircraft merged the air-transport and troop-carrier cultures, but that was far from complete. The new craft also reduced the anxiety of the commercial airlines and won important support from the US Army.[10]

The establishment of CRAF in the 1950s reduced the cost of military airlift and at the same time also diminished the concerns of the airlines. Since the government could not afford to build an airlift fleet sufficient to meet national emergencies, only to have much of it remain on standby during peacetime, it entered into an agreement with the airlines. This arrangement held that, in return for providing additional airlift in emergencies, the airlines would receive favored status in the awarding of government contracts during routine operations. CRAF served only as insurance for many years until it first mobilized for the Gulf War, during which it provided vital service.[11]

However, civilian airlines might opt out at crucial moments—witness the final evacuations of Vietnam in 1975. Near the end of the war, the Federal Aviation Administration's reclassification of South Vietnam as a dangerous combat area had the effect of canceling the insurance of any civil aircraft operating there. That, in turn, caused the airliners to withdraw from the operation, and the entire load then fell upon military aircraft and helicopters. In the Gulf War, insurance concerns also limited CRAF's activities in-theater—the airliners could not operate at nighttime in areas threatened by Iraq's Scud missiles, for example.[12]

The Consolidation of Strategic and Tactical Airlift

General Tunner retired in 1960, and a struggle ensued in the next decade and a half regarding the command and control (C^2) of tactical and strategic airlift. In general, the strategic airlifters controlled MAC, the successor organization to MATS, and they seemed to focus on the efficiencies that centralization of like functions under one national command might achieve. Their opponents generally consisted of people associated with the old troop-carrier culture and TAC. Tactical airlifters and their theater commanders seemed to focus on the effectiveness that arose from centralizing the command of all kinds of airpower at the theater level. This organic airlift, added to the usual airpower order of battle, thus would give theater commanders everything they needed for the task of winning.

Meanwhile, the increasing use of helicopters to do what tactical airlifters and gliders used to do at the battlefield end of the process diminished the potency of the troop-carrier argument. This issue came to a head in the middle of the Vietnam War (1966) with an Army/Air Force agreement. In the future, the Air Force would concede most helicopter functions to the Army, and the Army would get out of the fixed-wing tactical-airlift business by transferring its C-7 Caribous to the Air Force.[13] Since the Caribous did not last long in the Air Force and since they were not replaced with new planes, the transaction represented another step away from the battlefield for the troop-carrier tradition.

All of this maneuvering made orphans of the tactical airlifters, especially the C-130s. Theater commanders wanted them for their combat and logistical utility; MAC wanted them for the sake of consolidating functions. But they were not the primary systems in either command. When ACC came on the scene in the early 1990s, the tactical-airlift units wound up there but soon returned to AMC, which now wielded a functional unity of command over all fixed-wing air movement—except for some C-130 units assigned to theater commanders for the task of contributing to deterrence and winning the theater battle.[14]

The Age of Air Mobility

Over time, the heyday of the strategic bomber passed as ICBMs and submarine-launched ballistic missiles became more practical and as the Soviet threat eventually disappeared. But the tanker portion of SAC remained as vital to theater air warfare as it had been to the bomber force—and even to the airlift force itself by extending the range of C-5s and air-refuelable C-141s and thus overcoming the diminishing access to en route stations overseas. Finally recognizing the imbalance, in the early 1990s the military created US Strategic Command, modified the bomber force to better handle conventional air-attack missions, and established

The C-141 represented the technological side of the transformation of MATS's air-transport culture into MAC's airlift mind-set. After encountering difficulties with overflight and landing rights in the Yom Kippur War, the Air Force modified the fleet for air refueling and lengthened the fuselage to permit a greater payload.

ACC to prepare for all theater air-warfare functions. But what about the tankers?

Most of the tankers were assigned to MAC, now AMC, in order to include air refueling in that command's functions. But a new problem arose on the way toward merging the old air transport and troop-carrier cultures. Having resided in SAC for many years and having become fully assimilated to it, the tanker community now had to meld its culture into AMC's—and that took time. Sometime during the process, the old designations of *strategic* and *tactical* airlift increasingly fell into disuse and were supplanted by *intertheater* and *intratheater* airlift.

At least for the time being, creation of a two-hatted position provided a solution to the old C^2 problem. The Gulf War of 1991 included a director of mobility forces (actually known as the commander of airlift forces although the later director did not actually

A KC-135 refuels a pair of F-16s over Bosnia. The Air Force has many of these aircraft, operational since the 1950s. AMC must eventually deal with the rapidly rising cost of flying them, however.

command and also had responsibility for tanker forces), a position that seemed to work. In the Gulf War, that leader came from MAC sources but worked directly for the joint force air component commander for the duration of the campaign. The Air Force tried the same position again in the air war over Serbia. This time the director of mobility forces was collocated with the theater air commander at Ramstein Air Base, Germany, and worked for him, encountering little difficulty (although one should remember that neither of these campaigns involved a long, drawn-out land battle).[15]

It fell to the director of mobility forces to integrate the efforts of the strategic airlifters with the tactical-mobility units. The functional duality of the tankers further complicated the job. Some of them were dedicated to building an air bridge from the United States to the combat theater. The shooters would de-ploy along that bridge, refueling in midair on the way. Other tankers had to be dedicated to a tactical task, that of providing prestrike and poststrike fuel to the shooters and extending the on-station time of low-density/high-demand assets such as airborne warning and control system (AWACS) and joint surveillance, target attack radar system (JSTARS) aircraft. The tanker airlift control center at Headquarters AMC controlled air refueling along the air bridge. But in the air war over Serbia, the combined air operations center in Italy under the combined force air component commander planned and controlled the tanker force assigned directly to combat support. Partly due to the uncertain duration of the campaign, tanker planners of insufficient numbers and rank attempted to keep up with the process. Ultimately, a tanker colonel deployed to provide "top cover" for the hands-on refueling planners and to serve as the tankers' representative to other elements. The planners, assigned to work for the air operations center's combat plans division or combat operations division, developed a process that was working relatively smoothly at the end of the campaign. Recommendations emerged to make this tanker process a part of doctrine, but some doubters argued that it violated doctrine applied only in circumstances like Kosovo.[16]

The mobility task became even more complicated with the growth of the C-17 force, which had a foot in both the strategic and tactical worlds. It proved a mighty supplement to the force, deploying units from the States to the theater and at the same time participating in such in-theater operations as the movement of Task Force Hawk to the Balkans. Its direct-delivery mode brought it closer to the battlefield, a capability that seemed successful as of the end of the air war over Serbia. As always, though, the test was not definitive because that conflict proved more permissive to airpower, of far shorter duration, and presumably less stressful to intertheater air-mobility forces than a major theater war might be.

Air Mobility in the New Century

At the outset of the twenty-first century, air mobility had come a long way since bundles were dropped at Kut in World War I. A new technology had evolved that was unique to air refueling and to both the strategic and tactical forms of airlift. Accompanying doctrine had also developed through the decades, and an organization to apply these things to war had matured. According to Eliot Cohen and Thomas Keaney, the Gulf War demonstrated that the United States led the world in air-combat technologies, but many other countries also had fighters and missiles competitive with America's. But no one else had C^2 systems like our AWACS and JSTARS, space systems, and especially our airlift and tanker assets. Keaney and Cohen assert that many years, even decades, will pass before any state can hope to build up a complete airpower system including air mobility and C^2 assets that will rival that of the United States. That superiority, they argue, may empower the United States to sustain a period of international peace and prosperity longer than any in the past.[17]

However, many people also argue that America must take especial care to sustain the mobility part of the system. The Army will advocate robust ground forces,[18] the Air Force will certainly continue to favor combat aircraft and space systems, and the Navy will sponsor national power at sea. But only one Air Force major command serves as the advocate of air mobility—it is not the top priority for any of the services. True, its commander is also commander in chief (CINC) of US Transportation Command, but that does not seem to carry as much weight as do the geographical CINCs or service chiefs. Congress does keep a wary eye on these capabilities for various reasons. Still, the tanker fleet is nearly a half century old, and a new aircraft is barely on the horizon.[19]

The bulk of the tanker fleet consists of highly modified KC-135s, a design of the 1950s, but the reengining that produced the KC-135R makes it much more capable than the earlier versions. Although the fleet of KC-10s is of much more recent design, these air-

The modern Air Force uses both the flying-boom (above) and probe-and-drogue (below) methods of air refueling. The flying boom transfers fuel rapidly but can service only one aircraft at a time. In contrast, the probe and drogue, used by Navy aircraft, fuels too slowly for large bombers but can accommodate multiple aircraft simultaneously.

craft are relatively few in number. Because of the KC-10's size and impressive cargo-carrying capability and range, during the Gulf War we utilized many of them in the strategic airlift role rather than in air refueling.[20] Thus, in a major theater war, we might feel compelled to put the newest and largest tankers into the airlift effort, leaving the air-refueling function to the older KC-135Rs. However, two events in the fall of 2001 combined to add urgency to a tanker-replacement program and at the same time make it more feasible.

First, the terrorist attack on New York and the Pentagon on 11 September 2001 changed attitudes in Congress toward defense spending. Moreover, it further depressed the market for new airliners, which had the potential effect of lowering the unit price of replacement Boeing 767s configured as tankers. At the same time, the Air Force was contemplating a dual-track program to use the same airframe to modernize platforms for its airborne intelligence gathering and C^2 systems. Second, Lockheed-Martin won one of the largest contracts in acquisition history for the development of its F-35, the joint strike fighter, which further reduced the potential workload for the Boeing plants and threatened to increase unemployment in their vicinities. Simultaneously, the first campaign of the war on terrorism began in Afghanistan, whose distance from the United States and scarcity of airfields complicated the problem. That situation obviously increased the strategic need for both tankers and airlifters, adding to the impetus. Consequently, many congressional delegations renewed their interest in implementing an early tanker-replacement program—and in increasing the C-17 buy (also built by Boeing). Japan's and Great Britain's contemplation of new tanker programs and Italy's commitment to one might also lower the unit cost for new Air Force 767s. The combination of all these factors may make it possible to replace the tanker fleet and add to the C-17 fleet at a lower cost than would have been possible a year earlier.[21]

The addition of the C-17 gave the strategic airlift fleet a big boost in the number of ton miles it can produce in a given day; indeed, one C-17 is as productive as two C-141s. But the commander of AMC himself has testified that this reduces flexibility (e.g., one C-17 cannot be in two places at one time, but two C-141s with the same aggregate payload can operate on different continents).[22] This becomes a factor because of the drastically curtailed US presence overseas, the reduced numbers of en route bases, the new Air Force doctrine of air expeditionary forces, and the new Army emphasis on lighter formations that can be transported to overseas trouble spots by air. All of this increases the demands on the mobility part of the force, making it ever more difficult to move lethal forces to the scene of conflict on time and in shape to halt aggression before it establishes too firm a foothold. Seldom mentioned in the debates surrounding the mobility function is the fact that the C-130 design is as old as the tankers' and that no new airframe is on the horizon. In its direct-delivery mode, the C-17 can certainly pick up part of the load formerly known as tactical airlift, but, again, the limited number of C-17s, compared to the total number of aging C-130s and C-141s, limits flexibility—especially at the theater level. Furthermore, the C-141s will completely disappear from the Air Force inventory by 2003.[23]

As noted above, efforts are afoot in Washington to do something about the overall ton-miles-per-day shortfall by increasing the C-17 purchase yet again.[24] But that helps the flexibility problem only at the margin. Some defense contractors are looking at possible designs for a new theater airlifter,[25] but as yet no serious government program exists to bring one on-line. As of February 2001, the Air Force had plans to purchase 168 of the new C-130J aircraft, a dramatic improvement over the older Hercules but with a basic design that still harkens back to the 1950s. Furthermore, the first of these has gone to the weather-reconnaissance mission, and others will replace some of the oldest C-130Es flown by the Air National Guard and Air Force Reserve.[26] The KC-10 could pick up some of the airlift load in emergencies and could occasionally re-

lease C-17s for work in direct delivery, but, as mentioned previously, we have only a limited number available. However, Gen Charles T. Robertson, former commander of AMC, recently observed that foreign object damage (FOD) could limit the utility of C-17s in direct delivery.[27] He also cited the C-5's unreliability as a continuing problem, arguing that reengining that airplane would improve its mission-capable rate and relieve some of the pressure on the C-17 force.[28]

The issue of pilot retention creates pressures in the air-mobility force, especially AMC, whose airlift and air-refueling crews are proficient in flying aircraft similar to those used by the airlines.[29] Commercial operators, now in a growth mode, pay much higher salaries than those earned by aircrews in government service. That concern, combined with the high operations tempo in the mobility force (part of which is not included in the air expeditionary force's scheme to control that tempo), makes the situation rather serious. However, the decline in airline travel caused by the terrorist attack in September 2001 may change that.

The picture is not altogether bleak, however, for the AMC commander averred even before Afghanistan that the command could repeat its performance in Operation Desert Storm, notwithstanding the limited number of airframes and the difficulty in retaining pilots.[30] There is much more to the system than just planes and pilots, important though they may be. One such matter is increasing capacity.

Technology has enabled a global situational awareness that underlies the centralization of C^2 for all air-mobility forces in the tanker airlift control center at Scott AFB, Illinois, thus inducing efficiencies and increasing mobility capacity.[31] Too, the new air mobility operations groups at McGuire AFB, New Jersey, and Travis AFB, California, can field a C^2 capability as well as other services on the other end of the system—at austere locations and other places almost anywhere in the world. This can occur on very short notice, adding flexibility to the system. The Global Air Traffic Management System, another gain under way through software

The C-5, in service for 30 years, has mechanical difficulties that cause a low mission-ready rate. Yet, this aircraft is essential to the mobility business because of its great hauling capacity and ability to handle outsized cargo. The Air Force hopes to improve the C-5's reliability by adding new engines and making other improvements.

and hardware technology, provides for accurate navigation; collision avoidance; and automatic, instant position reporting anywhere in the world. That system, in turn, permits a freedom of routing and direct flight from departure to destination, with enormous savings in both time and costs. It also compensates somewhat for the limited number of both airlifters and tankers.[32]

One of the most distressing concerns in Operation Desert Shield had to do with tracking cargo. The incompatibility of information systems for supply and transportation and the loss of in-transit visibility of cargo led to major confusion at the airfields in the Gulf region.[33] Some progress in these areas has resulted in improved in-transit visibility with commensurate savings in airlift and air refueling because of a reduced need to reorder parts and other goods.[34] All of that, combined with hopes of eliminating the transshipment that used to occur at the interface between strategic and tactical airlift, could result in major improvements. If the C-17 can indeed do everything and more than the C-141 could in the logistical end of airlift and if it can replicate the C-130's accomplishments on or above the battlefield, then the Air Force will enjoy enormous savings. We achieved some good results in Albania during Opera-

The venerable C-130, here making a low altitude parachute extraction system (LAPES) delivery to a forward location, has been in production continuously since 1956. Much smaller but more numerous than the C-17, the C-130 has its engines on the high wing, making it less vulnerable to FOD when it operates on unpaved runways.

tion Allied Force, but, admittedly, those fields were not the most austere imaginable. As noted, General Robertson has expressed concern about FOD to C-17 engines[35] that undoubtedly would worsen if the aircraft were heavily used at even less-developed fields, such as those used by C-130s and C-123s in the Vietnam War. Conceivably, the Air Force may pursue yet another follow-on to the C-130. A new tactical airlifter presumably would be smaller and less vulnerable to FOD than the C-17. We should also have a sufficient number of them, at an affordable cost, to give mobility commanders the flexibility they need to complement the limited numbers of C-5s and C-17s as the C-130 fleet diminishes.

As we have seen, another improvement has to do with doctrine. During the Cold War, we had one principal enemy—the Warsaw Pact, a well-defined threat—and we forward-based major forces to face it. Air-mobility forces were important to Cold War strategies, to be sure, but a certain stability led to permanent basing and a well-defined route structure, doctrine, and organization. With the end of the Cold War, all of that changed.

As the attack on the World Trade Center certainly demonstrated, the new threat is uncertain, even its character—more entities than just states are now possible adversaries. Threats to our national security are dimin-

ished but still present, and our important interests face many challenges, their natures and locations uncertain. A huge drawdown in the force structure followed the end of the Cold War, and many of those remaining forces withdrew to the homeland, where their upkeep is less expensive and where they are kept ready for deployment in any direction.[36] But uncertainty, combined with the reduction in forces, leads to great turbulence in the lives of those who remain in service and causes great difficulties in retention—not just among crew members. Doctrine responded by reorganizing the Air Force along expeditionary lines (as opposed to permanent forward deployment), a move clearly beneficial to lethal combat air forces since their deployments would become much more predictable. However, this action places considerable strain on mobility forces.[37]

The lethal air forces are divided into 10 air expeditionary forces (AEF) and arranged in a schedule for deployments that will send two forces forward at a time (if needed). Each consists of fighters, bombers, and C^2 aircraft as well as other support platforms. Many of AMC's tankers and C-130s are permanently identified with each of these AEFs. This is not true of the strategic airlifters, however, which will have to support all of them as the need arises. For AMC the situation becomes especially complicated because of its heavy dependence upon Reserve forces. Both reservists and their civilian bosses have a good record of responsiveness, but they can be pressed too far. AMC does realize some benefit, especially among the tanker and tactical-airlift units, in that their attachment to specific AEFs makes life much more predictable. For the time being, the workload for much of the remainder will remain heavy, but ultimately that will level out and yield a more stable lifestyle for units not attached to AEFs.[38]

So far, American mobility forces have successfully developed the technology, doctrine, and organization to cope with all challenges, from Pearl Harbor right down to the present. They have never enjoyed a top priority but have sustained the flexibility they needed to

succeed in both wars and crises. The geographic CINCs and all the service chiefs have come to realize that they cannot succeed without the global reach of mobility forces. Hopefully, that will lead to a balance that enables our armed forces to get to the scene of trouble in time and with a force sufficiently large, capable, and sustainable to underwrite our foreign and security policies.

Ever since World War II, mobility forces have shouldered the burden of living between the worlds of logistics and combat. The favored children of neither, they had to adopt characteristics of both. From the beginning, the leadership of mobility forces has faced the challenge of devising ways to prevent the strategic-airlift culture from overwhelming the troop-carrier tradition. It has sought to build in as much air-transport efficiency as possible yet preserve the traditional troop-carrier desire for combat effectiveness. That tension goes all the way back to the conflicting demands of George Patton's Third Army, which wanted C-47s to haul its gasoline, and of the First Allied Airborne Army, which wanted them to deliver its troops directly to the field of battle. One needs to remember the imperative of cultivating the combat character of mobility forces, which oc-

curred when MATS transitioned into MAC. It is also important to take the same view of the air-refueling culture. Both cultures need to be absorbed and nourished, not overwhelmed, by the mind-set of long-range airlift. Only in this way can AMC sustain itself as something distinct from and more important than mere air transportation.

As with all the other fodder articles in this series, we close with a sampler for the air warrior/scholar—this one a list of 10 books on air mobility. Two books provide an overview of the subject, and the others should help readers add "depth and mastery," to use the words of Col Roger Nye, the man who inspired the series. I do not mean to imply that the list constitutes a definitive bibliography on air mobility—only that it provides a starting point for building a personal, professional reading program. This assumes especial importance for air mobility, which has attracted very little attention in either the media or academia; it is not even a favored subject of the official history structure. Unfortunately, we have yet to assemble enough literature on mobility to lay a foundation for solid doctrine and strategy making.[39] □

A 10-Book Sampler for Your Professional Reading on Air Mobility

Two for an Overview

The Military Airlift Command: A Short History, 1941–1988 by Roger D. Launius. Scott AFB, Ill.: Military Airlift Command, 1989.
The author, longtime command historian for MAC, writes with great authority.

Airlift Doctrine by Charles E. Miller. Maxwell AFB, Ala.: Air University Press, 1988.
The only comprehensive work available, Miller's book, written in a very short time, is based on a massive amount of work. Unfortunately, it is now dated, having been published before the tankers came to AMC, and is biased in favor of intertheater airlift. We urgently need a new version of this book.

Eight for Depth and Mastery

Arnhem 1944: The Airborne Battle, 17–26 September by Martin Middlebrook. Boulder, Colo.: Westview Press, 1994.
One of several books on the famous battle, *Arnhem 1944* is readable and effectively conveys the complexity and risks of large airborne operations.

Over the Hump by William H. Tunner. 1964. Reprint, Washington, D.C.: Office of Air Force History, 1985.
A chest thumper written largely from the strategic-airlift perspective, *Over the Hump* is nonetheless a primary source with which readers should be familiar. General Tunner commanded the Hump operations for the last 10 months of their existence, taking over the Berlin airlift forces from Gen Joseph Smith a little more than a month after the blockade began.

To Save a City: The Berlin Airlift, 1948–1949 by Roger G. Miller. Washington, D.C.: Air Force History and Museums Program, 1998.
Among the most competent of the historians in the Air Force History and Museums Program, Dr. Miller provides the best short treatment of the Berlin airlift. The author, who had access to the former communist archives, bases this impartial book on the latest scholarship.

Tactical Airlift by Ray L. Bowers. Washington, D.C.: Office of Air Force History, 1983.
The author is a distinguished historian and a veteran tactical-airlift crew member from the Vietnam War. A model official history, the book stands virtually alone in the field of academically sound historical studies of air mobility that have grown out of practical experience.

Revolution in Warfare? Air Power in the Persian Gulf by Thomas A. Keaney and Eliot A. Cohen. Annapolis: Naval Institute Press, 1995.
Although this book does not dedicate itself to air mobility, a large part of it deals with airlift and air refueling, covering those subjects impartially and authoritatively. Written by two distinguished scholars, *Revolution in Warfare?* grew out of the summary volume of the *Gulf War Air Power Survey.*

So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm by James K. Matthews and Cora J. Holt. Washington, D.C.: Research Center, United States Transportation Command and Joint History Office, Office of the Chairman of the Joint Chiefs of Staff, 1996.
In this work, US Transportation Command historians provide a good overview of the entire strategic-transportation effort in the Gulf War. It covers airlift in about 50 pages but does not address air refueling because the tankers were still a part of SAC at the time.

Passing Gas: The History of Inflight Refueling by Vernon B. Byrd. Chico, Calif.: Byrd Publishing, 1994.
Aside from the works of airplane buffs, Byrd's effort is the only commercially published book on aerial refueling available in Air University's library. Researchers must seek other materials in periodicals, SAC histories, RAND studies, and so forth. The Air Force History and Museums Program has contracted a book on the subject, but it will not see publication for some time. Engagingly written and illustrated by a former tanker crew member of

the Vietnam era, *Passing Gas* is the closest thing we have to a general history of air refuel-ing, including material on the British experience.

Anything, Anywhere, Anytime: An Illustrated History of the Military Airlift Command, 1941–1991 by Military Airlift Command, Office of History. Scott AFB, Ill.: Headquarters Military Airlift Command, 1991.

Containing substantial material on both strategic and tactical airlift, *Anything, Anywhere, Anytime* approaches authoritative status as a general history of airlift in America. Published by the history office at MAC (now AMC), it appeared before the command acquired the refueling function. An examination of its endnotes shows the heavy dependence of any history of air mobility upon official sources, many of them unpublished. A new edition of this book and its valuable appendices would be most worthwhile.

One for Good Measure

Air Force Doctrine Document (AFDD) 2-6, *Air Mobility Operations,* 25 June 1999.
Only 95 pages long, this document provides a clear overview of air mobility. It is available from the Air Force Doctrine Center's Web site at http://www.doctrine.af.mil.

Notes

1. As with the previous fodder articles, I have benefited greatly from the advice of experts in this field, including C-141 pilot and scholar Lt Col Peter L. Hays, C-130 pilot Maj Joseph S. Mets, tanker pilot Lt Col Peter Wangler, and C-17 pilots Lt Col David Allvin and Maj Adam J. McMillan. Any flaws are wholly mine.

2. Michael Fricano, "The Evolution of Airlift: Doctrine and Organization" (Maxwell AFB, Ala.: Air War College, 1 April 1996), 4, 5; and Roger G. Miller, "The U.S. Army Air Forces in Air Transport on the Eve of Pearl Harbor," in *Air Mobility Symposium, 1947 to the Twenty-First Century* (Washington, D.C.: Government Printing Office, 1998), 3.

3. Richard K. Smith, "Invisible Men, Invisible Planes: In-Flight Air Refueling," in *Air Mobility Symposium,* 59–63.

4. Miller, 1, 4; and Fricano, 7.

5. Jack E. King Jr., "The Air Transport Command: The Strongest Link in the Chain," *American Aviation Historical Society Journal* 43 (Summer 1998): 82; and Fricano, 9, 12.

6. By war's end, ATC alone had more than 3,000 aircraft and over 200,000 people assigned. King, 87.

7. Edgar F. Raines Jr., "The Army and Organic Tactical Air Transport," in *Air Mobility Symposium,* 85; and Fricano, 12.

8. This had been a concern of airline people as early as World War II. King, 90; and Fricano, 15. One result was that MATS and MAC were prohibited from transporting military dependents within the United States.

9. Fricano, 21.

10. For an authoritative discussion of these matters, see Col Robert Owen, "The Rise of Global Airlift in the United States Air Force, 1919–1977," draft, awaiting publication by the Air Force History and Museums Program; it will likely become a foundation stone of the literature on air mobility. For the Army dimension of air mobility, see Christopher C. S. Cheng, *Air Mobility: The Development of a Doctrine* (Westport, Conn.: Praeger, 1994).

11. Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare? Air Power in the Persian Gulf* (Annapolis: Naval Institute Press, 1995), 155–58; and Maj William G. Palmby, *Enhancement of the Civil Reserve Air Fleet: An Alternative for Bridging the Airlift Gap* (Maxwell AFB, Ala.: Air University Press, March 1996).

12. Thomas G. Tobin et al., *Last Flight from Saigon,* USAF Southeast Asia Monograph Series, vol. 4, monograph 6 (1978; new imprint, Washington, D.C.: Office of Air Force History, 1985), 66; and Keaney and Cohen, 158.

13. John Schlight, *The War in South Vietnam: The Years of the Offensive, 1965–1968,* The United States Air Force in Southeast Asia (Washington, D.C.: Office of Air Force History, 1988), 237–39.

14. John A. Tirpak, "Local Lift," *Air Force Magazine* 81 (Sep-tember 1998), on-line, Internet, 7 January 2002, available from http://www.afa.org/magazine/0998lift.html.

15. Lt Gen William J. Begert, "Kosovo and Theater Air Mo-bility," *Aerospace Power Journal* 13, no. 4 (Winter 1999): 16–18; and Lt Col Richard Simpson, "Command of Theater Air Mobility Forces during the Air War over Serbia: A New Standard or a New Data Point," *Airlift/Tanker Quarterly* 8 (Summer 2000): 11.

16. Begert, 21. For one doubter's view, see Simpson, 10–13.

17. Keaney and Cohen, 220.

18. The Army's requirements for airdrop capabilities and transportation of outsized cargo have frequently affected the de-sign of Air Force aircraft—witness the C-130 and C-124. Although support of the Army's own equipment acquisition usually takes a higher priority, there is increasing support for the C-17. John G. Roos, "Is the Army Set to Press the Case for More C-17 Trans-ports?" *Armed Forces Journal International,* November 2000, 2.

19. Gen Charles T. Robertson, "CinCTRANS Congressional Testimony," *Defense Transportation Journal* 55 (June 1999): 27.

20. Keaney and Cohen, 155.

21. Patricia J. Parmalee, "Refueling Tankers Eyed," *Aviation Week and Space Technology* 155 (5 November 2001): 17, on-line, In-ternet, available from ebhostvgw10.epnet.com/fulltext.asp; John D. Morrocco, "Bidders Vie for RAF Tanker Services Deal," *Aviation Week and Space Technology* 155 (9 July 2001): 41, on-line, In-

ternet, available from ebhostvgw10.epnet.com/fulltext.asp; James R. Asker, "Washington Outlook," *Aviation Week and Space Technology* 155 (3 December 2001): 21, on-line, Internet, available from ehostvgw10.epnet.com/fulltext.asp; "Because of Canceled Boeing," *Aviation Week and Space Technology* 155 (26 November 2001): 26, on-line, Internet, available from ehostvgw10.epnet.com/fulltext.asp; Bruce Rolfsen, "Air Force 767s Closer to Reality, Political Climate May Shorten Time Frame for Getting Craft," *Air Force Times* 62 (19 November 2001): 32, on-line, Internet, available from ehostvgw10.epnet.com/fulltext.asp.

22. Robertson, 26.

23. They will remain in the Reserve until 2006.

24. Frank Wolfe, "Mobility Plan Insufficient to Meet Military Strategy, Draft Study Says," *Defense Daily,* 24 October 2000, 5, on-line, Internet, 1 November 2001, available from http://ebird. dtic.mil/Oct2000/s20001024mobility.htm.

25. See Lt Col David W. Allvin, *Paradigm Lost: Rethinking Theater Airlift to Support the Army after Next,* CADRE Paper no. 9 (Maxwell AFB, Ala.: Air University Press, September 2000); and Lt Gen Ed Tenoso, "Air Mobility: Thoughts for the Future," *RUSI [Royal United Services Institute] Journal* 143 (August 1998): 58–60.

26. Bill Sweetman, "A Rising Imperative: More Demands for Airlift," *Jane's International Defence Review* 31 (February 1998): 28; and Seena Simon, "Air Force Gives C-130J Low Marks," *Air Force Times,* 26 February 2001, 16–18, on-line, Internet, 2 March 2001, available from ebhostvgw18epnet.com/fulltext.asp.

27. Perhaps AMC could learn something from Alaska Airlines on this point. That organization has operated Boeing 737-200s successfully on gravel strips in northern Alaska for a long time with relatively simple technical and procedural methods for avoiding FOD. One element, a simple blower system that utilizes bleed air to direct the gravel down and away from the inlets, seems to work quite well. Careful use of power during takeoff and reversing on landing also helps. Joseph Mets, Fort Richardson, Alaska, to author, E-mail, 7 November 2000.

28. Robertson, 27; Sweetman, 23; and Gen Walter Kross, "Readiness, Preparedness, Improvement—Themes for the Next Century," *Airlift/Tanker Quarterly,* Special Convention Issue, Fall 1997, 28.

29. Robertson, 27.

30. Ibid.

31. "The TACC & M2K: Real Time Mobility Command and Control," *Airlift/Tanker Quarterly* 8 (Fall 2000): 26–28.

32. Sweetman, 22; Gen Charles T. Robertson Jr., "Mobility 2000: The Way Ahead," *Airlift/Tanker Quarterly* 8 (Fall 2000): 23; and John L. Cirafici, *Airhead Operations—Where AMC Delivers: The Linchpin of Rapid Force Projection* (Maxwell AFB, Ala.: Air University Press, 1995), 82.

33. Keaney and Cohen, 178, 198; and Fricano, 33.

34. Col David E. Todd and Lt Col Phil Bossert, "Viewing Rapid Global Mobility as a Revolution in Military Affairs," *Defense Transportation Journal* 55 (October 1999):16, 50–60.

35. Robertson, "CinCTRANS Congressional Testimony," 26.

36. Lt Col Gregory Cook, "Watchwords of Change," *Airlift/Tanker Quarterly* 8 (Summer 2000): 14.

37. "EAF: Dawn of a New Era," *Airlift/Tanker Quarterly* 8 (Winter 2000): 12–20; for a summary of the AEF, see John A. Tirpak, "The Long Reach of On-Call Airpower," *Air Force Magazine* 81, no. 12 (December 1998), on-line, Internet, 24 December 2001, available from http://www.afa.org/magazine/1298airpower.html.

38. "EAF: Dawn of a New Era," 18.

39. The sampler contains only published sources. In addition to Colonel Owen's unpublished dissertation (note 10), see the following: John Douglas Harrington's two worthy studies: "United States Strategic Doctrine and the Evolution of Military Airlift" (master's thesis, University of Pennsylvania, 1987); and "Neglected U.S. Military Missions: Contending Theories of Bureaucratic Politics and Organizational Culture and the Case of Airlift Mobility" (PhD diss., Georgetown University, 1996). Both are in the Air University Library; they are also available through the Defense Technical Information Service.

So in the Libyan fable it is told that once an eagle, stricken with a dart, said, when he saw the fashion of the shaft, "With our own feathers, not by others' hands, are we now smitten."

––Aeschylus

Slumlords
Aerospace Power in Urban Fights

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Editorial Abstract: Urban warfare will likely become the norm in future conflicts. Captain Thomas's description of this challenging environment gives airmen a perspective that may prove helpful in winning the urban fight.

AIRMEN KNOW THE urban fight. Airmen of Fifth Air Force coordinated Marine Corsair strikes in the campaign for Seoul, Korea, in 1950. Airmen of Seventh Air Force struggled through gloomy skies to put 500-pound bombs on North Vietnamese army positions in the citadel of Hue, South Vietnam, during the Tet offensive in 1968. Desiring to avoid a house-to-house fight in the streets of Beirut, Lebanon, in 1982, Israel used airpower to besiege the Palestine Liberation Organization for several weeks. Airmen of Central Command Air Forces applied decisive force in the streets of Baghdad, Iraq; Kuwait City, Kuwait; and Khafji, Saudi Arabia, during the Persian Gulf War in 1991. But since past achievements do not necessarily guarantee current readiness, airmen need to review their urban-warfare doctrines, techniques, and overall readiness for the urban fight.

The changing character of American warfare necessitates this new look. All services are engaged in the transformation to a more expeditionary, technologically sophisticated force capable of achieving national objectives

without destructive, bloody force-on-force engagements.[1] It means applying our strengths against an adversary's vulnerabilities to attack his centers of gravity directly and with increased discrimination.[2] Among our many joint-force strengths, aerospace power stands out as highly relevant to this "asymmetric force strategy" and is increasingly relevant to the urban fight as well.

This article aims to enhance the thinking of airmen and their leaders about how to apply aerospace power in urban warfare.[3] It is not directly about strategy, tactics, techniques, or procedures. Rather, it adds to those areas with an operational focus on *control*—the ability to dominate an adversary's influence over strategic outcomes.[4] This article acknowledges the good work on tactics and technologies begun by the joint force in recent years but bemoans the persistent inadequacy of operational concepts. It builds on the concept that urban warfare is not just a mission or task but terrain that is complex and demanding. The urban-warfare battle space has two uniquely challenging components: people and infrastructure. This is the environment that airmen must be ready for in the future.

Urban Future

Airmen will fight in cities, which are integral to operations across the spectrum of conflict for two principal reasons: urbanization and strategic value. Both of these areas are increasingly important factors for the future, when, as we anticipate, the level of conflict will increase in cities as it takes on a variety of forms.

Urbanization

Although rapid urban growth by itself may not make the case for the inevitably increasing frequency of urban combat, as the argument goes, clearly growing urbanization on a global scale has important implications for warfare. People have been migrating to cities for centuries, primarily for socioeconomic reasons. In the industrial and postindustrial eras, cities have become centers for economic growth.[5] Yet, urban growth becomes a source of instability and potential conflict when its rate surpasses the capacity of government to provide for the basic needs of its residents. Decaying cities often portend the failure of a state.[6] According to the United Nations Population Division, virtually all the population growth expected from 2000 to 2030—2 billion persons!—will occur in urban areas.[7] Of this, 1.9 billion persons will be added to urban cities of the developing world. When city governments and economies cannot keep up, the result is relative deprivation, social tension, and, ultimately, collective violence.

Potentially more important for airmen is the way urbanization is occurring—ad hoc and out of control. One sees the most dramatic growth in the "million cities," those with populations between 1 and 10 million. By 2015, there will be 516 such cities, compared with only 270 in 1990.[8] But these cities generally do not receive priority for limited state resources.[9] Moreover, growth does not occur in the city's core but along the fringes, resulting in urban slums beyond the reach of government. As seen on the periphery of Delhi, India; Karachi, Pakistan; or Cairo, Egypt, this new urban sprawl constitutes its own highly complex system whose links to the industrial core are minimal at best. In essence, they exist next to each other but rarely interact. Therefore, rapid urbanization in developing countries results in a battle-space environment that is decreasingly knowable since it is increasingly unplanned.

Strategic Value

In addition to the fact that urbanization engenders social conflict, airmen will fight primarily in cities because cities have strategic value as a function of location, symbolism, and power.[10] Cities sustain populations due to the proximity of resources and lines of communication (LOC) that are vital to economic prosperity. Istanbul, Turkey, straddles the Bosporus Strait; Seoul, South Korea, hugs the Han River; and Singapore guards the Strait of Malacca. As hubs for air, land, and sea travel, cities can rarely be bypassed, particularly if

operations require the movement of military and/or humanitarian supplies into and throughout a region. The urban port in Mogadishu was essentially of strategic value in the dissemination of relief aid during Operation Restore Hope in Somalia.[11]

Strategic value can also stem from cultural relativity, whereby cities symbolize national identity that transcends their socioeconomic role. A city's symbolism derives from its cultural, religious, political, and social importance—it is psychological, implying the salient role of information operations in the urban fight. Given the link to identity, control often becomes the object of struggle, even when costs are excessive. US marines and South Vietnamese soldiers fought desperately to retake Hue, the cultural and educational heart of South Vietnam. The symbolism draws in conventional forces in wars between states as well as nonstate actors during civil wars. Insurgents, terrorists, and criminals thrive in the symbolically target-rich urban environment. Some of the darkest days of the conflict in Northern Ireland involved the Irish Republican Army's bombing campaign in London during October 1981.[12]

Most significantly, cities are centers of power, growing geometrically in economic, political, and economic importance. They are often seats of government, commercial epicenters, industrial backbones, and information hubs for states, regions, and even nonstate actors. Controlling them brings ready access to resources, technologies, information, and the population. As such, urban systems or elements thereof qualify as Clausewitzian centers of gravity.[13] Due to this powercentric nature of cities, US military interventions have often focused on them, including Mazar-i-Sharif, Afghanistan; Panama City, Panama; Port-au-Prince, Haiti; and Kuwait City.[14] As the culturally symbolic centers of economic and political power grow in size, number, and strategic importance, so will they more likely be embroiled in accompanying urban fighting.

Urban War Fighting

The urban fight will challenge the courage and skill of airmen. If aerospace power is to win this fight, airmen must understand the nature of urban combat as a subset of urban operations characterized by demanding warfighting rules.

Urban Operations

Airmen engage in urban warfare when two criteria are met: (1) they plan and execute operations in an area dominated by manmade features and noncombatants (Sarajevo counts; the Serengeti Plain does not),[15] and (2) they apply lethal and nonlethal aerospace power against an adversary often bent on their elimination. Although it sounds oxymoronic, the second criterion highlights nonlethal force as a means to enhance lethality as well as minimize collateral damage. Moreover, physical presence is not necessary for engagement in urban operations. For example, airmen of the 352d Special Operations Group, Royal Air Force Mildenhall, United Kingdom, engaged in urban combat in 1996 when they planned the noncombatant evacuation operation for Monrovia, Liberia.

Urban operations are a subset of all military operations because they represent an environment—cities—rather than being just a single point along the spectrum of conflict. The two distinguishing features of cities—people and infrastructure—are instrumental to military action in major theater war (MTW) as well as military operations other than war (MOOTW).[16] Although many urban operations since 1990 have originated as MOOTWs, aerospace doctrine correctly asserts that "a distinct characteristic of MOOTW is the ever-existing possibility that any type of MOOTW may quickly change from noncombat to combat."[17] Situations deteriorate!

War-Fighting Rules

Relevant aerospace-power functions as well as the level and scope of required force may shift across the spectrum of conflict, but

most urban-combat situations share several operationally significant characteristics. Among the lessons pertaining to the nature of urban warfare, *sensitivity to civilian casualties* and *restrictive rules of engagement (ROE)* are of particular relevance.[18] Their importance derives from our emerging asymmetric force strategy and the concentration of people and property, which makes force application far more complex in terms of the laws of armed conflict.[19]

In the urban fight, the density of people and property magnifies caution and necessitates adherence to the maxim "how we fight can decide victory." Although sensitivity can restrain action by US forces, it also argues for the prominent role of aerospace power, wherein our core competencies—particularly precision engagement—rise to the occasion. Depending on the circumstances, precise airpower can be less destructive than imprecise land power and, therefore, valuable to the urban fight. In the urban battle space, ROEs are primarily intended to minimize civilian suffering and collateral damage—we do not destroy the city to save it. Rules dictate when, where, against whom, and how we use force.[20] Urban-warfare ROEs adhere to international law and are no different inside than outside of cities, just generally more difficult to comply with. Recent experience, however, has shown that airpower can be the method of choice in sensitive circumstances demanding minimal collateral damage and minimal risk to friendly forces. During Operation Desert Storm, the air campaign known as Instant Thunder embraced an "absolute minimum of civilian casualties and collateral damage" as part of its concept of operations.[21] It began with intense, near-surgical strikes in a very urbancentric environment of downtown Baghdad, providing a positive perspective of airpower with respect to urban-combat ROEs.

The implications for airmen are critical. Restrictive ROEs can increase risk, chiefly at the tactical level, while a reduction in risk can increase the chance of collateral damage. Given the extreme difficulty of identifying hostile forces from a standoff orbit in complex terrain, even highly skilled rotary- and fixed-wing pilots place ordnance off the mark, striking dangerously close to friendly positions and hitting unintended targets.[22] Therefore, close scrutiny of target lists prior to inclusion in the air tasking order, particularly targets located in the urban battle space, has become a pervasive feature of conflict since Vietnam. For example, during Operation El Dorado Canyon in 1986, airmen had to conduct redundant identification of terrorist-related targets near Tripoli, Libya, to avoid collateral damage.[23] Similarly, ROEs for the planned invasion of Port-au-Prince required that all air strikes be direct and observed.[24] Restrictions in each case came not as a consequence of the urban character of the terrain, but the urban environment compounded the complexity of the fight under such ROEs.

Urban Battle Space

Airmen must have battle-space awareness in order to attain operational success. Understanding the urban setting is tough, given the complex and diverse nature of the environment. We need a framework that embraces the diversity of cities but in a manner that has actionable, operational significance. The framework offered here entails a systems approach in which subsystems interact to create a continuum with *modern* cities at one end and *primitive* cities at the other (table 1). Adding the type of threat faced by airmen results in a framework that has real consequences for the way we fight.

Systems Approach

The urban battle space is a system.[25] One can understand cities as a set of interrelated elements interacting as whole cities interdependent with the environment—cities are not islands. Rather, they are connected to a surrounding mixed terrain or rural setting through permeable boundaries and LOCs, a fact having much significance to urban airpower strategies, operations, and tactics. With a systemic perspective, airmen should better

Table 1

Battle-Space Framework

Threat Type	*City Type*	
	Modern	Primitive
Conventional Force	North Korean army in Seoul; Chinese People's Liberation Army in Taipei, Taiwan	Russian army in Baku, Azerbaijan; Indian army in Karachi
Unconventional Force	Leftist guerillas in Bogotá, Colombia; Islamic radicals in Bishkek, Kyrgyzstan	Technicals in Mogadishu; West Side Boys in Freetown, Sierra Leone

orient their thinking to relationships and patterns of activity rather than static objects or individual events in time and space. A systems approach recognizes that complex, interacting urban factors, including the relationships of human activity, intersect at key nodes. The more decentralized and unconventional the enemy, the more difficulty in discerning the nodes. The problem is compounded in the sprawling peripheries. The dynamic complexity of cities often means that relationships between cause and effect are difficult to discern and that the effects of aerospace power may be delayed in time.

Urban Space

The urban system is unique in that it consists of five dimensions or spaces. First, the airspace above the ground is usable to aircraft and aerial munitions.[26] Second, the supersurface space consists of structures above the ground that can be used for movement, maneuver, cover and concealment, and firing positions.[27] For airmen, the supersurface warrants special consideration since the enemy can locate weapons such as surface-to-air missiles or antiaircraft artillery there. Structures also channel or restrict movement at the surface. Third, the surface space consists of exterior areas at ground level, including streets, alleys, open lots, parks, and so forth.[28] Fourth,

the subsurface or subterranean level consists of subsystems such as sewers, utility structures, and subways.[29] Although often overlooked, the subsurface space is more exploitable than one realizes because these elements exist as part of a city's planned infrastructure; therefore, they have known relationships and nodes. The fifth domain is the information space.

Urban System

Distinctions between modern and primitive cities are a function of three subsystems: physical, functional, and social. All can exist in the five urban spaces.

The physical subsystem consists of manmade terrain. One argument holds that because "location, size, and materials making up the physical components are recorded and archived . . . that makes cities the most understandable and militarily exploitable."[30] Yet, although this is true for urban areas under government control, it is not always the case in unintended slums of the developing world, such as Kabul, Afghanistan. Although the relationships and nodes in these slums are harder to discern, they still exist within the context of a terrain that can be sorted into rough zones with operational relevance.

Terrain zones give direct insight into the challenges for aerospace-power functions

(fig. 1). The core is the heart of the city, normally located at the center of the urban area and home to the most important economic, political, and social structures. The boundary links the core to the periphery, usually consisting of critical LOCs and a mix of industrial, commercial, and residential structures. The periphery extends out from the core, transitioning into the surrounding landscape. The periphery can be an orderly mix of functional areas or an unruly sprawl that exceeds the capacity for governance. LOCs intersect the areas and serve as the locus for industrial and commercial functions.
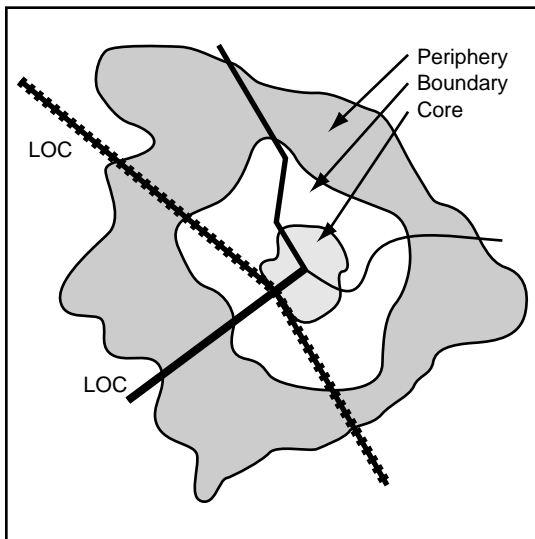

Figure 1. Terrain Zones

Critiques of the applicability of aerospace power focus on the challenge of operating in the urban core. The density and height of structures in the core create "canyons" with deep shadows. LOCs limitations make command and control difficult and can mitigate the effects of weapons, due primarily to high attack angles.[31] These critiques are valid, particularly when the enemy is conventional and dependent upon nodes at the core. It is not as limiting, however, when one considers that only 1–3 percent of urban areas are thus characterized. These zones dominate in developed cities, where airmen are less likely to fight.[32] Modern cities tend to have robust cores and peripheries, all under government control. Primitive cities tend to have small cores and sprawling peripheries, without government control. Many cities in the developing world are dualistic, having small, modern cores and unintended, primitive peripheries.

The functional subsystem is vulnerable to manipulation by aerospace forces. It consists of the lifeblood networks of the city that allow inhabitants to thrive and the enemy to survive. The functional subsystem includes services, transportation, communication, and utility networks that enable the flow of resources. Modern cities have formal subsystems characterized by centralized administration, industrial or postindustrial technologies, and identifiable links and nodes. On the other hand, primitive cities normally contain informal, decentralized subsystems in which primitive or adaptive technology dominates, and the network generally consists of patterns of individual or small-group activity. Nodes are highly decentralized or may not exist at all. The periphery of Karachi, for example, is a seemingly endless sea of urban squalor. No blueprints exist, and points of leverage in the system are not readily discernable.[33]

The physical and functional character of the urban battle space is irrelevant without the human dimension—the social subsystem, which includes a wide range of variables, such as culture, demographics, religion, and history. At the risk of oversimplification, one can divide the "human architecture" of cities into three rough types: hierarchical, clan, and multicultural.[34]

Hierarchical cities are those airmen know best. They are characterized by a unified citizenry that lives according to agreed-upon rules of interaction.[35] The city consists of chains of command that operate within an accepted legal framework.[36] Modern

cities are hierarchical. Most of the cities of North America and Europe qualify, as do many in Asia, such as Singapore; Kuala Lumpur, Malaysia; and Tokyo, Japan. At the opposite end of the spectrum are clan cities of rapid urban growth and associated impoverishment.[37] Relationships are governed by loyalty and revenge. Restless young men fight over limited resources and control of the government. Desperation and anger are core motivators, and they are alarmingly persistent and resilient. Airmen who enter a fight in a clan-based urban system will find it difficult to distinguish friend from foe or to identify patterns of activity and points of leverage to manipulate. Clans dominate in such primitive cities as Kabul; Kinshasa, Zaire; Dushanbe, Tajikistan; and Lagos, Nigeria.

Multicultural systems exist between these extremes, in which "contending systems of custom and belief, often aggravated by ethnic divisions, struggle for dominance. They are, by their nature, 'cockpits of struggle.' "[38] Multicultural cities might contain the pressure for conflict through a robust hierarchy, but they cannot eliminate the struggle for power among ethnic, religious, and/or criminal groups. Clan-type interactions can gain momentum and drag the city into brutal violence. Jerusalem, Israel, is a good example of a multicultural city that oscillates between hierarchical order and clan-oriented conflict. Sarajevo, Bosnia-Herzegovina, is an example of a modern city that descended into a factional hell. Airmen must recognize that many cities, indeed most, reflect both modern and primitive areas existing side by side, as in Lima, Peru; Mexico City, Mexico; and Beijing, China.

Threat

The threat is an indispensable component of the battle space. We complete our framework for it by considering two general threat types: conventional and unconventional. The former usually has definable chains of command, uses combined-arms tactics, and employs more technologically advanced (or at least larger-caliber) weapons; examples include the North Korean army and the Chinese People's Liberation Army.[39] Although capabilities vary widely, conventional forces tend to fight in urban areas with stiff defenses and muscular firepower; they focus on holding terrain against an attacking force.[40]

Unconventional, nonstate forces include terrorists, criminal gangs, and warlords. Organization can range from centralized and overt to decentralized and covert.[41] Terrorist and guerilla tactics dominate, and forces primarily use light arms. More than conventional forces, they challenge our understanding of objectives and values, use military technologies in surprising ways, and employ unpredictable operational concepts and tactics.[42] Unconventional forces often break the conventional war-fighting rules, such as using noncombatants for cover and concealment. Finally, these forces are not as dependent on the urban system as their conventional counterparts.

Battle-Space Matrix

Cross-referencing city type against threat provides a framework for developing operational art and achieving operational effects (table 2). Warfare in a modern city against a conventional force plays to contemporary nodal approaches for achieving direct operational effects. Air Force doctrine, training, and weapons are optimized for this fight. Warfare in a primitive city against an unconventional force, however, is more the domain of ground forces conducting tactical engagements. Aerospace power can achieve operational effects here as well, but indirectly, through cumulative attacks on key relationships (such as movement patterns, personal exchanges, and fluid assembly areas). Combat with a conventional force in a primitive city or a fight with an unconventional foe in a modern city requires combining nodal and nonnodal operational concepts and effects. The real challenge for airmen lies in fighting in cities such as Karachi, where both city types and threat types coexist.

Table 2

Battle-Space Framework

Threat Type	*City Type*	
	Modern	Primitive
Conventional Force	Nodal Attack; Direct Effects	Nodal and Nonnodal Attack; Direct and Indirect Effects
Unconventional Force	Nodal and Nonnodal Attack; Direct and Indirect Effects	Nonnodal Attack; Indirect Effects

Urban Art

When joining the urban fight, airmen can benefit from discerning elements of operational art vital to achieving effects that will accomplish command objectives. Due to the unique nature of war fighting in the urban battle space, operational art involves the fusion of principles of war and principles of MOOTW (table 3).

Table 3

Principles of War and MOOTW

War	*MOOTW*
Objective	Objective
Unity of Command	Unity of Effort
Security	Security
Offensive	Restraint
Mass	Perseverance
Maneuver	Legitimacy
Economy of Force	
Surprise	
Simplicity	

Operational art, regardless of the environment, is the process of planning and sustaining operations to meet strategic objectives.[43] The keys to effective operational art in the urban battle space are matters of contention, suggesting a need to return to the principles that guide operations, regardless of the level or environment. Both joint and Air Force doctrine distinguish between *principles of war* and *principles of MOOTW*. Yet, when airmen operate in the urban battle space, they must appreciate that this is an artificial distinction. Urban fights almost always include both. Gen Charles C. Krulak, former USMC commandant, discussed the spatial proximity of strategy, operations, and tactics in urban combat using the term "three-block war."[44] Similarly, there is a confluence of the *principles of war* and the *principles of MOOTW* in the urban environment, requiring the fusion of each. As seen several times around the world within the last decade, peacekeeping can escalate to combat, and theater war can involve refugees.

Fusing principles is not an intractable problem unless airmen cling to the idea that MTW and MOOTW are mutually exclusive. Three principles of each have the same basic purpose, and eight principles of war can be shaped by the remaining three MOOTW principles (see table 3). The challenge lies in linking an understanding of principles from an airman's perspective to our knowledge of the urban battle space. For example, the intent of both *unity of command* and *unity of effort* is to unite efforts to accomplish *objectives*. In the urban setting, these principles involve the centralized control of military forces *and* the building of consensus among nonstate actors. Given the multimission nature of the battle space, centralized control and decentralized execution of aerospace power are especially vital to prevent fragmentation and dilution of effects.[45] *Security* enables

freedom of action in both MTW and MOOTW. One must extend this principle in the urban environment to include protecting forces, noncombatants, civilian agencies, and information from potential adversaries.[46]

The remaining principles of war are tempered by the three remaining MOOTW principles.[47] The MOOTW principle of *restraint,* for example, essentially embraces the war-fighting rules. The inherent flexibility and versatility of aerospace power allow airmen to increase or relax restraint, based on command guidance. The development of measured firepower (scalable munitions) and nonlethal capabilities will increase versatility. Concurrent, ponderous efforts to negotiate cease-fires or impose sanctions during protracted urban fights, for example, will require airmen to be "patient, resolute and persistent."[48] Aerospace power can *persevere.* As clarified in Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine,* aerospace power's "inherent exceptional speed and range allows [*sic*] its forces to visit and revisit wide ranges of targets nearly at will."[49] Airmen do not occupy terrain—they dominate space and time. During Operation Provide Promise, airmen airlifted or dropped humanitarian-relief supplies in Sarajevo with perseverance over a three-year period, simultaneously maneuvering through the battle space and massing effects.[50] Finally, *legitimacy* enhances the amalgamation of objective, mass, and economy of force in the urban aerospace fight. With international interest and coalition efforts in activities from MTW to MOOTW, airmen are called upon to provide what is increasingly considered the most legitimate means of intervention, due largely to airpower's speed and precision.

The principles are a guide, not a checklist. They are interrelated, not exclusive. Fusion results in "universally true and relevant" principles that form a more lasting basis for operational art in the urban fight.[51]

Urban Effects

Aerospace power produces effects to achieve objectives based on operational art.

The core effect airmen should pursue in urban warfare is *battle-space control.* All other effects spring from the overarching, desired outcome of controlling the urban battle space to enable freedom of action by the joint force as well as critical state and nonstate actors.[52] Control is directed against the subsystems and threats of the battle space. Effects will be realized by existing functions of aerospace power, directly or indirectly, depending on the character of the battle space.

Full-Spectrum Effects

In MOOTW, airmen assert control over a deteriorating situation by channeling crowds. In MTW, we achieve control over an enemy by isolating him from reinforcements. The most important subeffects are revealed by history and embraced by contemporary joint doctrine, but only for MTW. Even though effects are equally relevant to MOOTW, joint and service doctrine neglects to discuss them, focusing only on types of operations. The multimission nature of urban operations and the asymmetric force strategy demand a focus on effects across the spectrum of conflict.

Currently, war-fighting doctrine identifies five effects: isolating, retaining, containing, denying, and reducing.[53] Of these, isolation of the adversary is consistently identified as paramount to operational success. A Marine Corps study of 22 urban battles in the last century revealed that "even partial isolation of the defenders resulted in attackers enjoying a success rate of 80 percent."[54] Isolation is equally valid in lower-intensity operations. Aerospace power sought to isolate Somali warlord Mohammed Farah Aideed by conducting counterinformation missions against his Radio Mogadishu broadcasts.[55]

MOOTW operations can also be refined to reflect an effects-based approach to urban combat. For example, strikes and raids are intended to "inflict damage on, seize, or destroy an objective."[56] Seizing and destroying are the effects! Recasting each of these types of operations results in such effects as *disrupt* (Iraqi armored forces en route to Khafji); *restrict* (Liberian rebels from reaching landing zones

used in noncombatant evacuation operations in Monrovia); *recover* (downed airmen or injured soldiers in Mogadishu); *evacuate* (embassy personnel in Tirana, Albania); and *demonstrate* (Operation Vigilant Warrior to Kuwait) (table 4).

Table 4

Operational Effects

Reduce	Isolate
Destroy	Seize
Deny	Confiscate
Delay	Enforce
Disrupt	Recover
Retain	Evacuate
Detain	Protect
Contain	Demonstrate
Restrict	Assist

Direct and Indirect Effects

The battle-space matrix clarifies whether or not one can obtain operational effects directly or indirectly. Direct operational effects result immediately in time and space from the application of aerospace power.[57] They occur more readily as a result of actions against modern cities and conventional threats due to the robust availability of key nodes and the more explicit nature of relationships. Also, knowing the relationships between subsystems allows one to predict effects more accurately.

Indirect effects flow out of direct attacks but are delayed in time or removed in space. These effects are more difficult to predict, given the highly complex nature of the connections between subsystems and threats. One can also achieve operational effects indirectly as the result of cumulative tactical effects. One may need to use this approach in primitive cities against unconventional enemies due to the lack of knowledge about subsystems. As previously asserted, both the system and the threat exist outside government control and may actually be nonnodal, featuring unpredictable, inconspicuous rela-

tionships. Microwave towers were not essential to command and control in Kigali, Rwanda, during the civil war of 1994. Rather, hundreds of thugs and small gangs with radios operated out of shacks and trucks. Achieving operational effects through cumulative tactical engagements does risk returning to attrition-style warfare if one assumes that only ground forces can successfully mass effects at the tactical level.

Using speed, range, flexibility, and precision, airmen employ the functions of aerospace power to achieve operational effects. Every function is worthy of thorough analysis, given the important contribution it can make to the urban fight. Air refueling enables counterair missions to achieve enforcement; navigation and positioning enable strategic-attack missions to destroy targets; special-operations employment can protect or detain individuals; and combat search and rescue can recover and evacuate personnel. Research has revealed that four functions are vital to urban fights: intelligence, surveillance, reconnaissance, and counterland operations.[58] Airmen fight for desired effects through aerospace-power functions that are currently optimized against the modern cores of Belgrade and Baghdad. These same functions can get the job done in the slum peripheries of Khartoum and Kabul only if airmen know the nature of the battle space and its implications for effects.

Closing

There is a strong historical record of aerospace power in urban fights, but the future demands even more awareness of the urban system and innovative approaches to using aerospace power in cities, based on the changing quality of American warfare. Airmen can apply their asymmetric strengths in the urban setting if they learn the war-fighting rules, understand the battle space, and embrace the basic elements of operational art and effects. Thus equipped, airmen can win in concrete downtowns as well as clapboard slums. ☐

Notes

1. The "new American way of war" rejects the "traditional strategies of attrition and annihilation that evolved from nineteenth century warfare." Air Force Doctrine Document (AFDD) 2-1, *Air Warfare,* 22 January 2000, 3.

2. Ibid.

3. This effort embraces the institutional shift within the US Air Force from "air" to "aerospace," with aerospace power defined as the use of lethal and nonlethal means by aerospace forces to achieve strategic, operational, and tactical objectives. Ibid., 1.

4. Adapted from a definition proffered by David A. Deptula (then a colonel) in *Firing for Effect: Change in the Nature of Warfare,* Defense and Airpower Series (Arlington, Va.: Aerospace Education Foundation, 24 August 1995), 5.

5. As of 1999, 76 percent of the populations of the advanced countries in the Global North lived in urban areas. *World Urbanization Prospects: The 1999 Revision* (New York: United Nations Population Division, 1999), 1.

6. The US national security strategy identifies failed states as a threat to US interests. Failed states include governments unable to provide "basic governance, safety and security, and opportunities for their populations, potentially generating internal conflict, mass migration, famine, epidemic diseases" and other effects that can weaken regional security. Executive Office of the President, *A National Security Strategy for a New Century* (Washington, D.C.: The White House, December 1999), 2.

7. "The Urban Environment," *World Resources, 1996–97: A Guide to the Global Environment,* on-line, Internet, 12 December 2001, available from http://www.wri.org/wri/wr-96-97/ud_txt3.html.

8. Ibid.

9. Resources tend to go to the handful of 10 million-plus resident megacities (23 in 2015). Ibid.

10. Adapted from an assessment of "The Role of Urban Areas in Military History," in the *Handbook for Joint Urban Operations* (Washington, D.C.: Joint Staff, J-8, Dominant Maneuver Assessment Division, Pentagon, 17 May 2000), I-5.

11. Ibid., IV-31.

12. Ibid., IV-39.

13. The joint force and airmen define centers of gravity as "those characteristics, capabilities, or localities from which a military force [adversary] derives its freedom of action, physical strength, or will to fight." AFDD 1, *Air Force Basic Doctrine,* 1 September 1997, 79.

14. The example of Port-au-Prince is taken from *Handbook for Joint Urban Operations,* I-7.

15. Ibid., I-5.

16. Briefing, subject: The City's Many Faces: Investigating the Multifold Challenges of Urban Operations, in *The City's Many Faces,* ed. Russell W. Glenn (Santa Monica, Calif.: RAND, 2000), 215.

17. AFDD 1, 8.

18. These primary political constraints on urban operations are highlighted in Alan Vick's *Aerospace Operations in Urban Environments: Exploring New Concepts* (Arlington, Va.: RAND, 2000) and discussed during an interview with the author on 22 July 2000 in the RAND Project Air Force offices, Pentagon City, Va. Subsequent interviews with marines of Marine Aviation Weapons and Tactics Squadron One (MAWTS-1), particularly Capt James Adams, on 25 July 2000 in Yuma, Ariz., reinforced the conviction that the law of armed conflict becomes increasingly important in urban operations due to infrastructure, the presence of noncombatants, the pervasiveness of the media, and the adoption by political leaders of this "new American way of war." An interesting example of airpower in urban combat that involved combatants'

perceptions of rules and sensitivities occurred in San Salvador in 1989. Members of the Farabundo Marti National Liberation Front believed the El Salvador government would never bomb middle-class areas of the city and took some ground in the wealthy areas. The government decided differently, however, and showed determination by bombing them.

19. Joint Publication (Pub) 3-06, "Joint Urban Operations," draft, 8 May 2000, III-143.

20. *Handbook for Joint Urban Operations,* III-30.

21. Col Richard T. Reynolds, *Heart of the Storm: The Genesis of the Air Campaign against Iraq* (Maxwell AFB, Ala.: Air University Press, January 1995), 57, based on remarks made by Col John A. Warden III during the presentation "Desert Storm Air Campaign" at the USAF Air and Space Doctrine Symposium, Maxwell AFB, Ala., 6–8 April 1993.

22. Maj Michael Moore, Marine Corps Air Station, Yuma, Ariz., interviewed by author, 25 July 2000. During a highly informative tour of the Urban Close Air Support (CAS) Facility, Major Moore explained the challenges and risks associated with target identification, based on his extensive training experience as a ground forward air controller (FAC) during several training events. Initial results from a year-long urban CAS study revealed that dry runs to verify target identification create an unacceptably high risk to aircraft. The challenge of visually identifying a target in an urban complex is compounded by the standoff distance required to avoid excessive risk to FACs and airmen.

23. Vick, 60.

24. Notably, Operation Uphold Democracy would have included the A-10 in an urban CAS role for the first time as part of deliberate planning. According to pilots of the 55th Fighter Squadron, Shaw AFB, S.C., the urban terrain posed challenges few of them had experienced, including the greatly compounded difficulty of positive target identification in and among the sprawling urban slums of Port-au-Prince. Capt Robert Givens, A-10 pilot, 55th Fighter Squadron, interviewed by author, October 1995; and *Aviation Combat Element (ACE) Military Operations on Urban Terrain (MOUT) Manual,* 8th ed. (Yuma, Ariz.: MAWTS-1, March 1999), B-3.

25. A definition of a system is "any organized assembly of resources and procedures united and regulated by interaction or interdependence to accomplish a set of specific functions." J-7, Joint Staff, *DOD Dictionary,* Joint Electronic Library, February 1999. Note, however, that the term *system* is not included in Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms,* 12 April 2001, on-line, Internet, 12 December 2001, available from http://www.dtic.mil/doctrine/jel/new_pubs/jp1_02.pdf. The seminal work of Col John A. Warden III, USAF, retired, is acknowledged as promoting this kind of systemic thinking in airpower theory.

26. Not all of the urban airspace is usable because much of it is cluttered with buildings, towers, wires, and so forth. Joint Pub 3-06, I-7.

27. Ibid.

28. Ibid.

29. Los Angeles, for example, has over 200 miles of storm sewers, which could actually be used for movement. Marine Corps Warfighting Publication (MCWP) 3-35.3, *Military Operations on Urbanized Terrain,* 1998, 1–3.

30. Joint Warfare Analysis Center (JWAC), *Air Power in MOUT: A JWAC Experiment,* CD-ROM, Science Applications International Corporation, August 1998, slide 4.

31. For a thorough discussion of the impact of terrain zones on aerospace functions and weapons effects, see Vick, 83–117. Urban CAS training at the Urban Training Facility, "Yodaville," in Yuma also reveals the difficulty of acquiring targets, such as tanks

and armored personnel carriers, nestled between tall buildings. The results are captured in the ACE MOUT manual (see note 24). The author's own walking tour of the facility on 25 July 2000 reinforced the training results.

32. Vick, 77.

33. This assessment is based upon the author's driving and walking tour of central and east Karachi during a three-day period in 1994.

34. Adapted from the work of Lt Col Ralph Peters, USA, retired, "The Human Terrain of Urban Operations," *Parameters,* Spring 2000, 4.

35. Ibid., 5.

36. Ibid., 4.

37. Ibid., 8.

38. Ibid., 5.

39. MCWP 3-35.3, 2–3.

40. Briefing slides, Col Robert Stephan, subject: The Role of Aerospace Power in Joint Urban Operations, 3 November 1999, 4.

41. Ibid.

42. Briefing slides, Alan Vick, Conference on the Role of Aerospace Power in Joint Urban Operations, subject: Aerospace Forces in Urban Military Operations: Images, Missions, Environments, March 1999, 5.

43. AFDD 2, *Organization and Employment of Aerospace Power,* 17 February 2000, 3.

44. In one urban zone, airmen "will provide food, care and comfort for an emaciated child." In the adjacent zone, airmen will be separating angry mobs or warring clans. In a third zone, airmen will engage in intense fighting with a hostile force. Accordingly, airmen "will need the flexibility to address a wide variety of crises." Adapted from a quotation by General Krulak in Lt Gen Paul K. Van Riper's "A Concept for Future Military Operations on Urbanized Terrain," *Marine Corps Gazette,* October 1997, A-2.

45. According to AFDD 1, "attempts to fragment the control and planning of air and space power will ultimately cost blood and treasure by diverting effort and impact" (23).

46. *Handbook for Joint Urban Operations,* III-13.

47. The *Handbook for Joint Urban Operations* offers a solid discussion of the principles of war and MOOTW on pages II-3 through II-14. My intent is not to recount these in detail but to suggest that members of all services should start looking at fusing principles for a single operation.

48. AFDD 2-3, *Military Operations other than War,* 3 July 2000, speaks to the need for the restricted use of force in the "judicious and prudent selection, deployment and employment of forces most suitable to the operation" (9).

49. AFDD 1, 25.

50. Example from *Handbook for Joint Urban Operations,* II-14.

51. AFDD 1, 12.

52. AFDD 2-1 states that "controlling the battlespace means exercising the degree of control necessary in all media (land, sea, and aerospace, in both their physical and information domains) to employ, maneuver, and engage forces while denying the same capability to the adversary" (4).

53. *Handbook for Joint Urban Operations,* II-10.

54. MCWP 3-35.3, 1–17.

55. Airmen dropped leaflets, broadcast messages over loudspeakers, and conducted a direct attack on the radio station to disable the adversary's information operation. Maj J. Marcus Hicks, "Fire in the City: Airpower in Urban, Small-Scale Contingencies" (Maxwell AFB, Ala.: School of Advanced Airpower Studies, June 1999), 84.

56. *Handbook for Joint Urban Operations,* II-18.

57. AFDD 2-1, 7.

58. Interviews with numerous experts support the great need to focus doctrine, training, and technologies on intelligence, surveillance, and reconnaissance as well as counterland. Advocates include Capt Kevin Psmithe, USAF, Headquarters USAF/XP; Alan Vick, RAND Project Air Force; and the J-8 Dominant Maneuver Assessment Division.

Fighting terrorism is like being a goalkeeper. You can make a hundred brilliant saves, but the only shot that people remember is the one that gets past you.

––Paul Wilkinson, 1992

Reflections on the 1972 Antiballistic Missile Treaty and National Missile Defense

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Editorial Abstract: The United States recently announced its withdrawal from the Antiballistic Missile Treaty. Major Ruse's examination of how the treaty restricted the development of our national missile defense system helps us understand what the withdrawal means for the future.

DID THE 1972 Antiballistic Missile (ABM) Treaty hinder American military capability, threaten international strategic stability, or endanger the safety and welfare of our nation and its citizens? Clearly, the Cold War strategy of mutual assured destruction (MAD) between the United States and the Soviet Union played a critical role in strategic stability and the prevention of global nuclear war. People saw the ABM Treaty as the cornerstone of MAD, but more than a decade after the fall of the Berlin Wall and the collapse of communism, we find numerous and divergent legal, political, and personal views on the ABM Treaty and its impact on our national security strategy. On 13 December 2001, President George W. Bush announced that the United States would pull out of the treaty. In light of that announcement, it is important to reflect on the various legal, political, economic, and military circumstances surrounding this decision if we are to understand the implications it has for our present situation.

In the context of international law, the 1972 ABM Treaty contributed significantly to the rapidly expanding legal discipline of warfare in space. Support of the treaty rose to national relevance and concern following the re-

lease in January 2001 of the report of the Space Commission, chaired by Donald Rumsfeld prior to his becoming secretary of defense. After its six-month investigation, the commission concluded that "the security and well being of the United States, its allies and friends depend on the nation's ability to operate in space."[1] The national security strategy even stated that "the ABM Treaty remains a cornerstone of strategic stability and the U.S. is committed to continued efforts to enhance the Treaty's viability and effectiveness."[2]

The ABM Treaty clearly had a prominent influence on the national military strategy and an expanding legal influence on future space warfare. The original treaty, however, focused on a much more limited role. As designed, it severely limited the deployment, testing, and use of national missile systems designed to intercept incoming strategic or long-range missiles. Interestingly, the treaty banned a technology that did not even exist in 1972. Specifically, it outlawed national missile defense (NMD) systems in the United States and Soviet Union but did not limit development and deployment of theater missile defense (TMD) systems. In the midst of the Cold War, with the two superpowers dominating global military might, the bipolar treaty was adopted to avert a possible nuclear war and curb the nuclear arms race. Logic held that if each nation remained defenseless to a nuclear attack and if nuclear retaliation to a first strike were guaranteed, then neither nation would have any motivation to consider launching a nuclear strike. The treaty codified MAD, which prevailed until the fall of communism and dissolution of the Soviet Union in 1991. Today, it seems ironic and contrary to logical thinking that any nation, especially a superpower like the United States, would agree to remain defenseless in hopes of maintaining strategic stability. For whatever reason, the two countries avoided nuclear world war, and MAD prevailed throughout the Cold War. Yet, the idea of developing and fielding antimissile missiles began as early as the 1950s, and President Ronald Reagan formally promoted it in 1983 with his quest for a "peace shield" to render nuclear weapons "impotent and obsolete."[3]

In an idealistic world, Reagan preferred nuclear disarmament to achieve nuclear stability, but, realistically, he understood that retaliation would continue to influence world relations. From the beginning, he intended his Strategic Defense Initiative, derisively termed "Star Wars" by the media, as a comprehensive defensive capability—possibly including space-based lasers—that would ensure the ineffectiveness of threats or the use of long-range missiles against the United States and its global interests/allies. He rejected the "logic" of MAD, declaring, "Wouldn't it be better to save lives than to avenge them?"[4]

The Clinton administration's aversion to NMD was based heavily on international promotion of Cold War–era MAD and support for the ABM Treaty, as well as intelligence estimates that foresaw no missile threat outside of Russia. The national intelligence estimate of 1995 concluded that "there would be no threat from long-range ballistic missiles for at least fifteen years."[5] This staunch, although outdated, support of Cold War strategy took a sharp blow on 14 July 1998, when a congressionally mandated commission led by Rumsfeld released its final report, unanimously concluding that "concerted efforts by a number of overtly or potentially hostile nations to acquire ballistic missiles with biological or nuclear payloads pose a growing threat to the United States, its deployed forces and its friends and allies. [These nations] would be able to inflict major destruction on the U.S. within about five years of a decision to acquire such a capability. . . . During several of those years, the U.S. might not be aware that such a decision had been made."[6] If this report were not daunting enough, the decisive wake-up call to US vulnerability came just six weeks later when on 31 August 1998, North Korea launched a long-range Taepo Dong 1 missile over Japan and 1,000 miles out into the Pacific.[7] Most disturbing was the confirmation that this missile actually contained a third stage which would have provided true intercontinental capability had it not mal-

functioned. Despite the undeniable threat, the required technology and associated cost of defending against it remained politically questionable.

On 10 June 1999, an Army theater high altitude area defense (THAAD) missile successfully intercepted and destroyed a ballistic missile launched 120 miles away, thereby validating the "bullet hitting a bullet" technology.[8] By the end of the year, the United States had completed four successful TMD intercept tests and one successful NMD "kinetic kill."[9] On 23 July 1999, President Bill Clinton signed the National Missile Defense Act of 1999, authored by Sen. Thad Cochran (R-Miss.), which called for deployment of a limited missile defense system "as soon as technologically possible."[10] Based on estimates that North Korea could have a reliable missile threat to the United States by the year 2005, President Clinton had to make a final decision by the summer of 2000 on whether or not to deploy a limited, land-based NMD system. This decision was based on technology development, affordability, potential threat, international treaty considerations, and competing defense priorities. Three of the 19 planned NMD tests were completed by mid-July 2000. Costing $100 million per test, only one of the three missile intercepts proved successful.[11] Lt Gen Ronald Kadish, director of the Ballistic Missile Defense Organization, testified before Congress that "93 percent of the system's critical engagement functions have been proven to work properly."[12] Despite this testimony, and possibly fearing a negative arms control legacy as he prepared to leave office, President Clinton decided on 1 September 2000 to leave his successor with the decision of whether or not to deploy an ABM system, thereby avoiding the treaty amendment or abrogation issue.

In contrast to the ambiguous statements and halfhearted efforts of the Clinton administration to deal with NMD, President Bush's position has not wavered. Contrary to information reported in several media summaries, the president is indeed aware of the serious technical, financial, and political challenges associated with NMD, but he isn't willing to let a 29-year-old treaty dictate our national defense strategy: "Missile defense is a sensitive issue for some members of Congress. It is a sensitive issue for some of the leaders of countries around the world. But I think we have to protect America and our allies from real threats of the 21st century."[13] Defense Secretary Rumsfeld also has had no qualms about abrogating the ABM Treaty in the interests of national defense, and, as a strong proponent of NMD, he will likely promote a comprehensive missile defense system, including land-, sea-, and space-based components. The secretary is acutely aware of the technical obstacles (two of the five NMD tests have been unsuccessful), political debates at home and abroad (threats to increase the arms race and pull out of previous treaties, as well as "shield of dreams" accusations), economic reality (estimates run from $120 to $240 billion), and legal ramifications of withdrawing from the ABM Treaty. However, he clearly summarized the new US intentions at the Munich Conference on Security Policy in February 2001, when he told other defense ministers that "the United States intends to develop and deploy a missile defense designed to defend our people and forces against a limited ballistic missile attack. That is a fact."[14] Unquestionably, NMD is on the fast track for development and deployment to protect America and its forces, but secondary concerns remain, such as how America will approach further international arms control, reduction of nuclear warheads, and global strategic security.

Article 15, a very significant element of the ABM Treaty, permitted either party to withdraw from the treaty with six months' notice if "extraordinary events" jeopardize that party's "supreme interests."[15] Clearly, the matter of what constitutes "supreme interests" and "extraordinary events" is a gray area for lawyers and politicians, but it appears reasonable that today's proliferation of intercontinental ballistic missiles by rogue nations and the demise of the confrontation between the superpowers would justify withdrawal from the treaty in the mutual effort to secure international stability based on modern threats, technology, and resources.

Numerous legal, personal, and political statements, based primarily on the reality of a new international security environment and the dissolving of the Soviet Union, have challenged the validity of the ABM Treaty. Secretary Rumsfeld highlighted the unique international environment by stating, "It was a long time ago that that treaty was fashioned. Technologies were noticeably different. The Soviet Union, our partner in that agreement, doesn't exist any more."[16] He stopped short of endorsing many conservatives' view that the ABM Treaty was no longer in force but opined that "it (the treaty) ought not to inhibit a country, a president, an administration, a nation from fashioning offensive and defensive capabilities that will provide for our security."[17] Perhaps most convincing was the opposition of the original drafters and negotiators of the treaty. Henry Kissinger, former secretary of state, denounced the ABM Treaty, explaining that "the circumstances that existed when the treaty was agreed to were notably different from the situation today."[18] Another original drafter, John Rhinelander, testified before Congress that the drafters assumed the treaty would be updated with technology to support "a live, viable, modern treaty to go with technology as it's changed."[19] He considers the treaty an "antique" since it has failed to evolve with technology over the past 29 years.

Examining the "intent" of the treaty provides interesting insight, but how did the Russian Federation's succession to the former Union of Soviet Socialist Republics affect the obligations and rights of the treaty? Many legal experts claim that as a bilateral, nondispositive document (i.e., it did not irrevocably fix a right to a particular territory), the ABM Treaty lapsed when the Soviet Union ceased to exist.[20] Historic precedent, recognized scholarly writings, international law, and judicial decisions all appeared to strongly support the lapse or abrogation of the treaty: "The United States has officially expressed its view that upon the extinction of a State, its bilateral political treaties automatically lapse, and has acted in accordance with that view in connection with the extinction of the Kingdom of Hawaii in 1898, the dissolution of the Austro-Hungarian Empire at the end of World War I, and the dissolution of Yugoslavia in 1992."[21] International law and legal scholars have supported the conclusion that upon a state's extinction, its bilateral treaties do not automatically become binding upon the extinct state's successor and the original treaty partner. Hence, the validity of the ABM Treaty since the collapse of the Soviet Union in 1991 became extremely questionable. Thus, the development and deployment of an American NMD system in the interests of national defense and international stability are justified.

Against this brief background of the ABM Treaty, one needs to explore why it became such a hot issue after three decades. The answer lies within a framework of political and technological developments as well as a revised security environment. Most likely, the predominant event was the collapse of the Soviet Union in 1991, which effectively ended the Cold War and the bipolar dominance of military affairs. Nuclear deterrence and MAD/vulnerability waned as dominant theories behind international security strategies. Even Russian opposition to any ABM negotiations or NMD development was largely just a reflection of ideological rigidity and patriotism.[22] Furthermore, the deterrence argument of "Why defend when you can reliably deter?" became less relevant with the advent of modern ballistic missile threats from rogue nations.[23] Several crises in the past decade involving Iraq, North Korea, Serbia, and China have highlighted misplaced overconfidence in deterrence, exposing security threats from regional challengers.[24] Additionally, the current threat of a few dozen ballistic missiles is also much more reasonable to defend against with an NMD system than against thousands of Soviet nuclear and conventional missiles. With obstacles to the ABM Treaty no longer an issue, American leadership will realistically consider international security issues and exploit available technology and resources to protect US interests and citizens.

A precedent exists for US withdrawal from the ABM Treaty. Russia provided notice in

October 1999 of its intent to violate the 1990 Conventional Forces in Europe (CFE) agreement by sending more ground forces to southern Russia in the ongoing battle against Chechen rebels.[25] The CFE Treaty limits the number of nonnuclear arms deployed in Europe, but Moscow invoked the "supreme national interest" provision in the treaty to give international notice prior to its deliberate violation of the treaty. This "withdrawal provision" is similar to Article 15 of the ABM Treaty, which allows for withdrawal under certain circumstances (see above). This bold decision, part of the effort to combat Islamic rebels in southern Russia, casts doubts on that country's resolution to abide by other international treaties when national interests conflict with treaty limitations. A senior US Senate aide made the obvious observation: "If the Russians can be honest enough to say when they are acting in their own national interest, we can only hope the U.S. administration will learn the lesson and do the same on the ABM Treaty."[26] Apparently, it did—finally.

During President Clinton's eight years in office, he promoted the ABM Treaty not only as valid but also as the very "cornerstone" of international stability.[27] Despite the political doublespeak, he did halfheartedly propose amendments to the treaty so that America could deploy a limited NMD system, attempting (unsuccessfully) to convince the Russians that it would not threaten their security. Understandably, this sent confusing messages to Moscow: if America believed so strongly in the ABM Treaty for international stability and security, why did it want to amend the treaty? Wouldn't America's desire for an NMD system contradict the very essence of the treaty?

The reality and threat of ballistic missile attacks from rogue or developing nations, whether armed with nuclear or conventional warheads, finally led to initial dialogue with Russia on amending the ABM Treaty. In January 1999, President Clinton petitioned Russian president Boris Yeltsin to renegotiate the treaty to permit a "limited" national defense system.[28] American dialogue centered on the need to update rather than nullify the ABM Treaty to provide defense against emerging global threats yet avoid a new arms race with Russia and China. Later, in October 1999, the United States offered cash-strapped Russia $60 million to complete a large missile-tracking radar near Irkutsk, Siberia, in exchange for an agreement to renegotiate the ABM Treaty.[29] (To see this as a sign of changing attitudes, one need only remember that the United States claimed in the 1980s that a similar radar at Krasnoyarsk, Siberia, violated the ABM Treaty and pressed the Soviets to dismantle it.)[30] Senior American negotiator John Holum presented a draft revision of the ABM Treaty to Russian authorities in January 2000.[31] Although that document now appears to have been overtaken by events, it is instructive to examine the legal terms as part of the sensitive political gamesmanship.

The proposal did not entail "amending" the text of the original treaty but simply "revising" it by adding two "protocols."[32] This "revision" allowed the first phase only of a limited NMD system by 2005, including expanded radars, up to 100 land-based missile interceptors, and extensive verification measures.[33] The protocol permitted the United States to construct a new, sophisticated radar system on Shemya Island in Alaska and to upgrade early warning radars in Alaska, Massachusetts, California, Greenland, and Great Britain.[34] The proposal also allowed for future negotiations to deploy an additional 100 missiles and launchers at a second location by the year 2010.[35] In the summary of the draft revisions, the United States acknowledged that the proposed limited NMD deployments contravened the current ABM Treaty but were necessary to counter emerging threats from rogue nations.[36] If the Russians experienced slight confusion from Washington's doubletalk and sly "legalese" language before, this proposal probably really sent them into a frustration tailspin. The preamble to the new protocol affirmed America's commitment to the ABM Treaty but at the same time justified the "adaptation" of the treaty to allow a limited NMD system due to changes in the strategic situation.[37] Specifically, the preamble concluded that a limited NMD system "will neither threaten nor

allow a threat to the strategic deterrent forces of either Party."[38] The prevailing American logic accompanying this proposal held that any "limited" NMD system was not aimed at Russia's strategic capabilities and that such a system would be effective only against a limited attack involving relatively unsophisticated missiles. American officials clearly explained that even with further reductions to 1,500 warheads—as proposed under the next phase of arms reduction, known as the Strategic Arms Reduction Treaty (START) III—Russia would still have more than enough missiles and decoys to easily overwhelm the American defense shield and thus preserve strategic equilibrium.[39]

For neutral outsiders considering the proposed amendment, it is difficult at best and impossible at worst for most of them to understand how permitting a limited NMD does not directly violate a treaty that permitted no NMD in order to ensure mutual vulnerability and the capability to conduct an annihilating counterattack. Despite a full year of high-level diplomatic maneuvering and discussions, including a personal meeting in June 2000 between President Clinton and Russian president Vladimir Putin, no further proposals or agreements were forthcoming. Many American congressmen and military leaders felt that these proposals were too restrictive for fully exploiting American technology to provide the best national defense possible. By the same token, Russian leaders and those of several other nations believed that the proposals were too extensive and would serve as a stepping stone for compounding the existing problems.

Concern over the ABM Treaty and NMD, however, is not exclusive to the United States and Russia. Diverse opinions, rationales, and recommendations exist among the people and leaders of most foreign nations regarding the ABM Treaty dilemma. The range of support sounds remarkably similar to opinions expressed in the United States among politicians, the media, military leaders, defense "experts," and the general public.

European nations have not actively taken a strong public stance against the United States on NMD, but factions in Germany, France, and England have historically been critical of breaking or amending the ABM Treaty. European leaders acknowledge their concern over the proliferation of weapons of mass destruction and are actively developing and deploying modern TMD systems.[40] However, European nations do not anticipate using or being the target of long-range ballistic missiles and, therefore, are more "comfortable" with the traditional and proven strategies of classic nuclear deterrence and nonproliferation agreements to provide global security and prevent arms races.[41] British members of Parliament criticized US steps towards an NMD system in August 2001, claiming it would be "highly destabilizing" to international security.[42] Historically, France has denounced a possible American NMD, but in January 2001 Francois Heisbourg, a respected French defense intellectual, encouraged Europeans not to resist the "American missile defense locomotive" because Europe has no compelling interest in "mounting a crusade against U.S. missile defense."[43] On the other hand, France's foreign minister, Hubert Vedrine, stated recently that "NMD can become a problem."[44] According to Germany's defense minister, Rudolf Scharping, "the technical feasibility and the financing of a strategic missile defense are not at all manageable yet."[45]

Concerns to the east of Europe are predominantly against an American NMD system but for varying reasons. South Korea remains "unofficially" concerned, not about an exploding global arms race but about the potential damage to current intra-Korean détente and increased military tensions with North Korea that an NMD deployment might trigger. Few people expect leadership in Seoul to express overt opposition to NMD, considering its strong ties with the United States, but internal opposition is brewing. Representative Chang Sung-min of the Unification, Foreign Affairs, and Trade Committee commented that "peace on the Korean peninsula will be put in jeopardy; the NMD could lead to the withdrawal of U.S. troops from Korea."[46]

As one of five states permitted to have nuclear weapons under the Nuclear Non-Proliferation Treaty, China continues forcefully to oppose any NMD system. Actually, the Chinese are equally or more concerned with the developing US capability and deployment of TMD systems to Japan or Taiwan, but no international law or treaty against TMD exists.[47] China's strategy since the 1960s has been "minimal deterrence," and by maintaining a nuclear capability and a small force of land-based, long-range missiles, the Chinese presented the world with a second strike capability while avoiding the kind of arms race the United States and Soviet Union engaged in. That could be changing, as China continues to rattle sabers and pose increasing strategic instability. As of yet, however, the Chinese are believed to maintain a meager two dozen or fewer long-range, increasingly outdated, and vulnerable nuclear missiles.[48] Hence, China's current deterrent capability and long-range missile threat appear questionable. Although China may primarily fear a future independent Taiwan with TMD capability, publicly it also has come out against the potential American dominance that abrogation of the ABM Treaty could lead to. Chinese ambassador Hu Xiaodi recently accused Washington of seeking "unilateral absolute superiority" in strategic arms to enable it to engage in "nuclear blackmail" against other nuclear powers.[49]

The review of Russia's adamant and universal support of the ABM Treaty has been extremely interesting over the past 18 months. Historically, the Soviet Union/Russia has repeatedly proclaimed the ABM Treaty as the bedrock of strategic stability without even considering the recommended amendments of the Clinton era. In fact, no major disarmament treaty has been successfully negotiated between Russia and the United States over the past eight years.[50] In October 1999, Russian Foreign Ministry spokesman Vladimir Rakhmanin observed that "Russia doggedly insists on the preservation and increased effectiveness of the ABM Treaty as the most important element for securing strategic stability in the world and for continuing the process of nuclear disarma-

ment."[51] Russia's first deputy chief of the General Staff, Col Gen Valeri Manilov, warned that "an attempt to withdraw from the 1972 ABM Treaty would destroy the entire system of treaties dealing with the restriction and reduction of weapons of mass destruction. There can be no compromise on this issue."[52] And President Putin stated that NMD deployment would "irreparably damage global stability"[53] and would "pose the most grave adverse consequences."[54] Russia's patriotic defense of ABM was paramount to that country's perceived protection of its last claim to great-power status and arose out of fear of losing influence and military respect in international relations.

On the other hand, Russia's sharp, belligerent defense of the ABM Treaty has begun to "melt" since about June 2000, and statements by Russian officials have indicated an understanding that American NMD is inevitable under President Bush. Following Bush's inauguration, President Putin advocated broader Russian-American cooperation and "a joint search for responses to 21st-century challenges both to Russia and to the international community."[55] This apparent "let's work together" rhetoric confirmed the opinion of Russian military expert Dmitri Trenin, who believes Putin knows that Bush is not bluffing about NMD and therefore will find ways to negotiate with the United States.[56] US experts calculate that Russia may have only 500–800 warheads by the year 2010, so any threat to radically modernize and expand Russian missile assets seems antagonistic to other pressing national requirements relating to economic and industrial survival.[57]

The future of NMD for the United States is now crystal clear. America will develop and deploy NMD. Allies and foes have grudgingly accepted that NMD is a fact, and the focus is shifting to how America can cooperate with its allies to improve global security and maintain positive relations with Russia. Even though, for all practical purposes, the 1972 ABM Treaty is now shelved, the United States must pursue arms control that considers offensive and defensive capabilities to further reduce nuclear arsenals yet maintain strategic

stability. Our approach must be firm but considerate of international opinions as we seek allied support and Russian cooperation to deter attacks from rogue nations and avoid any perception of isolationism or strategic threat. The Cold War is over, and America must develop new legal, strategic, political, and technological means appropriate for today's global security environment. An NMD system does not yet exist, but, hopefully, its inevitable deployment will spark fresh thinking about the strategic shape of our future world and contribute to a secure environment for future generations. ☐

Notes

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Protecting the Homeland

Air Force Roles in Homeland Security

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Editorial Abstract: In the aftermath of the 11 September 2001 terrorist attacks, many airmen wonder how aerospace power can contribute to improving homeland security. This piece defines the problem and recommends actions the Air Force should take to enhance its role in defending the US homeland.

The highest priority of the U.S. military is to defend the Nation from all enemies. . . . Defending the United States, which is the critical base of operations for U.S. defense activities worldwide, will be a crucial element of DOD's transformation efforts.

> —*Quadrennial Defense Review Report,*
> 30 September 2001

THE TRAGIC EVENTS of 11 September 2001 galvanized government and public focus on the defense and security of the American homeland. Unquestionably, the US military has always defended the homeland and provided for national security. However, until the September terrorist attacks, the military had primarily looked outward, beyond the borders, to defend the nation. Times have changed.

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This article discusses the most pressing issues associated with *homeland security* (HLS). It examines a taxonomy for HLS—*homeland defense* (HLD) and *civil support*. Given the impossibility of continuously defending our nation's vulnerabilities to all possible threats, it advocates a capabilities-based approach to HLS and surveys applicable supporting Air Force capabilities. The article also discusses the principal Air Force policy issues and concludes with recommendations and a plan for progress. Developing and executing a comprehensive plan for HLS will be a long-term undertaking for the Air Force—and, more broadly, for the Department of Defense (DOD) and the US government—so it is crucial that an informed national-level debate commence now.

New Concerns

DOD and the services must evaluate their HLS roles and missions in light of new threats that cannot be deterred by traditional methods. These new threats will require greater time and perseverance to defend against than most Americans are used to enduring. Threats may be initiated from within our borders and involve increasingly destructive weapons designed to inflict mass casualties. Any evaluation of this situation must be done in the context of national laws, policies, and other agencies' roles, missions, and capabilities.[1] There may be public and governmental pressure—and expectations—for DOD to "do something" or take on new lead federal agency (LFA) roles, given the military's ability to react to crises rapidly. DOD should avoid expanding its roles if the expertise, capabilities, and jurisdiction lie in other federal, state, or local agencies and organizations. Critical infrastructure protection, both physical and cyber, is an excellent example of the complexity and difficulty one faces in attempting to separate military missions from civil-agency responsibilities.[2] DOD may have limited capabilities compared to other organizations to respond to specific scenarios or crises. Nevertheless, DOD should be prepared to use its unique capabilities to undertake new or expanded HLS missions whenever the nation supports greater military involvement.

HLS missions must be put in the context of DOD's ability to execute its war-fighting missions. Units and capabilities with primary war-fighting missions could be dual-tasked to support HLS missions, thereby adding some level of risk to DOD's ability to conduct deployed combat operations successfully. A severe terrorist attack in the continental United States (CONUS) might require substantial military capabilities (fighters for combat air patrols, airlift assets, airborne warning and control system [AWACS] aircraft, intelligence/surveillance/reconnaissance [ISR] assets, medical and logistical support, etc.) thereby draining resources for deployed combat operations. Force-sizing constructs and risk metrics must account for HLS missions and associated resource requirements. These constructs will not only have to balance HLS and war-fighting needs and resources, but also the mix of active duty, Guard, and Reserve forces. DOD organizational structures may also need review to determine the most effective organizational construct to fight new threats. The current unified command structure is centered on regional combatant commander (CINC) responsibilities, and a different approach may be required to fight a new, global war on terrorism.

The ability of US forces to deploy in the face of asymmetric homeland attacks is a further concern. Severe attacks on airports or seaports of embarkation, major military facilities, or other crucial assets could affect DOD's ability to deploy. The 2001 *Quadrennial Defense Review Report* notes that the United States is the critical base of operations for US defense activities worldwide and that its defense is a crucial element of defense transformation.[3] Delays in deployment or an inability to deploy could increase risk in combat operations and constrain options available to the president or secretary of defense (SECDEF). Force protection at home has become a growth industry.

Successful responses to homeland attacks depend critically upon accurate, timely attribu-

tion. While domestic law-enforcement agencies (principally the Federal Bureau of Investigation [FBI]) are responsible for attribution of domestic attacks, DOD has significant capabilities that could support attribution. In certain cases, such as missile-launch warning/attack characterization, DOD has the only national assets capable of attribution. Consequently, DOD has a role to play—but this role must be carefully weighed against existing national laws and policies restraining DOD participation in domestic law enforcement and intelligence gathering. Where warranted, DOD should consider increasing its role in attribution in close cooperation with law-enforcement agencies and with potential legislative and policy changes.

Finally, an increased DOD emphasis on HLS may have potential impacts on civil liberties. The administration, Congress, and DOD must evaluate any increased military involvement with law enforcement or intelligence gathering and sharing in the current legal framework. Changes to the framework, such as exemptions to the Posse Comitatus Act or perceived or real infringements upon civil liberties, will likely meet stiff resistance.

Defining Homeland Security

In February 2001, the Air Staff proposed a set of HLS definitions. It suggested that *homeland security* is an umbrella term, encompassing the totality of efforts aimed toward protecting the homeland. HLS represents the combined efforts of government agencies, nongovernmental organizations (NGO), and the private sector to protect US territory through deterrence, prevention, preemption, and defense against attacks, as well as the management of the consequences of and the response to such attacks. DOD's role within HLS has two components––HLD and domestic support operations (DSO)––which refer to primarily military missions and missions supporting other LFAs, respectively. Figure 1 depicts the overall construct.

HLD is a subset of HLS operations where DOD is designated by lawful authority as the LFA—military missions to deter, prevent, defeat, or respond to aggression targeted at US territory.

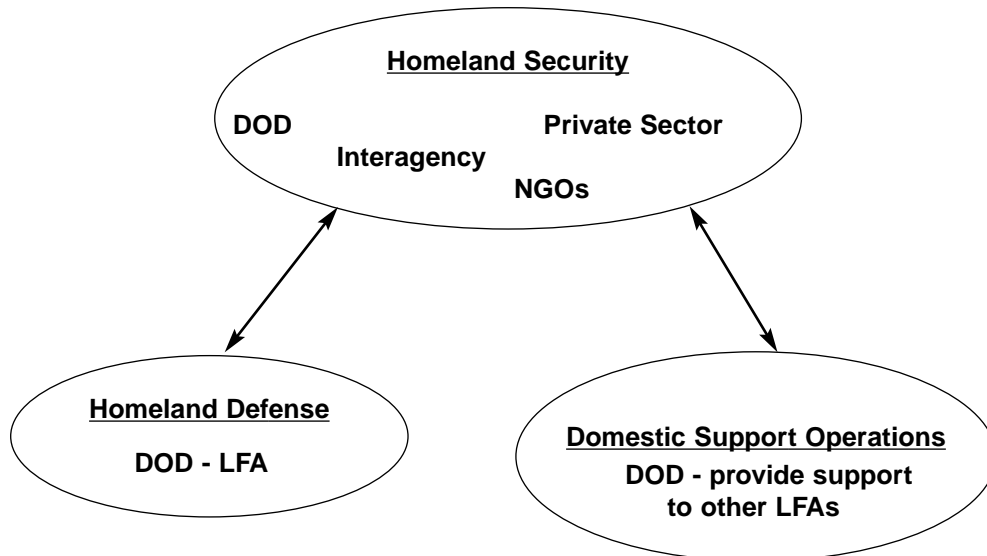DSO refers to those activities and measures taken by DOD to foster mutual assistance and

Figure 1. Homeland Security Construct

support between DOD and any civil government agency in planning or preparedness for, or in the application of resources for response to, the consequences of civil emergencies or attacks, including national security emergencies. DSO is also frequently referred to as civil support.

HLS is a subset of national security. Defense of US territory inherently includes protection of the population, institutions, and infrastructure located on US territory. HLS encompasses the use of American military capabilities on their own or in cooperation with civil authorities to accomplish national objectives within US territory, such as the land, sea, and aerospace defense of the United States. HLS must include roles and missions to protect the United States from new, nontraditional, or asymmetric threats that may be largely immune to traditional means of national defense, such as missile defense, protection from weapons of mass destruction, critical infrastructure protection, and counterterrorism. These threats can occur within CONUS or in tandem with operations outside the United States.

Several subtle yet crucial points must be highlighted.[4] First, the key distinction between HLD and DSO is whether or not DOD is the LFA as designated by a lawful authority. This distinction has important command and control (C^2), interagency coordination, and resource-allocation implications. Second, the HLD definition does not differentiate between the source of the attacks (i.e., inside or outside the United States).[5] Consequently, these definitions do not imply that DOD should emphasize its historical, external focus at the expense of an "inward look." In fact, aerospace operations conducted under Operations Enduring Freedom and Noble Eagle—US and allied action against the Taliban and the air defense of key US cities—demonstrate the simultaneity of these missions. Defense against attacks originating inside the United States raises critical policy questions, including interagency cooperation, roles, and missions; Posse Comitatus; use of military ISR assets to gather information on American citizens; rules of engage-

ment;[6] and the potential for serious collateral damage on American soil.

Under this HLS construct, a number of mission areas under HLD and DSO are immediately apparent (fig. 2). Several mission areas, such as critical infrastructure protection, could fall under HLD or DSO, depending upon the scenario. Importantly, DOD participation in and roles during an HLS event will vary during different phases of an attack—the Air Force could be directly engaged in preventing an ongoing attack (HLD) as the LFA, yet support the Federal Emergency Management Agency (FEMA) in consequence management activities in its aftermath.

Given the changed nature of the threat, the vast number of potential homeland targets, and the wide variety of delivery means available to adversaries, it is clearly impossible to protect all vulnerabilities from every threat. Even with vastly improved intelligence, it will remain difficult to determine a priori the exact nature and timing of an attack on the homeland. Consequently, capabilities-based planning and programming for HLS hold substantial advantages over the more traditional threat-based planning and programming. When it is possible to eliminate or reduce vulnerabilities, the LFA should implement steps to do so.[7] Thus, a general approach should marry existing or planned capabilities with vulnerability remediation, flexible concept of operations (CONOPS), system architectures, and organizational constructs. A capabilities-based HLS approach fits well with the capabilities-based strategy and transformation directed by the SECDEF in his 2001 *Quadrennial Defense Review Report.*

The Air Force has many capabilities that contribute to the mission areas outlined above. Our service has primary roles in air, space, and missile defense; nuclear deterrence, retaliation, and preemption; and ISR. Moreover, it has developed extensive capabilities in each of these areas. Expeditionary orientation through the Air Force's expeditionary aerospace forces (EAF) construct has led to the fielding of capabilities that could play substantial roles in domestic crises (table 1).
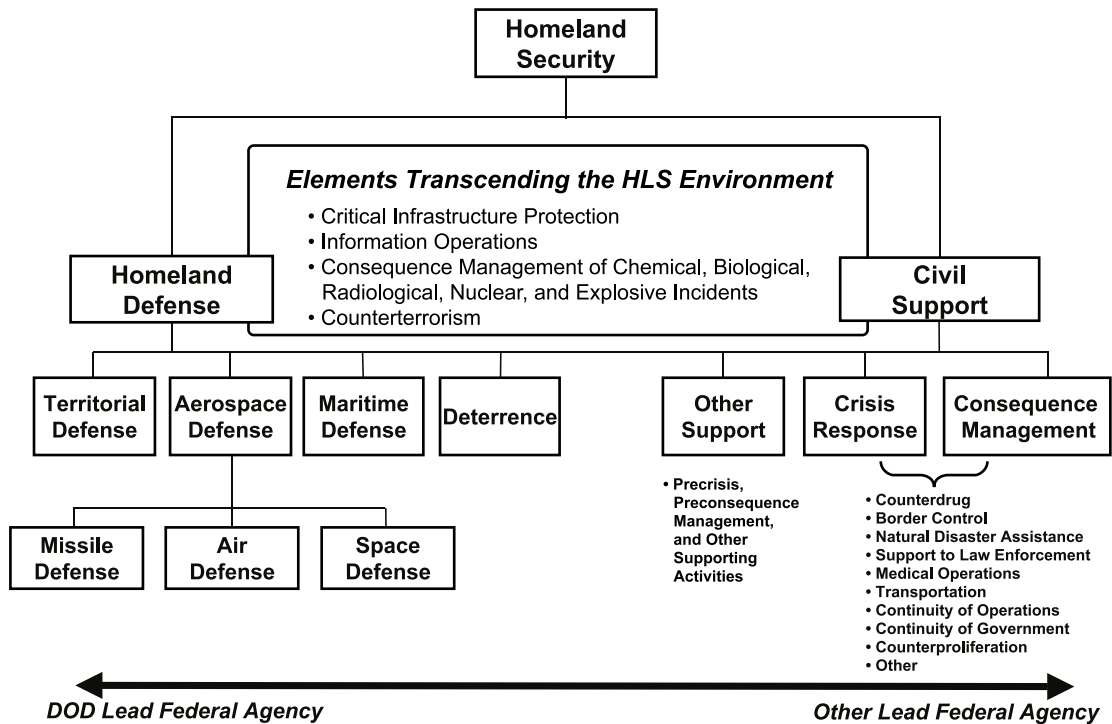
Figure 2. Homeland Security Mission Areas

Furthermore, the Air Force surgeon general has developed expeditionary medical teams with the capabilities to support war fighting that can be readily tailored and deployed to domestic disaster scenes. Table 1 lists representative capabilities that could be employed during homeland attacks.

Several remarks about a capabilities-based approach are prudent. First, those capabilities employed during a homeland attack will be highly scenario-dependent. For example, though mobilized and deployed, few Air Force medical assets were used in New York City following the World Trade Center attack. Given the severe level of devastation and limited number of survivors with injuries, local hospitals were able to handle the wounded. However, had that attack overwhelmed the New York City health care system and state re-sources, local authorities or the governor could have requested extensive federal military medical support. Second, the Air Force should make its capabilities widely known to the interagency community and senior policy makers. Lack of understanding of Air Force capabilities could lead to unrealistic expectations for military support—or worse, could overlook potentially vital support from the Air Force. Finally, the Air Force should look "outside the box" to determine if existing capabilities could be applied in innovative ways to support HLS. This is the essence of an HLS transformation—can the Air Force couple existing or improved capabilities to new CONOPS and organizational constructs to provide greatly improved security for the homeland at affordable costs and acceptable levels of risk?

Table 1

Representative Air Force HLS Capabilities

Command and control	Search and rescue
Crisis and deliberate planning	Fire-fighting assistance
Rapid, flexible airlift	Security-police assistance
Intelligence, surveillance, and reconnaissance	Crowd control
Computer network defense	Decontamination
Medical operations	Explosive ordnance disposal (EOD) teams
Engineering support	Mortuary affairs

Evolving Policies, New Issues

Now we turn to the principal HLS policy issues facing the Air Force. Current policy for civil support maintains that war-fighting missions have priority over DSO except as otherwise directed by the president or the SECDEF. Furthermore, the Air Force does not directly provide resources for DSO, unless otherwise directed. One notable exception to this rule is direct Air National Guard participation in and support of civil-support teams. This guidance could become blurred if the Air Force is directed to provide more resources and capabilities to civil-support missions than currently tasked. In addition, the Air Force could *indirectly* provide additional resources to DSO by developing and fielding capabilities applicable to both expeditionary war fighting and civil support, such as the medical community's small portable expeditionary aeromedical rapid response (SPEARR), expeditionary medical support (EMEDS), and critical-care air transport teams (CCATT) capabilities. With the current heavy emphasis on HLS, the Air Force will face numerous policy issues.

Air Force HLS Roles and Missions

What roles and missions should the Air Force undertake to support HLS? In the near

term, existing Air Force capabilities could drive new or expanded missions. Nevertheless, the Air Force must be prepared to develop and fund new capabilities should it be directed to undertake new or nontraditional missions. If other services or agencies have the requisite capabilities or expertise to fulfill such missions, the Air Force should consider deferring to those organizations (or at a minimum, working closely with them). The Air Force will need to carefully balance its expeditionary war fighting outside the continental United States (OCONUS) with HLS missions, especially with respect to force structure requirements and concurrent operational risk.

There are several closely related subsidiary issues:

- Under what conditions will the Air Force (or DOD in general) have the LFA role? This question will have to be answered in the interagency community, which should "test" lead-agency roles in experimentation and exercises, and modify them based upon lessons learned. As noted above, LFA roles will change, depending upon the particular phase of an attack or domestic crisis.

- What are the C^2 implications of these missions? To be effective, C^2 architectures for HLS must include interagency participation. C^2 must be thoroughly tested during

interagency experimentation and exercises. Ideally, C^2 architectures would enhance interagency cooperation, situational awareness, and information sharing.

- What are the appropriate CONOPS, organizational structures, technologies, and required new or additional resources? New or expanded missions will drive changes in these areas that could have serious resource implications. For example, substantially expanding combat air patrols over US cities could drain fighter and AWACS resources required for war fighting.

- What requirements-definition process will be used, and what priorities will these requirements receive? This issue drives to the heart of the resource-allocation question for war-fighting missions versus HLS missions. The senior Air Force leadership will have to determine the appropriate balance based upon guidance from the White House and Office of the Secretary of Defense (OSD). The Air Force must closely consider both short- and long-term implications of new missions upon the force structure. For example, if the president or the SECDEF extends combat air patrols over US cities indefinitely, then the Air Force must evaluate the effects upon the long-term fighter force structure vis-à-vis more traditional war-fighting missions.

Concurrent War-Fighting/ HLS Roles

What are the concurrent war-fighting/HLS roles for Air Force capabilities? As noted above, numerous Air Force capabilities can support both war-fighting and HLS missions. As the Air Force undertakes new or expanded HLS roles and missions, it must examine how dual tasking will affect mission-accomplishment risk. Furthermore, the Air Force should carefully examine if concurrency has any implications for the

EAF construct. Will the aerospace expeditionary forces (AEF) need to be organized or resourced differently to accommodate force-structure allocations to HLS?

Ensuring Power Projection

What measures should the Air Force undertake to ensure its ability to project power, given the potential for asymmetric attacks upon the homeland? This issue is closely related to the previous issue of dual tasking and concurrent risk. The US homeland must remain a secure base from which the Air Force can globally project power to defend vital interests. However, ensuring the protection of US facilities and infrastructure used for power projection will require resources and force structure. Here again, the Air Force must balance its homeland mission against power projection—with a focus this time on ensuring the availability of assets required to project power globally, such as military bases and associated infrastructure, national critical infrastructures, and information assets. The personnel, logistics, maintenance, and deployment information systems and databases are particularly critical for power projection abroad. The Air Force must devote the resources necessary to enhance and protect those portions of the infrastructure that enable the deployment of war-fighting hardware, weapon systems, and personnel.

Air Force HLS Capabilities

What postures or capabilities can the Air Force contribute to the deterrence of attacks on the homeland? Many new adversaries and threats are not deterred by traditional military means. The military instrument of national power may have to be used in innovative ways in conjunction with other instruments of power to deter new threats. New declaratory policies to counter terrorism, such as reserving the right to preemptively attack states that directly or indirectly sponsor terrorist activities and demonstrating the will to do so, may deter some state sponsorship. Well-exercised and

demonstrated C², planning, and crisis- and consequence-management capabilities may also contribute to deterrence. The Air Force should examine its capabilities and core competencies to determine those deterrent roles it can undertake, particularly in preemption, attribution, and retaliation.

Force-Structure Impacts

What force-sizing construct should the Air Force use for HLS? New HLS roles and missions will have force-structure impacts. The force-sizing construct is particularly sensitive to the degree of concurrent risk that senior policy makers are willing to accept. Driving down concurrent risk would imply dedicating force structure exclusively to HLS along with the required resources. Determining an appropriate force-sizing construct will require balancing war-fighting and HLS missions, determining appropriate roles for the active duty, Guard, and Reserve components, and ensuring the ability to project power from the homeland while keeping risks at acceptable levels. The recent *Quadrennial Defense Review Report* listed homeland defense as the number-one priority in the list of national security tasks. Allocating additional resources to contributing mission areas would seem to be consistent with that priority.

Organizing for War-Fighting and HLS Missions

How should the Air Force organize itself to best support its war-fighting requirements and HLS missions? The Air Force developed and implemented the EAF construct as its organizational framework. Ideally, HLS missions will integrate into the EAF construct with little modification and become part of "normal" EAF operations. However, the 10 AEFs may require additional resources to reduce the risk associated with concurrent HLS and expeditionary war-fighting missions and to ensure the ability to project power during or after a homeland attack. Furthermore, the 10 AEFs are not equally capable today, which implies that homeland crises may present a greater or lesser degree of risk, depending upon which AEFs are on call. Additional resources might reduce stresses on the AEFs and low-density/high-demand (LD/HD) assets such as ISR platforms. If the Air Force undertakes new HLS missions, such as expanded use of ISR for domestic surveillance, then already scarce LD/HD assets might not be available. The Air Force should examine how to best resolve these operational issues within the EAF construct, without "breaking" any AEFs, thereby ensuring the Air Force's ability to fulfill its HLS and war-fighting missions.

Recommendations

First, the Air Force must develop HLS force-sizing criteria based upon defined roles and missions and then apportion forces to specific, key HLS missions according to established priorities. This apportionment could be the key to avoiding dual- and triple-tasking of some resources.[8] Barring additional and specifically earmarked resources, the Air Force will have to carefully examine resource prioritization and allocations between HLS and more traditional war-fighting missions—and adjust the existing balance as necessary. Without sufficient personnel and materiel to cover new, apportioned missions, the risk of failure will likely be higher. This is particularly true for LD/HD assets and other critically manned fields. Concurrently, policies that prohibit providing resources to sustain civil-support missions (unless otherwise directed) should be loosened or rescinded, given the emerging need to directly resource new missions. This new force structure must be thoroughly tested in experimentation, exercises, and war games and adjusted as necessary to ensure the best mix of forces for deployed and domestic operations.

Second, the Air Force must maintain HLS as an integrated Total Force responsibility. The active duty, Guard, and Reserve components each bring capabilities and special expertise to HLS. The Guard and Reserve, for example, are already *forward deployed* in communities spanning the nation and frequently

have close ties with local first responders. However, HLS should not be the primary mission of the Guard and Reserve. These components have vital, integral missions in deployed war-fighting operations. Breaking the Total Force construct into separate war-fighting and HLS components could introduce additional risk into deployed and domestic operations or lead to expensive and unnecessary duplication of capabilities.

Third, the Air Force (in conjunction with the other services, Joint Staff, and OSD) should advocate a broad-based, intelligence-sharing program with other federal departments and agencies. HLS is inherently an interagency mission cutting across the totality of the federal government. A broad interagency common-operational picture (COP) is essential for the prevention and deterrence of future attacks and is crucial for crisis and consequence management. When it is possible and appropriate, the Air Force should integrate its ISR assets and processes into the COP. This may require changes in national policies or laws such as Posse Comitatus. Any such changes, though, must be balanced with appropriate oversight and controls, given the strong resistance the use of military assets for domestic intelligence purposes would likely draw. Furthermore, the COP will require dissemination controls to ensure the protection of law enforcement's case-sensitive information, intelligence sources and methods, and privacy rights.

Finally, the Air Force must fully engage the other services, the Joint Staff, OSD, and the interagency community on HLS issues. Air Force programs must necessarily integrate tightly into DOD and interagency programs. Engagement is more than just attending interagency meetings; the Air Force must commit to total interoperability, including C^2 architectures, communications, exercises and experimentation, CONOPS, technologies, and so forth. The Air Force must broaden its HLS perspectives to the interagency community and ensure tight integration of its programs with those in other key agencies.

Conclusions

Homeland security has moved to the forefront of governmental and military affairs following the tragic attacks on 11 September 2001. While the Air Force has always defended the homeland, it has substantial capabilities to bring to the fight against new threats to national security. As it does so, the Air Force will confront numerous key policy issues, including its proper HLS roles and missions, force sizing considerations, the mix of active Air Force/Air National Guard/Air Force Reserve forces, and resource allocation priorities.

The new threats directed at the United States have placed a difficult set of problems squarely before the Air Force. The service will likely face new missions and functions in an already resource-constrained environment. If resources are shifted to HLS, the Air Force will confront tough apportionment choices, such as reducing the risk of asymmetric attacks on the homeland while possibly increasing the level of risk of deployed operations. The service must balance emerging HLS roles among the active duty, Guard, and Reserve components, capitalizing on the inherent strengths of each. It will have to develop new CONOPS for domestic missions and forge operational relationships with other nondefense federal agencies and entities. In addition, it remains crucial for the Air Force to maintain its ability to rapidly project power from CONUS—even in the face of massive, asymmetric attacks on the homeland. This capability could spell the difference between victory and defeat during deployed operations.

Given the need for new organizational constructs, CONOPS, and technologies to address the threats to the United States, homeland security will be the forcing function for the next Air Force transformation. As the attacks of 11 September 2001 and the ongoing terrorist threats so clearly illustrate, ignoring the call for this transformation will place the nation's security and survival at risk. ☐

Notes

1. For example, the Federal Response Plan explicitly delineates federal department and agency responsibilities for the delivery of federal assistance following major disasters or emergencies declared under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (42 United States Code 5121 and following). Presidential Decision Directive 39 (PDD-39) assigns LFA responsibilities to the Federal Bureau of Investigation and the Federal Emergency Management Agency for crisis and consequence management, respectively. Other PDDs and executive orders delineate additional agency missions and functions.

2. The private-sector owners and operators of critical infrastructures have major roles and responsibilities to secure their assets—DOD can contribute to infrastructure protection, but of and by itself cannot, and should not, protect all of these infrastructures.

3. *Quadrennial Defense Review Report,* 30 September 2001, on-line, Internet, 1 February 2002, available from http://www.defenselink.mil/pubs/qdr2001.pdf.

4. At this writing, DOD has not yet finalized a set of definitions. Others have proposed similar constructs and definitions but do not make the two crucial points in the paragraph. In the summer of 2001, the Joint Staff proposed that HLD be defined as *"the defense of U.S. territory, population, and infrastructure against direct attacks.* These missions include: the defense of the land, aerospace, and maritime approaches to the U.S.; threat reduction, deterrence and preemption; missile defense; and countering large-scale terrorist activity" (emphasis in original). This definition does not make the critical distinction that HLD missions are those for which DOD is the LFA. Also, it leaves open to interpretation whether attacks in other locations, such as Khobar Towers, US embassies in Africa, and the USS *Cole,* are included in this mission set. While the *Quadrennial Defense Review Report* does not specifically define HLS, it does state that "the United States will maintain sufficient military forces to protect the U.S. domestic population, its territory, and its critical defense related infrastructure against attacks *emanating from outside U.S. borders,* as appropriate under U.S. law" (emphasis added). While similar to the Air Force definition, this statement explicitly excludes attacks originating inside US territory, whether of military, terrorist, or other origin.

5. Conceivably, foreign attacks could originate from within US borders. The 11 September hijackings and the follow-on anthrax attacks (if linked to foreign sponsors) are two cases in point. A foreign cyber attack launched from American computers is an additional example.

6. This issue was dramatically highlighted in the rules of engagement undertaken following the 11 September hijackings. If a hijacked aircraft were preparing to attack American targets, Air Force pilots could be placed in the uncomfortable position of downing airliners and killing American citizens.

7. Clearly, much of the responsibility for eliminating vulnerabilities falls outside of DOD—all government agencies, the private sector, and even private citizens have roles to play.

8. Local-community first responders who are also Guard personnel with a specialty applicable to both war-fighting and civil-support missions could find themselves triple-tasked during concurrent homeland and overseas crises.

The outcome of a battle depends not upon numbers, but upon the united hearts of those who fight.

––Attributed to Kusunoki Masashige, 1294–1336

Fighting Stupid, Defending Smart

Col Richard Szafranski, USAF, Retired

Editorial Abstract: Are America's terrorist enemies smart or stupid? From the attacks of 11 September 2001, the author deduces that their intent is to destroy our economic strength and that by openly announcing their strategy, they have committed a cardinal error. He argues that a smart defense concentrates on defending the pillars of US economic strength while conducting the offensive war against terrorism.

> *To bend the enemy's will, one must put him in intolerable circumstances; and the best way to do that is to attack directly the defenseless population of his cities and great industrial centers. It is as sure as fate that, as long as such a direct method of attack exists, it will be used.*

> —Giulio Douhet

THOUSANDS OF INNOCENT Americans were attacked and murdered on 11 September 2001. The war that "many of us feared and anticipated," to use Under Secretary of Defense (Comptroller) Dov S. Zakheim's words, has arrived.[1] The enemy abducted and used instruments of American global aerospace power—our own fuel- and passenger-laden long-range commercial airliners—against us with hateful and perhaps strategic effect. The attacks seemed directed against our people—our most precious asset—and the enemy's objective appeared to be the destruction of the physical symbols of America's greatness. However, evidence is developing that the enemy intended more than symbolic attacks and mass murders: the real objective was to destroy America's economic strength.

The war is on. Americans, our friends, and allies must be determined that history will show that the enemy was stupid. That history can be written only if we hunt, capture, and bring our enemies to justice; ceaselessly work to eradicate terrorism; and successfully defend ourselves in the interim. Appreciating the enemy's aims is key to an intelligent defense.

Early Warnings

Cicero recognized that money is the sinew of war. Europeans fought wars in Europe and in its colonies over possession of wealth. In America, taxation was a stimulus for the Revolution, and desire for wealth a primary motive driving westward expansion. America built and sustained a great navy to protect commerce. In the nation's Civil War, Gen William T. Sherman marched to the sea using 1860 census data on the South's economic centers to draw his *scientific* route of destruction.[2] Until the advent of the airplane—as Brig Gen Giulio Douhet recognized and Col John A. Warden III elaborated—it was first necessary to engage and destroy an enemy's fielded forces before attacking his economic heartland. The US Air Corps Tactical School studied the *industrial web* with an eye toward understanding how airpower could strike deep and dismantle the production capacity of an enemy state. For decades and through many evolutions in the Cold War, the US Single Integrated Operational Plan (SIOP) threatened the Soviet state with industrial and economic ruin and the loss of its hostage colonies.[3] Then the Cold War ended.

During the decade that followed, many analysts and pundits struggled to understand the underlying dynamics of a new world order. Some said the new enemy was *instability.* Many urged a *revolution in military affairs* to cope with the new threats or a *transformation* of military power to dominate them. Some envisioned and articulated the West's material and spiritual weaknesses to novel forms of attack. Most talked of *asymmetrical* warfare, perhaps failing to appreciate that the aim of all warfare is to create asymmetries to best an enemy. In 1993 Alvin and Heidi Toffler, in their book *War and Anti-War,* gave warning:

> Imagine . . . the World Trade Towers or the Wall Street district. The ensuing financial chaos—with bank transfer networks, stock and bond markets, commodity trading systems, credit card networks, telephone and data transmission lines, Quotron machines, and general commercial communications disrupted or destroyed—would have sent a financial shock wave across

the world. Nor does one need such sophisticated weaponry to accomplish a similar effect.[4]

In China, Qiao Liang and Wang Xiangsui daringly outlined numerous forms of unrestricted or "no limits" warfare and their "new weapons concepts":

> New weapons concepts are completely different from new concept weapons. New weapons concepts is a broad conception of weapons that transcends the military field—whatever method can be used to fight a war is a weapon. In this view, whatever provides benefits to mankind can also be turned around to be a weapon to harm mankind. That is to say that there is nothing in the world that cannot become a weapon. This smashes our conception of just what a weapon is. Just as technology is multiplying the number of different kinds of weapons, new thinking breaks down the distinction between weapon and non-weapon. To our way of thinking, a planned stock market crash, a computer virus attack, making the currency exchange rate of an enemy country erratic, and spreading rumors on the Internet about the leaders of an enemy country can all be thought of as new concept weapons. This new way of thinking puts weapons into the daily lives of civilians. New concept weapons can make of war something that even military professionals will find hard to imagine. Both soldiers and civilians will be disturbed to see items in their everyday lives become weapons that can attack and kill.[5]

The events of 11 September 2001 were destructive and bloody, but they did not collapse the American economy. However, if we fail to approach the situation thinking *smart,* enemy actions that are still unconsummated could write the very history we must avoid. It is easier to be smart against a stupid enemy, and perhaps we have one. Any enemy incautious enough to openly specify strategic and operational objectives provides us the opportunity to block those objectives.

Fighting Stupid?

Stupid could easily refer to a particular person, but more importantly the term implies a way of fighting that isn't smart. For example, at the tactical level it is not smart to announce bat-

tles in advance of initiating them or to proclaim targets in advance of attacking them. Acknowledging that media attention is the oxygen of terrorism—a terrorist's objectives include inflaming media hype by creating visual drama—it is still unwise to telegraph major operations in advance or illuminate strategic objectives for an adversary. Napoléon once said that he would throw his cap in the fire if it knew what his head was thinking. In Chinese military classics the general is urged to be "inscrutable," and the key elements of strategy are described as "mouth-to-ear" affairs. The US secretary of defense's (SECDEF) justifiable ire over *leaks* made it clear that he would be intolerant of fighting stupid.[6] In contrast, witness an enemy general with an ego so uncontainable that he was given to regular speech making and performing in front of camcorders. Do the speeches reveal strategy?

It would be stupid to underappreciate Sun Tzu's warning that all warfare is based on deception. Misinformation and misdirection are tools the strategist knows well and the best strategists employ well. Thus, when an enemy appears to have revealed a secret or a strategic direction, the skeptic looks for evidence of misdirection. When insufficient evidence is forthcoming, the strategist, ever paranoid, looks more closely and more broadly. If the secret is corroborated or if there is proof that a professed strategic direction may be an actual one, then the good strategist uses the enemy's incaution as a gift of knowledge. It pays to listen closely when an enemy speaks—even one as deceptive as Osama bin Laden. What was this enemy alleged to have revealed?

In congratulating the killers who brought down the World Trade Center, he said, "They shook America's throne and struck at the US economy in the heart. They struck the largest military power deep in the heart. . . . This is clear proof that this international usurious, damnable economy—which America uses along with its military power to impose infidelity and humiliation on weak people—can easily collapse . . . those blessed attacks, as they themselves admitted, have inflicted on the New York and other markets more than a trillion dollars in losses."[7] Osama bin Laden continued praising the murderers for "hitting the economic structure, which is the basis for military power. If their economy is destroyed, they will be busy with their own affairs rather than enslaving weak peoples. It is important to concentrate on hitting the U.S. economy through all possible means."[8] Moreover, in case that wasn't clear enough, he added, "The economic bleeding is continuing to date, but it requires further strikes. The young people should make an effort to look for the key pillars of the U.S. economy. The key pillars of the enemy should be struck, God willing."[9]

The source of these remarks is the transcript of alleged Bin Laden videotape that appeared on Al-Jazirah, a Qatar-based Arabic 24-hour news satellite-channel, on 27 December 2001. I will set aside the important but tortuous process of proving the authority and veracity of attributing these utterances to Bin Laden, the accuracy of the translation, and other similar issues, to allow us to focus on the words. Note the steady repetition—seven times—of the word "economy" or "economic" in these remarks. The logic Bin Laden advances is that the United States is evil, ruthless, and able to do ill in the world because of its military power borne by its economic power. Key pillars underpin the US economic power: although its economy is "bleeding," future attacks must focus on striking these pillars.

Economic attacks are not necessarily a new thought. In 1987 Paul Kennedy illuminated the relationships between economic power and military strength in *The Rise and Fall of the Great Powers*.[10] In its 1999 report, the United States Commission on National Security/21st Century also noted potential sensitivities in the evolving economic infrastructure: "Even more portentous, as global and domestic infrastructures become indispensable to modern life, their disruption can have literally life-threatening consequences. Such infrastructures, including crucial transportation, health, sanitation, and financial systems, are bound to become targets of the disgruntled, the envious, and the evil—individuals, groups, and poten-

tially hostile countries alike. They will be very difficult targets to defend."[11]

What is new, however, is the complexity of today's economy and its volatility. Evidence of serious disruption and hurt in the wake of the 11 September 2001 attacks mounts: the airline industry,[12] tourism, commuter travel, insurance, construction, retail, layoffs in many sectors, and the worst year on Wall Street since 1973 or 1974. All this evidence suggests at least temporary "bleeding."[13] But in a sense, by directing economic attacks, Bin Laden is proposing an impossible task for the young martyrs because neither he nor our best economists really understand our economy well enough to identify with certainty the "pillars" on which it rests.

The fact is that there isn't a single American economy. There are a number of quite different economies at play, each with its own dynamics. There are agricultural; mineral-extraction, industrial-era, assembly-line; information- or knowledge-based; and entertainment[14] economies, each with its own unique needs and outputs. There are domestic and regional economies (both protected), and there are expansive and highly interactive global sectors. There are sectors with redundancy—and hence a degree of security—built in, and other sectors that are so lean that the loss of a single component would take them down and cause big ripple effects. The blunt fact is that we have much—almost everything—to learn about the fragility and the resilience of the twenty-first-century economy and the different sectors within it.[15]

On the other hand, terrorists realize that even random strikes could kill large numbers of people and damage parts of the system. More carefully planned strikes, they are likely to reason, could inflict grave damage. Thus there is every reason to believe that somewhere, sometime, the young martyrs will try another wave of attacks. Mounting a smart defense requires that we first accept that the robust US economy—or some critical contributing elements—constitutes a rich set of targets for the present enemy and an assuredly difficult set for us to defend.

Winning Smart

A smart defense involves thinking within the adversary's frame of reference—from the obvious to the subtle. To learn what pillars the enemy would attack, we first have to advance a theory of the basis of US economic power. What ends does the American economy serve, how does it work, and where might be its vulnerabilities?

As young premartyrs, the enemies might start by reading the great economists. That would likely be unrevealing because the twenty-first-century economy is different from the one these economists described. Alternatively they could—and probably would—scrutinize the numerous public tomes, paid for by the US government, that expose our economic and other weaknesses. These might include reports of the President's Commission of Critical Infrastructure Protection and of the United States Commission on National Security/21st Century. They might choose to study our supply chains, study financial analysts' reports, or steal documents from insurers or reinsurers (who are usually well informed about risks and vulnerabilities).

This may be too subtle. Behind the enemies' fanatic hostility lies a worldview that concludes the US economy is based on the exploitation of the weak everywhere to pay for evil American social and economic aggrandizement. America's physical infrastructure moves mass and electrons throughout the United States and the world, provides lines of communication, and furnishes gathering places for commerce and individual or public entertainment. Alongside this physical infrastructure is an American culture that includes freedom from guilt and a supreme confidence that Americans have the inventiveness to create nearly limitless wealth. In turn, that wealth sustains American military power and thereby compounds the potential for further exploitation of the weak.

As America's enemies look around the world for evidence to support these views, they see the enormous global divide between the rich and the poor. They see huge American financial dealings that, in their

eyes, are unfair and usurious. They see the United States—the Great Satan—supporting both Christianity and the Jewish state of Israel in opposition to the Muslim community or *ummah.* Their frame of reference overlooks constitutionally guaranteed freedom for all religious expression, including that of Muslims, and ignores American support for Muslims in Kosovo and Bosnia. Instead, it despises the non-Talibanic, American *mores*—especially the equality of the role, status, and worth of women in American society. They are shocked by the dress of American women and the scandalous behavior of many female celebrities. They see American entertainment as corrupt, polluting, and self-serving. They glare at American tourism, theme parks, and sports stadiums (not used for beheadings, amputations, floggings, or other public torture) as corrupting activities and symbols. Worse yet, they see America flaunting its wealth and exporting all it can of this unclean culture from which it earns huge profits.

Given these views, the enemy would strive to meet many goals simultaneously. First, do economic damage to a "damnable" economic apparatus that none of us understands. Next, humiliate and chastise America: make us conscious of our vulnerability, create fear, unweave threads of our social fabric, and make us lose faith in our government's and our armed forces' ability to protect us. America, the enemy would reason, is vulnerable to perturbations in its economy, and attacks of any kind would erode our confidence and hurt our morale.

From the enemy's frame of reference, which targets satisfy what Bin Laden called the "key pillars" of the US economy? With the enemy's postulated understanding of our economy, there are many potential targets, but five would likely top the list (table 1). Given these "pillars," a notional target set emerges for those young terrorists committed to—and perhaps already walking—the road to martyrdom.[16]

Defending the Pillars

Thinking as the enemy might think, a large return on investment would appear very important since each transaction deliberately liquidates part of his human capital.[17] The enemy would also strive to mitigate this liability by recruiting an abundance of would-be martyrs and allies—hence the many training

Table 1

Economic Pillars and Potential Targets

Pillars	*Targets*
American financial and currency markets	World Trade Center, Wall Street, World Bank, and overseas economies
American interior and global lines of communications	Airlines, telecommunications, ports, Internet, and mass transport
American mass points of sale	Stadiums, theme parks, malls, theaters, and *main streets*
America's confidence in its inventiveness to create and expend wealth	Malls, wealthy heroes, labs, Silicon Valley, and *Fortune* 50 companies
America's confidence in its government, including its armed forces and law enforcement agencies, to protect American institutions and values	Pentagon, US Capitol, White House, FBI Headquarters, Supreme Court

camps. He would strive to arm the martyrs with weapons of mass destruction and employ them in ways that would create mass destruction or mass disruption. We would be stupid to think the enemy does not have a large and well-distributed presence in the Americas already. I have heard the number "150,"[18] but we should think in terms of much larger numbers, including the additional witting and unwitting accomplices aiding and abetting the enemy.[19] Some of these may be the home-grown variety of terrorists that plague every nation. Witness the bombing of abortion clinics, the Oklahoma City bombing, a light-aircraft suicide, and at least one American caught fighting on the side of the enemy. Al-Qaeda, Inc. has been in business long enough to have products everywhere. The enemy most likely has a large number of combat, combat-support, and combat-services-support troops in the Americas. Prudence dictates we not think otherwise.

In addition, we must assume our enemies have access to—or will try to get access to—radiological, chemical, and biological weapons.[20] Surely they must, because they need a high return on investment in martyrdom and will aim at doing permanent damage to American morale and institutions by striking "the key pillars" of the American economy. Hijacking airliners and flying them into buildings is horrific and unforgivable, but poisoning water or food sources or contaminating many square miles of a city rich in government buildings or financial centers could rise to the level of an unrecoverable tragedy.[21] Exploding a container ship or a tanker in port or beneath a bridge, detonating a truck's cargo in a tunnel, rendering many hospitals unusable simultaneously, disrupting emergency services, hijacking airliners and flying them into nuclear power plants, or engaging in massive information attacks—all are within the logic of the enemy's model. The model? Do massive and demoralizing destruction while attacking and reattacking the key pillars until they collapse. While the enemy strives to pull the pillars down, we must be vigilant and active to ensure that the enemy goes down but the pillars stay up.

Imposing Our Will

The smart move is to accept that we will be at grave risk until the enemy is eradicated—wherever he is found. Whether or not official *threat alerts* are issued, we must remain vigilant and remember that we are in a fight for our lives. The fight will be expensive. It will entail tangible and intangible costs we cannot see today. Since we became actively engaged on 11 September 2001, the war against terrorism is reportedly consuming more than $2 billion each month.[22] There are many months of fighting ahead, and even after holding the line, we will have to cope with the longer-term financial and social implications of these huge costs. The Social Security and medical-care accounts likely will suffer. Our country will accrue debt that our grandchildren will have to pay. There will be longer-term constitutional issues. We must deal with these as best we can now but without becoming distracted. If we do not endure—then none of these issues required our attention.

Many of the remedies under way appear to be appropriate, as long as we also explicitly defend the "key pillars" of our economy. The president—or the SECDEF, or the homeland security chief, or the secretary of commerce, or the director of central intelligence—should commission separate (and perhaps secret) studies that determine what pillars of our economy must survive, their vulnerabilities to attack, and ways we can defend them. The president must deal with additional challenges: the smoking gun of anthrax, our energy dependence and associated vulnerabilities, and other nations that host terrorists. Simultaneously, the SECDEF and the services—even while fighting enemies abroad and going through the processes of transformation at home—must ask what each can do to protect the US economy from attack. How can land power help? How can sea power help? What does "force protection" mean now? What ought to be the future mission of the North American Aerospace Defense Command?

Aerospace power is airpower plus space power plus the economic power of the American aerospace industry. Aerospace power can

and will help—certainly more than providing combat air patrols. It will contribute more than keeping the aircraft-production lines of the major vendors alive and well, and more than helping to eradicate the enemy abroad. We must begin by accepting that in a complex world of multitudinous and multidimensional threats, authentic airpower expertise precludes advancing single, simple solutions to complex problems. Airpower is not just about simplistic thinking: "kicking down the door" of the enemy, or "rapid decisive operations," or "rapid halt," or even the "five rings." Clearly, none of these frameworks stimulated the thinking that preempted or deterred the attacks that rendered thousands of Americans "defenseless," to use Douhet's word, on 11 September 2001. Yet, the vantage of airmen ought to give them the advantage to systematically think through the complex problem of attacking economic "pillars" and "red-teaming" (role-playing the enemy during simulated planning and execution) our own economic infrastructure to envision what we must defend and how aerospace power can contribute. How do we preserve the strength and competitiveness of our aerospace industry? How do we protect all the contributing elements of it from attack or even from vulnerability? The Commission on the Future of the US Aerospace Industry is seated and may help, but military aviators and planners cannot be excused from thinking of both attack and defense in new ways. Who among us can break the shackles of buzzword and buzz-phrase thinking and conceive of new ways to use aerospace power in defense against the new threats to our country? Defending the notional target set offered here is only a beginning. And these issues and questions only scratch the surface.

There is much to do—and the time is limited. Before us is either our finest hour or what the enemy intends as our last hours. We must be smart, impose our will, and prove that the enemy has made a profoundly stupid mistake. ☐

Notes

1. Vernon Loeb, "Not Just Writing Checks for the Military," *Washington Post*, 2 January 2002, on-line, Internet, 8 February 2002, available from http://www.washingtonpost.com/ac2/wp-dyn?pagename=article&node=&contentId=A49428-2002Jan1.

2. Tom Wheeler, *Leadership Lessons from the Civil War: Winning Strategies for Today's Managers* (New York: Currency Doubleday, 1999), 195.

3. Desmond Ball, "Development of the SIOP, 1960–1983," in Desmond Ball and Jeffrey Richelson, eds., *Strategic Nuclear Targeting* (Ithaca, N.Y.: Cornell University Press, 1986), 80–81.

4. Alvin and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (New York: Little, Brown and Company, 1993), 149.

5. Qiao Liang and Wang Xiangsui, *Unrestricted Warfare: Assumptions on War and Tactics in the Age of Globalization* (Beijing: PLA Literature and Arts Publishing House, 1999), 21–22, summary translation of *Unrestricted Warfare–Part One*, on-line, Internet, 12 February 2002, available from http://www.fas.org/nuke/guide/china/doctrine/unresw1.htm.

6. Rowan Scarborough, "Rumsfeld Eyes Global Command to Oversee Long War on Terrorism," *Washington Times*, 23 October 2001.

7. " 'Full Text' of Usama bin Ladin Recorded Statement Aired by Al-Jazirah TV 27 Dec," available in FBIS *(Foreign Broadcast Information Service)* on-line subscription service (Document ID: GMP20011227000257, Entry Date: 27 December 2001, Version 2), 4.

8. Ibid.

9. Ibid., 7.

10. Paul Kennedy, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000* (New York: Random House, 1987).

11. "Supporting Research and Analysis," *New World Coming: American Security in the 21st Century*, Phase 1, 15 September 1999, 151, on-line, Internet, 8 February 2002, available from http://www.fas.org/man/docs/nwc/NWR_A.pdf.

12. Frances Williams, "ILO Sees Huge Air Industry Job Losses," *Financial Times*, 20 January 2002. The International Labour Organization (ILO) notes in a report prepared for a meeting this week of governments, trade unions, and employers to discuss responses to the crisis, the ILO estimates that one operational aircraft supports 150–250 direct jobs and about the same number of indirect jobs. For every direct-flight job lost, at least four jobs are lost within the airport perimeter (catering, baggage, maintenance, and airport security) and about three jobs around the perimeter in hotels, transport, and other services.

13. Michael Grunwald, "Terror's Damage: Calculating the Devastation," *Washington Post*, 28 October 2001, n.p., on-line, Internet, 12 February 2002, available from http://www.washingtonpost.com/ac2/wp-dyn?pagename=article&node=&contentId=A63343-2001Oct27. Mr Grunwald details some of the hurt:

  - New York's total "lost human productive value": about $11 billion.

  - The airlines, which comprise the most prominent terror-damaged industry, have received a $15 billion government bailout, announced 100,000 layoffs and slashed 20 percent of their flights.

- The Pentagon sustained about $1 billion in damages.

- New York also sustained "business interruption" costs estimated at $21 billion, focused in the downtown neighborhoods that were inaccessible for weeks after the attacks.

- Reagan National Airport was closed for 23 days at a cost of $330 million to the airport and Northern Virginia businesses and $27 million to state and local tax revenue.

- The $126 billion commercial insurance industry—facing a $30 billion to $50 billion payout—is clearly one that will never be quite the same. Insurers and reinsurers had never considered terrorism when pricing their premiums.

- A third of the nation's 265,000 unionized hotel and restaurant workers have been laid off. Hotel expansion plans are on hold everywhere.

14. Michael J. Wolf, *The Entertainment Economy: How Mega-Media Forces Are Transforming Our Lives* (New York: Random House, 1999). Wolf's thesis in 1999 was that "locally, globally, internationally, we are living in an entertainment economy" (p. xxi). He noted on page 31 that

> while the rate of personal savings in the United States has declined to a sixty-three-year low of 2.1 percent, entertainment spending is at a high of 8.4 percent of total consumer expenditures. Soon the annual outlay for entertainment could surpass that for health care, household supplies, and home furnishings. Equally telling are the results of a number of surveys that gave consumers the choice of more free time or more money. Resoundingly, they chose more free time. Of course, we cannot simply find more free time just by wishing for it on a survey. More and more, we have to pay for it. Fun, entertainment, recreation, no matter what you call it, we have become a nation—make that a world—of fun-focused consumers.

If the fun foreseen in 1999 is now over, the economy will manifest the loss.

15. Allan Sloan, "A Year That Defied Forecasting," *Washington Post*, 1 January 2002, n.p., on-line, Internet, 12 February 2002, available from http://www.washingtonpost.com/ac2/wp-dyn?pagename=article&node=&contentId=A46875-2001Dec31.

16. Clearly this notional target set is an expansive one, suggesting the need for massive investment and new thinking.

17. Our actions have already reduced the size and reach of the enemy force, but we must find the forces already forward-deployed.

18. Dan Eggen and Michael Dobbs, "Danger Persists after Hobbling of Al Qaeda," *Washington Post*, 14 January 2002, n.p., on-line, Internet, 12 February 2002, available from http://www.washingtonpost.com/ac2/wp-dyn?pagename=article& node=& contentId=A40815-2002Jan13. The authors write: "Since Sept. 11, the United States has frozen more than $33 million in assets of more than 150 groups and individuals allegedly involved in funding terrorism. A similar amount has been frozen by 142 nations cooperating in the effort, and teams of U.S. experts have been sent to help countries such as the United Arab Emirates plug holes in financial systems that terrorists exploit."

19. David Ignatius, "The 'Sleepers' among Us," *Washington Post*, 18 November 2001, n.p., on-line, Internet, 12 February 2002, available from http://www.washingtonpost.com/ac2/wp-dyn?pagename=article&node=&contentId=A43725-2001Nov16.

20. Graham Allison, "We Must Act as if He Has the Bomb," *Washington Post*, 18 November 2001, n.p., on-line, Internet, 12 February 2002, available from http://www.ksg.harvard.edu/news/opeds/allison_binladen_bomb_wp_111801.htm.

21. In *Biological Warfare in the 21st Century: Biotechnology and the Proliferation of Biological Weapons* (London: Brassey's, 1994), 198, Malcolm Dando writes that

> examples of hypothetical attacks put forward in the open literature include a ship attacking New York with aerosolized anthrax and perhaps causing 400,000 deaths, and the deliberate contamination of milk supplies with botulinal toxin at a commercial processing plant. Moreover, though it is possible to think of policy responses which would help alleviate the danger . . . it would be very difficult to prevent a determined terrorist group from using biological weapons effectively.

22. "Pentagon Seeking a Large Increase in Its Next Budget," *New York Times*, 7 January 2002, 1.

Wise men refuse to move until they are wronged, but brave men as soon as they are wronged go to war, and when there is a good opportunity make peace again. They are not intoxicated by military success; but neither will they tolerate injustice from a love of peace and ease.

––Thucydides

The K-767
Tanker for the Future

CAPT GILLES VAN NEDERVEEN, USAF, RETIRED*

IN JULY 2001, a launch order and a consortium proposal gave Boeing 767 airframes the edge in the global aerial-tanker market. The Italian air force ordered four of them with an option for two more (fig. 1).[1] In addition, the Royal Air Force (RAF) is seeking a contractor-financed scheme to lease up to 30 of these tankers, but a decision on this Boeing proposal is not expected until the 2003 budget is set. The US Air Force continues to work with the Department of Defense and both the House and Senate Armed Services Committees on a congressional proposal to lease 100 tankers. Written in the aftermath of the terrorist attacks of 11 September 2001, the proposal will require additional monies not yet authorized by Congress. The lease is supposed to help both Boeing, hurt by cutbacks in airline orders, and the Air Force, which is using up KC-135E hours during Operation Enduring Freedom. But during the Christmas recess last year, some senators questioned the wisdom of a lease in lieu of an outright purchase. Historically, leases for the Air Force have proved expensive, and the service has usually converted them to purchases (e.g., the C-20H).

In January 2001, the US Naval Air Test Center at Naval Air Station Patuxent River, Maryland, ran a series of engineering tests on a British Airways Boeing 767-300ER for the
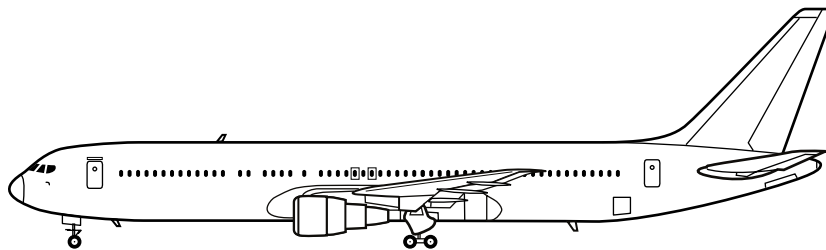

Figure 1. The Italian air force has ordered several Boeing 767-300 tankers, and the RAF is interested in them as well.

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RAF, using an F/A-18 and S-3 as receiver aircraft.[2] Flying behind the airliner, the two aircraft gathered data on turbulent airflow, sight lines for probe-and-drogue refueling, and boom-refueling positions.[3]

As the Boeing 707 tanker approaches the end of its useful life, the world's air forces are closely monitoring tests such as this one.[4] Numerous airframes on the world market could be modified to serve as tankers, but the Boeing 767s may have an edge. The RAF is currently pursuing various options to replace its aging VC-10 and L-1011 tanker fleet with new airframes, and British Airways is coming out of a business restructure with excess 767 airframes it would like to sell. Other aircraft currently undergoing tanker modifications include the Airbus A310 for Germany and Canada as well as the DC-10 for the Dutch Air Force. Wide-body tankers can also serve as airlifters for deploying units, and most air forces are interested in cutting operating costs by combining missions on a few platforms.

The 767 airframe is large enough to allow the fitting of both center-line boom and wing-tip probe-and-drogue-pod air-to-air refueling systems. These two systems, used worldwide, give air forces the versatility to refuel the majority of their aircraft. Obviously, this capability is essential for air forces that have both boom- and probe-type aircraft in their inventories.

Tankers have become a combat enhancer and force multiplier in the post–Cold War world. Because aerial-refueling capability improves an aircraft's mission duration, deployability, and force projection, tanker-equipped air forces have grown in number from eight in 1989 to over 20 today. A tanker's ability to increase the range and endurance of fighters makes it essential to modern air war, as evidenced in recent air campaigns such as those in Iraq and the Balkans. Tankers give air commanders greater flexibility in conducting operations and improve the endurance of intelligence, surveillance, and reconnaissance platforms. Aerial refueling also enhances the targeting abilities of modern fighters by allowing them to carry larger combat loads and fly greater distances.

Against this growing demand, the grand old workhorse Boeing 707—no longer in production but still in use around the world—is experiencing corrosion problems and high maintenance costs, making economical operation increasingly difficult. Additionally, the Air Force's KC-135 fleet will require replacement in the 2010–2020 time frame. The smaller KC-130 tankers, used by some air forces, also need to be replaced, and their relatively slow speed creates problems for some high-performance aircraft. Therefore, air forces are taking a close look at the market for used wide-body aircraft to fulfill both their tanker and strategic-airlift needs. The Air Force hopes to lease 767-200 airframes as replacements for its 135 KC-135Es and, later, its KC-135Rs. The Boeing 767-400 will probably become the next reconnaissance platform, initially deploying an X-Band radar for ground surveillance.

The Italian air force, which operates four 707 tankers, will receive the first of its new 767s in 2004, with the others to follow in 2005 and 2006. Other foreign operators might decide to acquire the 767: Australia needs to replace four 707 tankers; furthermore, the Japan Air Self-Defense Force as well as the air forces of South Korea and many other countries will follow suit as their tanker requirements grow. Airbus and its consortium nations continue to offer the A310 or A330 aircraft as tankers, but orders have not met expectations. Boeing currently expects to sell 50 K-767 tankers overseas, but its biggest sale could be a US Air Force order for over 500 of them.   □

Notes

1. "Boeing Wins Italian Bid Military 767s," *Seattle Post-Intelligencer,* 10 July 2001.

2. Eric Tegler, "767 Undergoes Wake Survey," US Naval Institute *Proceedings,* February 2001, 8.

3. See National Technical Information Service, *Boeing 767 Proximity Evaluation with F/A-18C and S-3B Aircraft,* report no. ADA389851 (Patuxent River, Md.: Naval Air Warfare Center, Aircraft Division, 30 March 2001).

4. For more information, see *Tanker/Transport,* on-line, Internet, 16 January 2002, available from http://www.boeing.com/defense-space/military/767t-t.

The terrible thing about terrorism is that ultimately it destroys those who practice it. Slowly but surely, as they try to extinguish life in others, the light within them dies.

—Terry Waite, 1992

A Proposal for Homeland-Defense Organization

L T C OL D. R OBERT P OYNOR, USAF, R ETIRED*

OVER A YEAR ago, a news article described congressional testimony about homeland defense and national missile defense (NMD). After discussion of the Army's NMD system and some Navy proposals for shipborne missile interceptors, the senior Air Force official present fielded a question about Air Force initiatives. His response, something akin to "We have nothing to offer in this mission area at this moment," was a missed opportunity. The Air Force does indeed have something to bring to this discussion—the heretofore undiscussed piece that ties it all together. So far, NMD discussions have centered only on systems, which by themselves are merely tactical-level discussions. What they will need to work together effectively at the operational level—the truly visionary piece—is organization. When it comes to efficient joint organization, the Air Force is the only service that advocates and employs a proven, truly joint model based on proven doctrinal principles about joint war-fighting organization that have been accepted within the overseas regional theaters.

To those familiar with the idea of a revolution in military affairs (RMA), organization is one of the three critical pieces to realizing an RMA (the other two being technology and doctrine). The challenge to implementing NMD and other emerging military homeland-defense issues lies in untangling the unified and combined commands that currently exercise pieces of the puzzle. These commands—North American Aerospace Defense Command (NORAD), US Space Command (USSPACECOM), and US Strategic Command (USSTRATCOM), and, to a lesser degree, US Joint Forces Command (USJFCOM)—are stovepiped, legacy organizations, a binning of missions made necessary by the

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technological limitations of another era. We have the organizational doctrine to do much better.

A key role of doctrine is to provide a baseline for intelligent decisions about how to operate and organize, and current joint doctrine provides an excellent blueprint for building a joint organization along proven lines. The objective joint organization should have a single joint force commander supported by functional component commanders—air, land, and maritime component commanders. The functional component structure, seen in many recent joint operations, can cut across service lines to obtain unity of effort and unity of command. This becomes important in a homeland context because several of the issues in play, and their technical solutions, involve aerospace missions. To explain how this model could work for homeland defense, one must first recap how this structure works in the regional context.

Within a regional theater, the joint force air component commander (JFACC), in addition to commanding all aerospace missions, also normally serves as the area air defense commander (AADC). With this second responsibility, the JFACC can cut across service lines to integrate defensive counterair operations throughout the theater, utilizing air-breathing interceptors, friendly surface-to-air missiles, and, eventually, airborne lasers. If we expand this vision to a homeland-defense construct, a "homeland JFACC" would exercise control over fighter interceptors currently under NORAD as well as any ground- or sea-based interceptors—antiair or antimissile. Naturally, to enable this function, the JFACC also would require the requisite command authority over missile and early warning systems. So far, this homeland JFACC construct fits within the existing NORAD construct.

But this analogy is still not complete. In a regional theater, the JFACC also normally is the supported commander for offensive missions such as strategic attack and theaterwide interdiction. Together with his or her AADC hat, the JFACC thus has the means to carry out both the offensive and defensive aspects of the counterair function across the theater. On the homeland level, however, the nation's long-range offensive forces are vested in another unified command, USSTRATCOM, whose forces currently are arrayed in a series of service-specific, single-purpose task forces—one each for bombers, tankers, intercontinental ballistic missiles (ICBM), command and control (C^2), reconnaissance, submarine-launched ballistic missiles (SLBM) in the Pacific, and SLBMs in the Atlantic. Separate task forces are perfectly allowable under current joint doctrine, but such a concept is arguably stovepiped and cumbersome. If one is to fully transfer the JFACC analogy to the homeland, the homeland JFACC should also command the Single Integrated Operational Plan (SIOP).

If organization is based on proven doctrinal foundations, then doctrine suggests a new organization for homeland defense. Under this joint command, appropriately led by a commander in chief, a homeland JFACC would oversee the missile-warning activities currently performed by

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USSPACECOM, the airborne threat warning and air-breathing interceptors currently run under NORAD, and the intercontinental nuclear response currently performed by USSTRATCOM. If it comes on-line, NMD also would naturally align under the JFACC. Further into the future, the JFACC might also command any antisatellite forces as well, thus rounding out the full counterair (or might it be "counteraerospace"?) function. If one takes this joint construct to its logical conclusion, a joint force maritime component commander (JFMCC) would oversee maritime defensive operations, including port security. He or she would command the day-to-day operation of the Navy's ballistic-missile submarine fleets in the Pacific and Atlantic (execution, however, would fall under the JFACC as aerospace operations), as well as any shipborne NMD interceptors currently under discussion. Similarly, activities associated with land defense, civil support, and consequence management within the continental United States (CONUS), currently assigned to USJFCOM, might logically rest under a joint force land component commander (JFLCC).

Similarly, various internal disaster-response efforts, such as flood relief or fighting forest fires, might find a more logical plug-in within a homeland command in the form of ad hoc joint task forces, creating recognizable chains of authority, which become especially important when Guard and Reserve forces activate. Military support to the nation's counterdrug effort, currently spread across three unified commands within the Western Hemisphere, is also a candidate for consolidation within a new homeland command. Finally, homeland-level Computer Network Operations might find a more logical home within this new, single war-fighting command.

Consolidation of the offensive element is perhaps the most controversial issue, but it bears reexamination now. Until just a few years ago, we could not match homeland offense with homeland defense. The SIOP was simply too massive to support truly dynamic battle management. It had too many warheads and targets to cover, and C^2 proved inadequate. Early C^2 estimates for the Strategic Defense Initiative, with its numerous orbiting sensors and interceptors, were similarly massive. Thus, the scale of the offensive and defensive elements created an insurmountable C^2 problem that resisted integration. But that is not the case today. The SIOP's target set is smaller, as is the number of weapons. We now have the computational capability for dynamic planning and battle management, and we have demonstrably better warning and overall C^2. The Cold War separation of offense (USSTRATCOM), defense (NORAD), and warning (vested in USSPACECOM), based upon past technological limitations, is no longer necessary. Furthermore, recent discussions of CONUS-based conventional strike, such as the Air Force's Global Strike Task Force, would logically nest in this new command.

Intentionally absent from this discussion is any restructure of the services' CONUS-based commands in their roles as force providers. If a

new, unified "homeland command" is established, Air Combat Command and Air Force Space Command [AFSPACECOM] might be restructured to provide a better alignment. There is even room within a new homeland-command model for AFSPACECOM to better fulfill its recent congressional designation as the lead for all military space. If redesignated as a specified command, it could fulfill its worldwide responsibilities for space, while acting as a supporting command to the homeland command. With an attached joint-planning element, similar to the Joint Strategic Target Planning Staff colocated with Strategic Air Command, AFSPACECOM could then reasonably subsume USSPACECOM, thus reducing staff overhead and duplication of effort.

This is not a trivial proposal; it constitutes a massive restructuring of several major unified commands. USSPACECOM, USSTRATCOM, and NORAD as we currently know them would disappear, with large pieces taken over by a new, unified command. USJFCOM would surrender its role in civil support and domestic consequence management and focus on joint training and experimentation; AFSPACECOM might evolve into a specified command. Finally, a homeland command, laid out as described, would be more recognizable to the overseas commands and would help establish clearer supporting/supported relationships between a single CONUS war fighter and overseas activities. But perhaps the time is right. Over the last decade, the services have developed war-fighting organizational principles and have codified them in existing joint doctrine. It's never too late to take another look at long-standing organizations and refit them with a proven organization. Congress is always interested in reducing headquarters staffs and eliminating perceived duplication, so such a consolidation might win approval on that front.

This suggestion is based on proven doctrine—specifically, principles about a joint war-fighting organization that overseas regional theaters have accepted. By comparison, USSPACECOM, NORAD, and USSTRATCOM have remained rooted in older organizational paradigms, dictated largely by the limitations of Cold War–era technologies. It is time to bring these stovepiped commands into the twenty-first century. Until September of last year, discussions about homeland defense in general, and NMD in particular, were arcane. Our recent experience now provides the impetus for a fresh look.

The Air Force was the first service to transform itself after the Cold War and the first to break the code about fighting jointly, through the JFACC. Unlike the other services, it has no service-only, "organic" model for employment. The Air Force expects to be employed jointly, and that's how it trains. Because the bulk of these homeland-defense operations are aerospace operations, it is fitting that the organizational vision be an airman's vision. □

Maxwell AFB, Alabama

The Role of the US Air Force in Fighting Terrorism at Home

Lt Col Michael Champness, USAF*

> *We have to think differently. . . . The enemy who appeared on September 11 seeks to avoid our strengths and constantly searches for our weaknesses. So America is required once again to change the way our military thinks and fights.*

> —President Bush, 11 December 2001

IF ONE ACCEPTS the view of the president (and since he is our commander in chief, it would probably behoove us to do so), the question then becomes, How? Of the things we do now, what should we stop doing; and what are we not doing that we should? Air Force members were just as outraged by the events of 11 September 2001 as Americans everywhere. What should we do to help?

In the immediate response to the terrorist attack, the North American Aerospace Defense Command and our air defense forces played an important role in protecting our skies from further attacks, and they continue to do so today. Our consequence-management capabilities, particularly in mobile emergency medicine, although not called upon due to the lack of injured victims, remain robust and ready. Over the long term, we will have to develop a "single integrated picture" of the range of airspace threats to the United States and develop a new readiness posture for our air defense forces.

In the aftermath of the terrorist attacks, however, the preeminent role for our airpower and space power has been in taking the fight to the Taliban and al Qaeda forces in Afghanistan. Coupled with special operations forces on the ground and Navy strike aircraft, our expeditionary forces have proven highly effective in destroying both the ability and the will of enemy forces to fight. Secretary of Defense Donald Rumsfeld has said he does not see the military success in Afghanistan being used as a "cookie mold," but it certainly seems clear that our long-held views on the advantages of effectively applied airpower are being vindicated emphatically.

But is this enough? I would not argue that "thinking differently" requires us to stop doing what we are already doing or are prepared to do

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to protect the homeland and battle terrorism at its source. I would argue that it does require us to look at our full range of capabilities and ask ourselves whether there are other ways we can contribute. Unfortunately, it sometimes seems that our expeditionary mind-set—particularly in times when our combat power has shown such impressive results—often blinds us to other opportunities.

No matter how much effort we put into snuffing out terrorist threats in foreign lands or protecting our borders from penetration by enemy weapons or personnel, it is inconceivable that we will be able to prevent every terrorist from entering our country. This challenge is compounded by lessons from the modus operandi of the 11 September attackers: they were not immediate terrorist threats when they first crossed into our country, and it took them two years to execute their evil plan after they arrived.

Because of this vulnerability at home, the president established the Office of Homeland Security. Its battlefield is our homeland, and its challenge is to protect against terrorist threats that emerge within our nation. It was not formed because of any shortcomings in the ability of our forces to protect our border from military attack or because the president and secretary of defense lacked confidence in our ability to root out terrorists overseas. It was formed because the terrorists had identified and exploited a glaring asymmetry in our defense: our free and open society allows them to penetrate our border and operate virtually unimpeded. Our current government structure is not well organized to intercept these terrorists before they strike or to deal effectively with the consequences of an attack. Leaving this vulnerability unrectified would be akin to playing hockey without a goalie.

A common refrain since 11 September has been that federal agencies need to share information about potential terrorist threats among themselves and with state and local law-enforcement officials. A great deal of work is also being pursued within the intelligence community to identify predictive attributes that can be used to focus the search for terrorists. Of course, the heightened sense of concern among the American people also provides a fresh source of potential intelligence. The challenge for the federal government lies in meshing the efforts of many different agencies and departments and coordinating with a myriad of state, local, and private organizations.

A critical component of this effort involves creating a seamless information web. Governor Tom Ridge, director of the Office of Homeland Security, as well as the president and secretary of defense, will need secure, survivable, and dependable command, control, intelligence, surveillance, and reconnaissance (C^2ISR) to provide decision-quality information and instantaneous response. Does this sound familiar? Of course it does: in the Air Force, we call the system that provides this capability an air and space operations center (AOC). Maj Gen Robert

Behler, commander of the Aerospace Command and Control and Intelligence, Surveillance, and Reconnaissance Center (AC²ISRC) at Air Combat Command, has written that "the crux of homeland security is identical to that of air and space command and control: putting the constant flow of time critical, decision quality information into the right hands. The U.S. Air Force has the command and control skills that can assist in the nation's most pressing challenge—combating terrorism at home."[1]

To achieve this end, we need to fuse data from many different sources, including law-enforcement databases, financial records, and human intelligence (which should prove easier here than overseas), perhaps along with existing Air Force and national ISR assets periodically turned inward. Although it is not clear that the American people are quite ready for unmanned aerial vehicles flying overhead, we have a host of data-gathering techniques that are much less obtrusive. Ultimately, we can translate each of these sources into electronic formats that we can share horizontally without human intervention or interpretation.

The goal of this horizontal integration is the same as that desired by our airborne combat forces: predictive battle-space awareness. To paraphrase Gen John P. Jumper, Air Force chief of staff, when you know your universe of potential targets, you are able to more quickly categorize the specific intelligence you receive. Imagine that a Combined Federal Campaign thermometer (his analogy) represents your confidence level; you keep adding information—indications and warnings—to what you already know until you reach the requisite confidence level to act. This is exactly the same procedure we would use to ascertain whether a subject represented a terrorist threat, and it would also apply conceptually in the response to a cyber attack.[2]

The difference between an AOC used in this manner and the way we use it to support our expeditionary forces is that overseas, we would send a strike package to destroy the target; domestically, we would very likely forward our information to the FBI, which would then send an agent (or a team) to arrest the suspect. Although we might have difficulty visualizing an AOC feeding its results into anything other than a typical expeditionary strike package, it is even more difficult to imagine the president and secretary of defense authorizing the Air Force to apply deadly force domestically in any but the direst circumstances, and only when all other techniques have failed—as on 11 September.

As reliance upon a domestic AOC grows, its design would begin to diverge from that of an expeditionary AOC because of its need to integrate with so many different entities. Over time, our AOC could evolve to provide the foundation for the system used by the entire federal government and the president and secretary of defense. In the end, once a national system is fully established, our involvement could end. Even though every federal agency has crisis-response capabilities, a system does

not currently exist to provide national-level, predictive battle-space awareness and crisis-decision support.

There is general consensus that the United States must make it as difficult as possible for terrorists to move freely about our country, yet we still must preserve as many of our civil liberties as possible. To that end, the challenge becomes separating the minute number of terrorists from the millions of law-abiding citizens and residents of this country. The Posse Comitatus Act of 1878 generally limits federal military forces from acting in a domestic law-enforcement role, but, more than likely, the new security environment will cause our elected leaders to update the balance between freedom and security, just as America has always done during times of war. This does not mean that military surveillance assets will soon find wide use domestically; nor is it conceivable that the Defense Department would be granted expanded arresting authority. It does make it more likely that, with our expertise in battle-space decision procedures, civilian authorities would welcome our help—on perhaps a permanent, but at least a temporary, basis.

The Air Force is right to move cautiously. The president and secretary of defense will make any decisions about how the Air Force might participate in the domestic preemption of terrorist acts. At the same time, this mission is consistent with the Air Force mission and our aerospace expeditionary force construct and mind-set. It merely has a different mix of capabilities than a typical expeditionary strike package, with different sensor inputs and little-to-no role for airborne weapon-delivery systems. Our mission is to defend the United States and protect its interests through aerospace power—and our expeditionary aerospace forces are only a method. If we can achieve our mission through a different mix of our air, space, and information capabilities—whether alone or together, in the lead or in support, domestic or overseas—we have an obligation to the American people to do so.

The campaign against terrorism is a global war. The United States cannot afford to have different systems and procedures for fighting the war overseas and domestically. This would create gaps that terrorists would surely exploit. Intelligence gathered about terrorist activities overseas and domestically will provide critical information, both to our homeland defenders and our overseas forces. As crises brew in the homeland, the civilian sector will see it and respond first. Although in many cases, civilian defenders will be able to handle the crisis on their own, it is quite possible that some attacks will rise to a level that requires military crisis-response capabilities. At that point, and under life-and-death time pressures, the military will be expected to pick up the baton flawlessly. Because the military cannot do this from a standing start, we must not allow ourselves to be put in the position of the Japanese fishing vessel that was struck by the USS *Greeneville*.

The Office of the Secretary of Defense is already working on an advanced-capability technology demonstration for joint, interagency command and control for homeland security. The Office of Homeland Security has established a joint data-coordination center in Washington, D.C. This train is already leaving the station, and it will depart with or without the Air Force on board.

Apart from the institutional imperative of having a seat at the table when the inevitable architecture is established and when decisions about concepts of operations are made to ensure Air Force views are heard and incorporated, there is another, more basic, reason for the Air Force to offer up its expertise in the information area. On 11 September, a foreign power killed the largest number of Americans on our own soil in 200 years, and it stands ready to do so again. If we do not look for ways to provide the president and secretary of defense with the tools they need to fight this war domestically, then we are abdicating our responsibility to protect and defend against all enemies, foreign and domestic. That's the wrong answer. □

Washington, D.C.

Notes

1. Maj Gen Robert Behler, "Homeland Information: AOC Can Coordinate U.S. Terror Defense," *Defense News,* 10–16 December 2001, 13.

2. Gen John P. Jumper, remarks to the Air Force Association National Symposium, Los Angeles, Calif., 16 November 2001, on-line, Internet, 9 January 2002, available from http://www.af.mil/news/speech/current/sph2001_20.html.

It is a well-known fact that we always recognize our homeland when we are about to lose it.

––Albert Camus

Back to the Future

Thoughts on a Bipolar World Redux

Maj Paul J. Bellaire Jr., PhD, USAF*

COLD WARRIORS EVERYWHERE, rejoice! What you have yearned for since the fall of the Soviet Union has returned with a vengeance. Today we again face the old conundrum of "us" versus "them." Adapting a passage from the *Communist Manifesto* of Karl Marx and Friedrich Engels, "A specter is haunting Europe—the specter of Terrorism. All the powers of old Europe have entered into a holy alliance to exorcise this specter: President and King, Blair and Bush, French Radicals and German police-spies." This time, not only Europe but also global civilization is threatened.

On the one hand, there exist Westernized, secular governments run by the rule of law (no matter how corrupt and inefficient), while on the other hand, there exist theocratic, fundamentalist regimes that follow the infallible Word of God (no matter how bizarre the interpretation). The two systems are mutually hostile. Conflict is inevitable.

In each camp, one finds a wide spectrum of political behaviors and deviations from orthodoxy. China still struggles with the rule of law but abhors insurrection and religious fanaticism. It is clearly an example of a secularized system. Iraq has suppressed Islam but has perverted it for fanatical purposes, utterly unfettered by the rule of law. Although it is not a Muslim theocracy, Iraq has no government at all by Western standards—merely thuggery.

Multinational coalitions dominate each camp. Although nominally unaligned nations exist outside these two ideologies, the vast majority of these recalcitrant states could never join the "other side." The choice for them lies between internationalism and isolation. Their national interests and goals are too well aligned with one or the other camp to sustain delinquency for long. The pressures on these fence-sitting states to toe the party line are just beginning, and neutrality will not be a viable option. China will eventually join "us," and Iraq will join "them."

A New World Order

In the very near future, US involvement in the Central Asian states of the former Soviet Union will become the linchpin of a truly "New World

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Order." These growing alliances represent a tectonic shift in American geopolitics that we have not yet fully grasped. Many of these states have untapped oil reserves as well as clear advantages of geography relevant to our new war against terrorism. We will not be leaving the area anytime soon.

Russia has sanctioned US involvement in the region and is eager to cooperate with the West. Why? The Russian Federation today has between 10 and 20 million Muslim citizens. Accurate numbers are difficult to obtain since many practice their faith surreptitiously or shun official counting. Even before the fall of the Soviet Union, Moscow experts understood that the Muslim South represented the country's "soft underbelly" and a grave threat to its national security. The weak independent states that now exist in the former Soviet South are vulnerable to Muslim insurgency (indeed, Tajikistan endured religious civil wars throughout the 1990s).[1] An unstable Afghanistan has been the bane of czars and general secretaries of the Soviet Union for over a century, and xenophobia is a Russian trademark.

The United States realizes that the Russians possess neither the resources nor the strong institutions required for the task at hand. For their part, the Russians wish to focus on regenerating their economic, political, and military power. They have also made the astute judgment that the southern "Islamic problem" presently lies beyond their capabilities to resolve (just as it lies beyond any single nation's ability, including that of the "last superpower"). So they are throwing their lot with the West and forming a united front that clearly serves their national interests. The Russians now understand that the enemy is not the North Atlantic Treaty Organization (NATO) on the Western Front but Islamic fundamentalism on their southern borders. An entirely new foreign policy must be constructed to accommodate this political reality.[2] The United States and Russia have come to the realization that sustained collaboration in Central Asia will be necessary in order to solve the problem.

We must not underestimate this Russian policy shift. It will lead to stronger integration with NATO over the next few years and possibly to full NATO membership. This, in turn, will imply modification of US policies within NATO at large. In particular, the presence of Russian influence within NATO will substantially alter the alliance's stance toward Turkey. Since the two nations are historical enemies, a Russian-Turkish antagonism within NATO will pose at least as much of a challenge to the alliance as the ongoing Greek-Turkish face-off. The stress of maintaining these two separate feuds will likely lead to unanticipated political change within Turkey, which will certainly affect the Turkish-Iranian competition over Azerbaijan. We must also note that the Central Asian states are predominantly of ethnic Turkish stock (although Tajikistan has Persian affinities). Russia wishes to moderate Turkey's attempts at pan-Turkish nationalism and limit the Turks' influence in the region. NATO will

probably acquiesce to these modest goals lest we lose Russia's cooperation in the New World Order. NATO cannot forget that Turkey is becoming the strongest ally Israel has in the region, which complicates the strategic complexion of the Middle East even further.[3]

As Russia moves inexorably closer to NATO and the West, China's leaders will become increasingly anxious. The presence of the United States in the Central Asian states will seem a direct challenge to growing Chinese markets and political influence in the region. It may also create the impression of military encirclement. Viewing an arc stretching from Japan and Korea in the northeast, to Mongolia and Russia in the north, to the Central Asian states in the west, and on toward the Indian subcontinent, the Chinese will see themselves surrounded by US allies, client states, or proxies. The obvious conclusion derived by the Chinese Politburo will be that the United States and Russia are bringing a military cordon to their doorstep. Who could blame them if they saw this as "hegemonic"?

Given Russia's objections (until recently) to the Baltic States joining NATO, imagine the protests of Chinese Communist leaders when an unforeseen US-Russia-NATO coalition arises on their western borders! Our rapprochement, albeit fitful, with India and Pakistan will only exacerbate their fears. China, seeing itself surrounded, will divert precious resources to its northern and western borders, not previously a cause for concern. One need only hark back to the Hainan Island incident to recall how seriously the Chinese take perceived threats to their sovereignty. President Bush's assertion that China is our "strategic competitor" will be writ large.

Ironically, India and Pakistan will probably feel isolated and marginalized by US moves in Central Asia unless we provide constant reassurance. They could conclude that we are replacing them with more docile but better-positioned allies north of Afghanistan. In their view, the United States has never really considered them significant, either in the region or in the world community. Having endured years of US sanctions and neglect, and just when things were improving, they see us wooing more compliant allies elsewhere. At the very least, the Pakistanis and Indians will see our investments in Central Asia as draining US resources that they would have preferred to receive. In the current crisis, the arms-length stance we have taken vis-à-vis Pakistan, an ostensible ally, will be seen as an object lesson in this regard. From the subcontinent's point of view, the United States may "talk the talk" but not "walk the walk." Thus, nuclear saber rattling may become the method of choice for India and Pakistan to grab our attention. The United States must preempt this situation by using vigorous diplomacy and engaging with these two pivotal states. In particular, Pakistan is very fragile. Indeed, the current regime may not survive Afghan reconstruction.

Finally, China is not the only nation that may see a conspiracy of containment aimed its way. The Central Asian states share borders and

ethnic groups with Iran. The Iranian mullahs, who already see US allies off Iran's south and western shores, will also feel threatened by the Great Satan moving into their northern and eastern backyard. Iran is now at a critical point in its history—it must choose between secular rule of law or continued theocracy, and it must do so quickly. The internal forces of democracy, although growing stronger in Iran, have not yet defeated the entrenched religious elite in Tehran. The outcome of this struggle is incredibly important to the United States and its allies. If Iran falls back into fundamentalism, our war against terrorism will become vastly more expensive, time-consuming, and complex. The stability of any political and military structure we set up in the Central Asian states will always be threatened by Shiite rebellion if the mullahs win in Iran. If the war against terrorism is to succeed in our lifetimes, Iran must join the West. The United States would be well advised to engage Iran diplomatically and economically—and soon.

Military Implications

What are the implications for the US military? Clearly, "transformation" will be de rigueur. Today, we are too bloated, heavy, slow, and spread too thinly.[4] We must form light, nimble, and quickly deployable all-terrain antiterrorism units with overwhelming firepower. We must devise smaller, stealthier, and more autonomous weapons and sensors. We must perfect nonlethal crowd control as well as "snatch and grab" techniques. We must miniaturize precision-guided munitions for smaller, "personalized" targets. We must acquire rapid-response airlift, sea lift, and space lift. We must also develop "launch on demand" and a piloted space plane for global reach.

Speed will become critical. Force projection from space will partially answer the "need for speed," but this will require space control and weaponry on orbit. Therefore, we must revisit space treaties, increase research-and-technology investments across-the-board, and harness the combined brainpower of US academia, industry, and national labs more effectively and synergistically. We must also train greater numbers of US citizens, provide them with advanced degrees in engineering, mathematics, and the sciences, encourage them to enter government service, and pay them well. We cannot use foreign or immigrant alien talent to fill the highly technical but increasingly classified new jobs that will be created in the US civil service and uniformed military during the course of this new war.

We must strengthen and upgrade our global network for command and control, making it invulnerable to both cyber and physical attack. Surveillance and reconnaissance must attain higher temporal cadence, higher resolution, finer spatial coverage, and multispectral capability. Environmental monitoring of Earth and space must become more robust so that we can disguise our attacks within natural events and prevent our

adversaries from doing the same to us. We must be able to mitigate nature's disruptions so we can prosecute this new war under any environmental conditions—on land or at sea, in air or space.[5] Consequently, we may need to revise prohibitions against manipulating the environment.

Airpower and space power, although critical to this nation's success, will not be a panacea. True joint operations, as well as interservice and international compatibility, will become ever more important. Future US commanders can expect to work more frequently in concert with multinational forces. Our troops will require a certain degree of diplomatic know-how, cultural training, and geopolitical savvy. Our officers and enlisted personnel will have to learn obscure foreign languages and may take direction from (or at least trust information provided by) personnel from former Soviet states. For all of this to work, we must provide more effective education and training for our own troops, as must our allies for theirs. Old suspicions die hard, but now we must overcome them.

To combat terrorism adequately, the United States must have eyes and ears everywhere, at all times. We must exploit wireless technology and the Internet. Because of privacy concerns and constitutional protections, identification and discrimination of friend from foe become paramount, in cyberspace as well as physical space. Encoding and encryption must protect our communications, yet we must be able to crack all codes and intercept all messages useful to our enemies. The United States must become "their Big Brother" without becoming the same to its own citizens.

The West must find a way to end the production of eager martyrs for Islam by going after the hearts and minds of their youth as well as their educated elites. Obviously, the grinding poverty, illiteracy, oppressive government, and religious fanaticism found in much of the Muslim world must become our targets in this war.[6] We will inevitably engage in disinformation, "dirty tricks," psychological operations, and aggressive propaganda—from the mosques and foreign press to Cable News Network's *Headline News*—in order to undermine our adversaries' recruitment and retention. However, a "Marshall Plan" must follow, involving the construction of secular, civil societies for all Muslims in their homelands. Today, their disaffected youth have nothing to lose. We must give them and their parents hope for a better future.

Ultimately, we must be mindful of our own problems in recruitment and retention. Our national will is going to be sorely tested as mistakes are made, collateral damage occurs, casualties accrue, and campaigns go poorly. Our own population must be convinced of the necessity for continuing this struggle. We must also engage our hearts and minds—we will need total commitment. America must find and exercise its best leadership for the task ahead. □

Arlington, Virginia

Notes

1. See Jed C. Snyder, ed., *After Empire: The Emerging Geopolitics of Central Asia* (Washington, D.C.: National Defense University Press, 1995).

2. See Robert D. Kaplan, *Eastward to Tartary: Travels in the Balkans, the Middle East, and the Caucasus* (New York: Random House, 2000).

3. See William Dalrymple, *From the Holy Mountain: A Journey among the Christians of the Middle East,* 1st American ed. (New York: Henry Holt and Company, 1998).

4. Department of Defense, *Quadrennial Defense Review Report,* 30 September 2001, on-line, Internet, 7 January 2002, available from http://www.defenselink.mil/pubs/qdr2001.pdf.

5. See Bob Preston, *Plowshares and Power: The Military Use of Civil Space* (Washington, D.C.: National Defense University Press, 1994).

6. See Carl Sagan, *The Demon-Haunted World: Science as a Candle in the Dark* (New York: Random House, 1995).

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Managing Editor
Aerospace Power Chronicles

Evolution of the Air Force Expeditionary Logistics School
A Revolutionary Approach to the Employment of Combat Support

LT COL J. REGGIE HALL, USAF*

Author's Note: This article is a follow-up to "Employment of the Agile Logistician" by Maj Nancy A. P. Stinson, Capt Malcolm E. Blair, and Capt Alex E. Dubovik, reprinted in the "Contributor's Corner" section of Aerospace Power Chronicles *on 27 September 1999. It provides an update on the proposal for an integrated Air Force logistics school. Since publication of the* Chronicles *article, the chief of staff of the Air Force has approved concept implementation and Headquarters Air Combat Command (ACC) has moved forward to build the course curriculum, establish faculty requirements, and identify the beddown location. Lt Col Diane Tatterfield, Headquarters ACC/Logistics Maintenance Training Division (LGQT), and Mr. Carl Cafiero, Synergy contract support, are the action officers tasked with bringing the new logistics-school concept from theory to reality. Similar to the process of building aircraft from the design-phase blueprint to final production model, the evolving Agile Logistician concept has been modified and refined to meet Air Force operational needs. The necessity and intent of the course, however, have remained constant—to produce logistics professionals capable of integrating the full spectrum of combat support to employ aerospace power and leverage logistics enablers as effective components of the expeditionary global strike force. The article includes excerpts from the new Advanced Logistics School Core Curriculum Document to provide a historical perspective on the school's evolution and to highlight areas of continuity and deviation from the original concept.*

I N JULY 1999, the Air Force chief of staff initiated the Chief's Logistics Review, a one-year bottom-up assessment of Air Force logistics. One component of the review—a look at the professional development, education, and training of logistics officers—identified a deficiency in integrated logistics training and revealed a gap between the Air Force's agile combat support (ACS) logistics doctrine, air expeditionary force (AEF) strategy, and training of logistics officers. A cross-functional training course for logistics officers modeled after the USAF Weapons School program was originally recommended as a solution to bridge the gap among logistics-officer training requirements, ACS doctrinal principles, and AEF

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employment strategy. Following presentation of the proposal at the Corona meeting in fall 2000, Headquarters ACC was tasked to develop an integration plan for incorporating logistics-officer training at the Weapons School.

Weapons School Logistics Division Concept

Maj Nancy A. P. Stinson and a group of cross-functional logistics officers assigned to the 56th Fighter Wing at Luke AFB, Arizona, articulated the initial Agile Logistics School concept and published their proposal in the Spring 1999 issue of *The Exceptional Release*.[1] The present article represents the second phase of their business plan to establish an Expeditionary Logistics School (ELS). The author, a member of the original Luke team, further advocated the school idea as an Air Command and Staff College student and initiated an academic research project sponsored by Headquarters USAF's Directorate of Maintenance to evaluate that concept and recommend a future course of action. The research results and recommendations, used as a baseline justification for the Logistics Division's presentation at the previously mentioned Corona, provide a more comprehensive description of this effects-based approach to integrated training for logistics officers. The research results were also used by ACC as the blueprint for developing an independent advanced logistics officer school. The new ELS's first class is scheduled for January 2003.

The conceptual framework of the Weapons School Agile Logistics Course called for developing a selective, expert-level, integrated logistics program to train multifunctional logisticians in the direct support and sustainment of combat operations (fig. 1). The primary objective entailed establishing a formal, resident course that provided in-depth analysis of
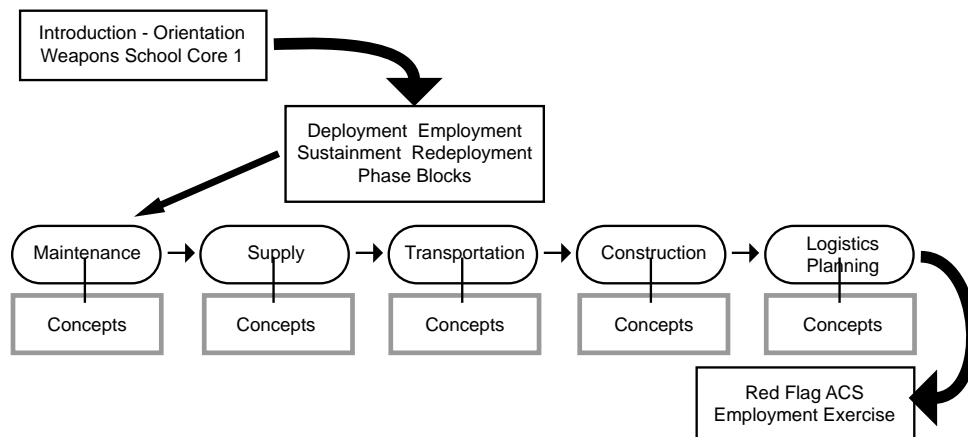

Figure 1. USAF Weapons School Logistics Course Flow

the operational tenets in all logistics disciplines, as well as the core responsibilities associated with the integration and employment of aerospace power. An element of practical application was proposed to leverage the value and utility of current operational combat training by incorporating the employment and redeployment phases of Red Flag exercises as "hands-on," performance-based, capstone-training application evaluations in real-world environments. This would have capitalized on existing effects-based, combat-employment scenarios.

Although the Red Flag capstone-exercise option was not included in the ELS curriculum, several practical-application courses were selected to provide a working understanding of combat-support functions. Throughout the syllabus, trips are scheduled to courses offered outside the campus at Nellis AFB, Nevada, that provide necessary instruction for cohesive development of the consummate logistics war fighter. Prime among these are the courses taught by Air Mobility Command, which address combat-support beddown activities, and by the Air Force Combat Ammunition Center (AFCOMAC), which teach weapons buildup and munitions-surge operations. Both are key to a comprehensive understanding of the functions that contribute to successful combat support.[2]

Doctrinal Support: ACS, EAF, and the Air Force's Global Engagement Vision

The Air Force's *Global Engagement* vision and expeditionary air force (EAF) strategy focus on the ACS core competency as the foundation for rapid force projection of light, lean, and lethal aerospace power.[3] ACS—the cornerstone of *Global Engagement* and the foundation for the other Air Force core competencies—creates, sustains, and protects all air and space capabilities to accomplish mission objectives across the spectrum of military operations. This definition expands the traditional scope of logistics, which includes maintenance, supply, transportation, and logistics plans, to incorporate the critical support functions of contracting, services, civil engineering, force management, and force protection. The employment of ACS logistics functions mandated in Air Force Doctrine Document (AFDD) 2, *Organization and Employment of Aerospace Power* (17 February 2000)—the service's "capstone operational" document—authoritatively prescribes cross-functional logistics tasks as key responsibilities of the staff assistant for the A-4 director of logistics. The latter, who reports to the commander of Air Force forces (COMAFFOR), has responsibility for logistics plans, force beddown, transportation, supply, maintenance, services, civil engineering, explosive ordnance disposal, and related logistics activities. However, Air Force logisticians are not taught integrated logistics concepts in their basic, supplemental, or functional training programs.

Current Training for Logistics Officers

The Air Force does not have an expert-level course that teaches officers operational and tactical logistics concepts and procedures. Further, the diverse technical-training schools for logistics officers do not teach employment tactics for expeditionary logistics. Supplemental logistics courses focus on deliberate and crisis-action planning, deployment/redeployment, and planning/execution:

> During the development and production of the [Expeditionary] Logistics Officer School syllabus, the ACC implementation team surveyed available instruction relative to the subject matter to avoid duplicating existing efforts. Their investigation verified that although certain components of instruction may be found scattered among some existing courses, the fact remains that there is no centralized course of instruction dedicated to the development, in senior captains, of the leadership skills and knowledge of the tactics, techniques, and procedures necessary to produce combat sorties and associated combat support in contingency operations at a deployed location.[4]

The absence of training in logistics employment and sustainment has created deficiencies in the professional development of combat-support and logistics officers. Due to this lack of training, logistics officers are not prepared to perform the very duties they are deployed to accomplish.

Company grade logisticians commonly have responsibility for any or all of the logistics functions at a deployed location. Commanding a team of 35–50 personnel who represent the broad spectrum of logistics specialties, these young officers are usually the resident experts and senior logisticians on site during a 120-day deployment. Logisticians deployed with expeditionary forces often learn "on the job" how to support a provisional logistics squadron at an air base or how to function as a COMAFFOR's A-4 staff officer. Therefore, the lack of training for expeditionary logistics officers constitutes a critical deficiency in the implementation of the Air Force's EAF/AEF strategy. It was necessary to develop the ELS with an integrated curriculum to encompass all required facets of effects-based logistics instruction.

Effect on the War Fighter

The increased operations tempo and corresponding personnel tempo required to meet the objectives of *Global Engagement* have driven a need to reduce the number of personnel who support AEF deployments. Reducing the logistics "footprint" in the area of responsibility (AOR) to the minimum number of specialists necessary is based on the assumption that technicians have a very good knowledge of what they are doing. Unfortunately, that baseline assumption is wrong. Most logistics officers deploy without cross-functional expertise or training and in many cases are exposed to their integrated functional responsibilities for the first time during a deployment. Officers who learn on the job take a significant

amount of time to become familiar with the diversity of deployed logistics functions and to become proficient in managing the myriad of ACS operations. The pegged learning curve causes difficulty for anyone who has to make key decisions affecting logistics outputs. Accelerating the learning curve becomes paramount in the AOR, where time is precious and every minute wasted by having to learn on the job is a minute closer to mission failure. If logistics cannot support the sequence of events in the operational plan, it is not a plan at all but simply an expression of fanciful wishes.

Reducing the ACS learning curve in initial combat operations is also vital in supporting expeditionary aerospace forces. A RAND feasibility study briefed at the Agile Logistics Users meeting in 1998 supported the EAF's 48-hour bombs-on-target concept of operations. It noted that in order to meet the 48-hour mark, challenging logistics-support timelines would have to be achieved and maintained, with little room for error or delay.[5] Failure to recognize the time required to provide logistics support or delays caused by logisticians' having to learn on the job may force operational commanders to change plans, thus affecting the air campaign or impeding opportunities to exploit the enemy's weakness. Reports from F-15, F-16, and F-117 aircraft-maintenance officers deployed to Southwest Asia over the past several years have indicated that a lack of expertise in integrated logistics employment has hampered initial sortie generation.[6] For example, F-15 maintenance officers deployed to Saudi Arabia noted that several factors—including a lack of sustainment capability—drove the aircraft mission-capable rate below 50 percent after only a month of combat sorties.[7]

Although there are integrated logistics-training shortfalls across the full spectrum of logistics ranks at all levels––tactical, operational, and strategic––guidance from senior Air Force leadership is specific about the target audience for the ELS. The primary focus of this new school is on the tactical level of operations at the wing, both home and deployed. Further, it is targeted for the company grade officer with a specific background and at a specific career juncture. The foundational objective of the ELS is to train this officer to become a skilled practitioner of effects-based logistics.[8] This does not imply that senior leadership is less concerned with the broader spectrum of logistics-training shortfalls; however, this initial effort is focused on addressing the most critical need first.

Expeditionary Logistics School: Value Added to the War Fighter

An in-residence, integrated logistics course will institutionalize standard instruction in logistics employment at the tactical level and provide the Air Force with a corps of expert logisticians educated in the practical application of functions across the full spectrum of logistics disciplines. The focus of the

course, as defined by the Air Force logistics community, is on the phases of a contingency operation.[9] The ELS will offer blocks of instruction in mobilization, deployment, beddown, combat employment, redeployment, reconstitution, sustainment, and command and control (C^2) consistent with the Agile Logistician proposal (table 1). It will also bridge the gap in the professional development of logistics officers and create experts in the application of expeditionary logistics concepts.

Table 1
Strawman Course Outline

Block	Location	Duration
1. Instructor Training	Nellis AFB	2 weeks
2. Warrior Prep	Nellis AFB	2 weeks
3. Doctrine History: Lessons Learned, Organizational Structure	Nellis AFB	2 weeks
4. Mobilization/C2: Aircraft Generation, Fleet Management, Unit Type Code Tailoring	Nellis AFB Fort Dix, N.J. (Air Mobility Warfare Center [AMWC])	3 weeks
5. Deployment/C^2: Strategic Lift, En Route Support, Joint Total Asset Visibility, Global Transportation Network	AMWC: Phoenix Readiness	2.5 weeks
6. Beddown/Sustainment/C^2: Reception, Base Support Plan, Communications, Reachback, Host Nation Support	Hurlburt Field, Fla.	2.5 weeks
7. Combat Employment/C^2: Munitions Management/Bomb Buildup, Sortie Generation, Fleet Management, Theater Distribution	Nellis AFB Beale AFB, Calif. (AFCOMAC) Hurlburt Field (Blue Flag)	4 weeks
8. Redeployment/Reconstitution/ C^2: Planning, En Route Support, Base Closure	Nellis AFB	1 week
9. Mission Employment/C^2	Hurlburt Field or Nellis AFB	3 weeks
10. Graduation		
Total		22 weeks

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Source: Briefing, Lt Col Diane Tatterfield, ACC/LGQT, January 2002

The original Agile Logistician proposal was designed to integrate logisticians into the current mix of operational-weapons/tactics-school students at Nellis AFB and enhance the training-environment site picture by bringing ACS perspectives to the table—similar to the integration of space operators several years ago. The incorporation of critical logistics

tactics, techniques, and procedures necessary to generate airpower employment was seen as a catalyst for infusing a more holistic perspective into the "train as we fight" academic environment and better prepare future Air Force senior leaders. The end product of the original Weapons School Agile Logistics Course was envisioned as a better-qualified logistician, fully equipped to immediately employ resources for the provisional commander or AEF commander of the future.

Although the Air Force chief of staff decided not to associate the ELS with the Weapons School at this time, the beddown of the school will be at Nellis AFB. The two entities will remain separate until such time as the ELS demonstrates its validity and credibility through the performance of its graduates. At that time, the ELS could be incorporated into the Weapons School as a fully vested division. Association potential aside, key components of the Weapons Instructor Course (WIC), such as course design, rigor, and active-mission curriculum content, are essential to the success of the Weapons School and are in line with the recommendations of the Agile Logistician Course concept. In light of the format's proven success, efforts were made to mirror these components as much as possible while keeping firmly in hand the training requirements specified by Air Force senior leadership.[10]

Adding Logistics to the "Family of Patches": One Team, One Fight

The legacies of the Weapons School and Red Flag stand as prime examples of Air Force training programs driven by operational combat requirements. Building experts in effects-based logistics and providing them realistic training in combat-support employment are just as critical to the successful employment of the AEF today as they were for tactical aviation in World War II, Korea, and Vietnam. The Air Force cannot afford to have deployed logisticians learning on the job as it executes theater airpower operations. We must train logistics officers and develop their expertise in expeditionary logistics and ACS competencies to leverage logistics and improve combat capability. We need this course in order to train logisticians in EAF beddown, sustainment, and redeployment. Just as the operations community trains by using Red Flag, combined force air component commander (CFACC) exercises, and C^2 exercises, so does the logistics community need realistic training to create the world's most effective expeditionary logisticians. Applying lessons learned from combat-aviation training to create the ELS provides an opportunity to benefit from the Air Force's history and places expeditionary combat support, as an operational imperative, on equal footing with aerospace operational art that war-fighting commanders use to shape and influence the battle space.

We must train as we fight, and that means having realistic, in-time, and combat-oriented logistics training as well! The ELS syllabus includes a component addressing weapons-systems capabilities and employment that

would be taught by WIC instructors. The intent is to provide the logistics officer an operational focus on and understanding of the significance of selected sorties in overall combat operations. This understanding not only allows the expeditionary logistician to better anticipate the demands of a fluid combat environment, but also provides the insight to recommend viable alternatives to facilitate operational intent (e.g., selection of beddown airfields that reduce initial deployment requirements for specific combat/mission-support aircraft). The company grade logistician will be challenged to comprehend the complete picture of aerospace power projection and develop the insight to effectively leverage combat-support elements, thus becoming an indispensable part of the global strike team.[11]

The ELS will give war-fighting commanders special expertise in the employment of agile combat support and will leverage effects-based logistics to improve combat capability. This revolutionary concept lies outside the development process for traditional logistics officers. Currently, no other training venue for combat-support specialists focuses on outside, technical logistics functions and considers the interdisciplinary spectrum of combat-support actions required to prosecute an air campaign successfully. Logistics officers who successfully complete the ELS will truly be war fighters in every sense of the word! □

Washington, D.C.

Notes

1. Maj Nancy A. P. Stinson, Capt Malcolm E. Blair, and Capt Alex E. Dubovik, "Employment of the Agile Logistician: Future EAF Leaders Propose Creation of a Loggie Weapons School Counterpart to Meet New Challenge," *The Exceptional Release,* no. 73 (Spring 1999): 14–16.

2. Carl A. Cafiero and Margaret Timmons, "Preface," *Core Curriculum for the Advanced Logistics Officer School to Complete CORONA Fall Tasker, CFOOT-18,* no. F44650-01-F-0013 (Washington, D.C.: Synergy Inc., 28 September 2001).

3. *Global Engagement: A Vision for the 21st Century Air Force* (Washington, D.C.: United States Air Force, 1997).

4. Cafiero and Timmons.

5. Robert S. Tripp et al., *Enhancing the Effectiveness of Expeditionary Aerospace Forces through Integrated Agile Combat Support Planning,* RAND Report DRR-1857-AF (Santa Monica, Calif.: RAND, May 1999), 7.

6. Col Ralph J. Templin, "Desert Shield Lessons Learned—First 30 Days," report sent to Headquarters Tactical Air Command, 27 September 1990, in Capt James D. Allen and 1st Lt M. Brian Bedesem, "Deploying and Sustaining an F-117A Expeditionary Fighter Squadron: Why Agile Combat Support Is Needed Now," *Air Force Journal of Logistics* 22, no. 4 (Winter 1998): 32–36.

7. Capt Ben Davis, "War Stories, Great Expectations . . . ," *The Exceptional Release,* no. 69 (Spring 1998): 13, 15.

8. Cafiero and Timmons.

9. Ibid.

10. Ibid.

11. Ibid.

Ricochets and Replies
Continued from page 5

CAOCs would keep their skills sharp under one of these brigadier-led teams for at least three years, maintaining the integrity of the unit. They would run all joint force exercises, service exercises, Green Flags, Red Flags, Blue Flags, Cope Thunders, and so forth, and be ready for a contingency operation.

I have learned that not all minds can think in terms of a command post, so not all should be selected for such duty. If a brigadier flunks the training, he or she goes into acquisition, maintenance, or something appropriate— same thing for the men and women who are below that rank and in training.

Perhaps Colonel Wilkes can flesh out his concept and get himself hired by the chief to build this necessary structure and training ground for employing airpower. Do the manpower and equipment, and you will have a real plaything. This isn't rocket science—just hard, painful skull work and list making.

Bob Clark
Arlington, Virginia

THE "NEED TO BLEED"

Several articles in the Summer 2000 issue of *APJ* dealt with casualty aversion and its implications for national policy. By way of contrast, a curious notion in other recent military think pieces runs the other way. The counterargument goes like this: if the United States is to demonstrate its commitment in a crisis, it must do so by putting ground forces into the fray, thus risking their blood. One sees a very good example of this line of thinking in "The Plight of Joint Doctrine after Kosovo," *Joint Force Quarterly,* Summer 1999, by Col Peter F. Herrly, USA, retired:

> Kosovo lays bare a fundamental problem evaded by joint doctrine during the early 1990s. As French General Philippe Morillon remarked: "What good are members of an armed force who are permitted to kill but not to die?" An obsessive fear of casualties not only robs warfare of useful tools (such as infantry, tanks, and

manned aircraft), but on a deeper level strips away its redeeming qualities. Conflict has always presented a terrible dual reality for soldiers: the necessity to kill and the willingness to sacrifice oneself for a greater cause. In Kosovo the cause was just. But what message was sent? That the lives of 10,000 Kosovars are not worth the life of a single American or allied soldier?

> The fact that extensive combat operations could last for two and a half months without the loss of one servicemember to hostile fire is an astonishing tribute to the leadership and skill of the participants. . . . But given the horrors inflicted on the Kosovars, we must ask if the right type of campaign was conducted and if the standard of zero casualties can be justified.

> Two aspects of jointness—the joint campaign and decisive force, both of which require the display of courage—appear to be jeopardized. Joint Pub 1 *[Joint Warfare of the Armed Forces of the United States]* must be revised. This is the moment to rethink the reasons for service to the Nation—not in terms of the price we are willing to pay, but the price that we may be allowed to pay. The effects of this reexamination, like every doctrinal pursuit, will have far-reaching implications for the Armed Forces (p. 104).

Granted, we live in interesting times, but when exactly did the death of America's soldiers become an ennobling and worthy goal? And has anyone asked the privates and corporals how they feel about this notion? Have some Army officers become so wedded to the notion of the close battle and so wedded to the notion that it is *the* decisive element of combat that they have lost the ability to recognize other solutions?

The "need to bleed" arguments are the ultimate manifestation of symmetrical thinking. The underlying implication smacks of a suspicion of the morality behind the employment of aerospace power. Somehow, striking the enemy at a distance is unmanly, sneaky, and ungentlemanly. If so, what are we to make of the Army's investment in the "deep battle"? Never mind that, if done right, it makes the soldier's job easier and safer. Is that service ready to walk away from the Army Tactical Missile System, multiple rocket launchers, or the Comanche helicopter

because they "strip away the redeeming qualities of warfare"?

Gen George Patton supposedly said, "No dumb bastard ever won a war by dying for his country. He won the war by making some other dumb bastard die for his country." David did not close with Goliath; he stayed out of his reach and killed him with a stand-off weapon. Nobody I know of thinks the less of David.

Lt Col Robert Poynor, USAF, Retired
Maxwell AFB, Alabama

BOOK REVIEW REVIEWED

I was gratified that your reviewer Capt Clifford E. Rich captured the essence of my book *Military Assistance: An Operational Perspective* so well and summarized my findings so clearly and succinctly in your Winter 2001 issue. I share Captain Rich's feeling that an appreciation of US involvement in South Vietnam remains incomplete without a parallel appraisal of Soviet military assistance to North Vietnam. Although the early drafts of this volume included a summary of Soviet and Chinese support for Hanoi, editorial considerations led to my decision to delete these sections from this volume and expand the Soviet summary into a separate study of Soviet military assistance to both North Vietnam and Cambodia in my subsequent companion volume *Soviet Military Assistance: An Empirical Perspective* (Westport, Conn.: Greenwood Press, 2001). Captain Rich and your readers will no doubt have an interest not only in the second volume but also in the third volume *United States Military Assistance: An Empirical Perspective* (forthcoming from Greenwood Press, 30 July 2002), both of which apply and refine the paradigm and findings developed and presented in this first volume of the series.

Lt Col William H. Mott IV, USA, Retired
Lynnfield, Massachusetts

Every bullet has its billet. Nothing happens by chance, and no act is altogether without some effect. "There is a divinity that shapes our ends, rough hew them as we will." Another meaning is this: an arrow or bullet is not discharged at random, but at some mark or for some deliberate purpose.

––E. Cobham Brewer

The shaft of the arrow had been feathered with one of the eagle's own plumes. We often give our enemies the means of our own destruction.

—Aesop

Stopped at Stalingrad: The Luftwaffe and Hitler's Defeat in the East, 1942–1943 by Joel S. A. Hayward. University Press of Kansas (http://www.kansaspress.ku.edu), 2501 West 15th Street, Lawrence, Kansas 66049, 1998, 398 pages, $19.95 (softcover), $39.95 (hardcover).

This campaign history is a well-written study of great victories and incredible defeats. It provides a detailed account of the Luftwaffe's role in German battles against the Soviet Union from November 1941 to the surrender of the German Sixth Army near Stalingrad in January 1943.

To explain this campaign, Joel Hayward uses unit histories, the work of other historians, memoirs, and diaries of key German generals. The diary entries give the book a personal touch and show the generals' emotional reactions to key events. The responses to impressive victories and heart-rending defeats show the personal effect of these events on the participants. The diary entries contrast the death, wounding, or surrender of hundreds of thousands of men.

During the battles, both sides lose many men, and countless Soviet civilians are affected by the war. Early in the book, the Germans capture 90,000, then 239,000, and then 170,000 prisoners in different battles. The Soviets fight with great bravery and fanaticism in Sevastopol and other places. Later, they surround and capture the entire German Sixth Army as the Germans grimly follow orders, holding out until smaller and smaller units are forced to surrender when they are no longer effective.

As Hayward relates these events, he shows his mastery of the subject, starting with incisive background information that explains Germany's desire for Soviet oil. As the battles unfold, he aptly describes events at many different areas of the front without confusing the reader. Hayward writes of weapons, strategies, and leaders in a clear and understandable way.

One of the pivotal leaders, *Generaloberst* Wolfram Freiherr von Richthofen of the Luftwaffe, becomes a key figure in the book. His leadership of Luftwaffe forces in the Soviet Union was especially effective when he could set up a *Schwerpunkt* (point of main effect) with coordinated army and air forces. By focusing on a single point with concentrated air and ground firepower, the Germans often broke through the Soviet lines on their way to victory.

Ultimately, many factors combine to defeat the previously victorious Germans, including bad weather, limited supplies, a long logistics train, poor decisions and tactics, and an overwhelmingly powerful Soviet counterattack. At Stalingrad, the German logistics train was stretched to the limit. German military units often found themselves short of fuel, munitions, and spare parts. Later, lacking food, they are ruined by an abysmal decision to try to supply the surrounded Sixth Army by air as the Soviets gain ground. The Germans have to fly increasingly further with fewer aircraft and landing fields to drop supplies.

Hayward's history will appeal to many readers, especially those who want to learn more about the Soviet front. It is a fine introduction to the Eastern front because it focuses on some German successes and the key turning point, which occurred when the Soviets began to win battles. Hayward's book made me want to learn more about the rest of the battles on that front.

The book includes many examples of good and bad leadership as well as different leadership styles. Richthofen is usually held up as an example of good leadership, while Hermann Göring is revealed as a poor decision maker and someone who refused to admit his terrible mistakes.

The struggles of these great military forces contain many lessons for modern warriors—especially airmen. The book's examples of close coordination of air, ground, and sea forces illustrate the value of air doctrine and strategy and demonstrate the value of understanding and using the principles of war (objective, offensive, mass, maneuver, economy of force, unity of command, simplicity, security, and surprise).

History buffs, strategy lovers, and warriors learning about their profession will all enjoy *Stopped at Stalingrad*. It will also encourage Americans who are much more familiar with the combat history of their own forces to learn more about the Soviet experience in World War II.

Herman Reinhold
Yokota AB, Japan

The War in Croatia and Bosnia-Herzegovina, 1991–1995 edited by Branka Magaš and Ivo Žanić. Frank Cass Publishers (http://www.frankcass.com), 5824 N.E. Hassalo Street, Portland, Oregon 97213-3644, 2001, 416 pages, $26.50 (softcover).

The military history of the recent wars in the former Yugoslavia is yet to be written, but for the next decade this volume of essays is likely to be the starting point for both academic researchers and military professionals. This collection is based on the proceedings of a conference in Budapest, Hungary, sponsored by the Bosnian Institute and Central European University in September 1998. The essays redress the "systematic inadequacy" of Western scholarship, which largely discounts military affairs, the war on land, and war termination. War may well be "an extension of politics by other means," but as the authors rightly point out, this should not imply that military matters are irrelevant. In fact, the situation on the ground is of critical importance from the perspective of military professionals, considering the problem of intervention. The collection's strongest essays and greatest contributions deal with the weaknesses of the Yugoslav national army; Croatian military preparations, including Operations Flash and Storm; as well as the defense of Bosnia-Herzegovina. These contributions demolish many myths, especially the belief in the invincibility of Serb forces waging "people's war." Despite the immense destruction and atrocity, these were limited wars, pursued for limited (and often poorly conceived) ends. The ambivalence of ordinary Serbs toward the war and the Greater Serbia project is striking. And for all the conceits of the military command-

ers, these wars are revealed to be contests of very small, often irregular, forces. Bosnian Serb forces, in particular, appear to have been a "paper tiger," the figment of Serb propaganda and Western imaginations. Fighting is characterized as mostly World War I–style positional battles. War termination is among the areas specifically addressed in the essays. Norman Cigar's analysis of war termination from the Serbian perspective is particularly insightful although readers will still find it necessary to consult Col Robert C. Owen's *Deliberate Force: A Case Study in Effective Air Campaigning* (Maxwell AFB, Ala.: Air University Press, 2000) for NATO's contribution to bringing the war to an end.

One important feature of this book is that it brings the voices of Croatian and Bosnian scholars, political leaders, and military men to the attention of Western audiences. These authorities refute the "ancient hatreds" and other simplistic arguments that abound. Here, Rusmir Mahmutćehajić reprises his powerful analysis of a war to destroy the multiethnic fabric of Bosnia. Such well-grounded and realistic assessments are made all the more convincing by military leaders' presentations on the conduct of operations. Under close scrutiny, these wars resemble any other, being fraught with miscalculation, leaders' naïveté, and civil-military conflict. Dušan Bilandžić's conclusions regarding Croatia's Pyrrhic victory are especially thought provoking. Serbian voices are mostly absent although the editors have included an arresting report by Belgrade journalists on the "call-up crisis," which underscores the widespread evasion of military service in 1991 and 1992. The quality of essays is uneven; American and British essays on the international community's response are particularly disappointing. The inception of the book in 1998 means that Kosovo and Macedonia are excluded, not having become theaters of major armed conflict by that date. Nevertheless, the book's strengths are far greater than its weaknesses. The former also include excellent translations from Serbo-Croatian, as well as a meticulously edited text, useful chronology, and full index. In sum, this volume is recommended reading for scholars and military professionals interested in small wars in the Balkans and the problem of intervention.

Matthew R. Schwonek
Maxwell AFB, Alabama

Touch and Go

In this section of "Net Assessment," you will find additional reviews of aviation-related books and CD-ROMs but in a considerably briefer format than our usual offerings. We certainly don't mean to imply that these items are less worthy of your attention. On the contrary, our intention is to give you as many reviews of notable books and electronic publications as possible in a limited amount of space. Unless otherwise in dicated, the reviews have been written by an APJ *staff member.*

Sharing Success—Owning Failure: Preparing to Command in the Twenty-First Century Air Force by Col David L. Goldfein. Air University Press (http://www.maxwell.af.mil/au/aul/aupress), 131 West Shumacher Avenue, Maxwell Air Force Base, Alabama 36112-6615, 2001, 130 pages, $8.50.

Sometimes big things—in this case, big ideas—come in small packages. Written by the former commander of the Triple Nickel and, perhaps more notably, one of the pilots shot down and rescued during Operation Allied Force, *Sharing Success—Owning Failure* is an enjoyable and inspiring read. From his own experiences and those of other leaders, Col David "Fingers" Goldfein has collected important lessons on leadership—specifically command—and tells them in a personal and direct style. If you are looking for an exhaustive, academic book on leadership, look elsewhere. That's not what Goldfein intended this book to be. If, on the other hand, you want something you can read in an evening and remember for a decade, this is it. Published by Air University Press, *Sharing Success—Owning Failure* is available free to Department of Defense personnel and organizations and is a must-read for anyone heading toward command.

The Pocket Guide to Military Aircraft and the World's Airforces edited by David Donald. Sterling Publishing Co., Inc. (http://www.sterpub.com/sterling.htm), 387 Park Avenue South, New York, New York 10016-8810, 2001, 192 pages, $14.95.

The Pocket Guide to Military Aircraft and the World's Airforces is a fairly concise general-reference book. Although the omission of Brazil's EMB-145 airborne early warning and ground-surveillance platform is surprising, the inclusion of defunct Russian aircraft such as the AN-70, Kamov-50, and the MiG 1.42 is perhaps a greater flaw. In its 192 pages, this book presents the salient details of 125 aircraft, both fixed and rotary wing, of 79 air forces. Granted, this isn't a Jane's publication, but *Pocket Guide*'s compactness and generally good coverage is worthy of its place on the quick-reference shelf.

Aircraft of World War II: A Visual Encyclopedia by Michael Sharpe, Jerry Scutts, and Dan March. Sterling Publishing Co., Inc. (http://www.sterpub.com/sterling.htm), 387 Park Avenue South, New York, New York 10016-8810, 2001, 512 pages, $24.95.

Some the world's best aviation photographers compiled *Aircraft of World War II,* which contains pictures of and data about virtually every major aircraft used in that conflict. This book will delight World War II and aviation buffs alike **.**

Battle over Bavaria: The B-26 Marauder versus the German Jets, April 1945 by Robert Forsyth with Jerry Scutts. Classic Publications (http://www.classic-books.co.uk), Friars Gate Farm, Mardens Hill, Crowborough, East Sussex TN6 1XH, England, 1999, 200 pages, $42.00.

This book combines a coffee-table presentation with a monographic account of the meeting between American B-26 medium bombers and German Me 262 jet fighters. The operational account of this strange, late-war air battle occupies but a few pages. The remainder of this handsome book includes many personal accounts, sidebars, and brief unit histories of the German fighters, American B-26 bomb groups, and P-47 fighter groups. Forsyth also includes several full-page color renditions of the American and German aircraft. Stu-

dents of the World War II air war will find *Battle over Bavaria* a nice addition to their collections.

The Enterprise of Flight: The American Aviation and Aerospace Industry by Roger E. Bilstein. Smithsonian Institution Press (http://www.si.edu/sipress), SI Building, Room 153, Washington, D.C. 20560-0010, 2001, 304 pages, $19.95 (softcover).

Roger Bilstein gained great credibility with *Flight in America,* his pioneer, sweeping volume on American aviation. *The Enterprise of Flight,* an updated paperback edition that continues the study of aircraft manufacture and production, is very useful for understanding important aspects of military aviation, especially the interwar years that gave birth to the US Air Force. Bilstein studies both the technology and international competition associated with aircraft manufacture, covering not only American airlines but also the military. In a new introduction, he also discusses the F-22 Raptor in relation to the American aviation industry and makes observations about space, missiles, and rockets.

Bloody Ridge: The Battle That Saved Guadalcanal: A Memoir by Michael S. Smith. Presidio Press (http://www.presidiopress.com/catalog/new/BloodyRidge.htm), P.O. Box 1764, Novato, California 94948, 2000, 288 pages, $27.95 (hardcover).

In July 1942, the US Joint Chiefs of Staff decided to eject the Japanese from the Solomon Islands in an effort to turn the tide of Japanese expansion in the Pacific Ocean. The chosen target was Guadalcanal. Early on the morning of 7 August, Rear Adm Richmond K. Turner's Task Force 62, consisting of over 80 ships, executed Operation Watchtower. Maj Gen Alexander A. Vandegrift's First Marine Division took the Japanese garrison by surprise, overrunning Henderson Field, the island's landing strip. Outnumbered by at least three to one, the marines withstood a series of determined assaults on a ridge just one mile from the field. After battle reinforcements arrived, the process of slugging it out for the rest of the island began. Michael Smith's book is the tactical story of that battle, known as Bloody Ridge.

Bloody Ridge, which relies on many reports, letters, and previous books, is an adequate treatment of the subject but has several shortcomings. For one, there is very little discussion of Guadalcanal's strategic implications. Furthermore, the author's use of the word *enemies* in referring to US marines is awkward, especially for an American audience. The book lacks a bibliography and fails to substantiate such issues as the ignominious removal and discharge of Maj Charles A. Miller in the aftermath of the battle. Moreover, the author's use of the term *Cactus Express* rather than the established *Tokyo Express* as the nickname of the Japanese reinforcement effort is puzzling. Lastly, the book devotes more space to events preceding and following the battle than to the battle itself.

Although *Bloody Ridge* has flaws, it is a decent tactical study of the early days of the six-month-long Guadalcanal campaign. Readers looking for a muddy-boots version of the events will find Smith's book a good fit. Those looking for a more solidly written historical work may be disappointed.

Command Sgt Maj James H. Clifford, USA
Fort Gillem, Georgia

Luftwaffe at War, vol. 17, **The Sea Eagles: The Luftwaffe's Maritime Operations, 1939–1945** by Peter C. Smith. Stackpole Books (http://www.stackpolebooks.com/Stackpolebooks.storefront), 5067 Ritter Road, Mechanicsburg, Pennsylvania 17055-6921, 2001, 72 pages, $14.95.

Stackpole Books has added yet another volume to its *Luftwaffe at War* series. *The Sea Eagles* is an interesting look at this seldom-reported aspect of the Luftwaffe's combat-and-support operations. Peter Smith begins with a well-written four-page synopsis of the Luftwaffe's maritime operations and then traces its early roots in the 1920s through the Legion Kondor to operations in Norway, the North Atlantic, and the Mediterranean. As with other books in this series, *The Sea Eagles* includes more than 160 photographs, 17 of them in color. Although this book is not the definitive work on this aspect of World War II, the author's information is interesting, well presented, well crafted, and easy to grasp. Readers interested in this area of Luftwaffe operations will appreciate the pictures of the men, aircraft, and weapons. I recommend *The Sea Eagles* to any student of the Luftwaffe.

Lt Col Robert Tate, USAFR
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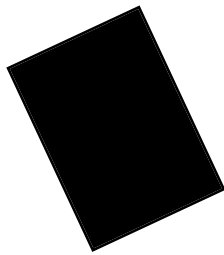
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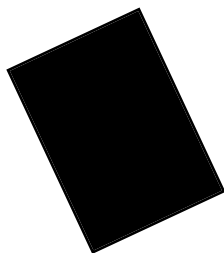
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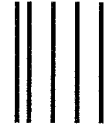
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