In Service to the Nation …
Air Force Research Institute Strategic Concept for 2018–2023

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*The mission of the United States Air Force is to fly, fight, and win . . .
in air, space, and cyberspace.*

In the Fall 2008 issue of *SSQ*, I wrote an editorial that outlined the challenges that I believe confront our military leaders as they develop a comprehensive strategy that would guide our contributions to solving the security problems our nation confronts. In this strategy, our leaders must balance between fulfilling military needs of the present and properly preparing the service for the future. Their strategic challenge involves presenting options that provide national leaders and operational commanders with the flexibility to gain a return on our service's investment in training, organizing, and equipping. In September 2007, the Air University commander tasked the College for Aerospace Doctrine, Research and Education, and subsequently the newly formed Air Force Research Institute (AFRI), to complete a strategy study. The study would provide an "outside-the-beltway" perspective on what the US Air Force should be about in the future; specifically, what capabilities the service should provide the nation 10 to 15 years from now—roughly 2018–2023. As the director of AFRI, it was my privilege to help shape the response.

The time frame designated for the strategy study was far enough outside the Future Years Defense Program (FYDP) to avoid some current programmatic boundaries but not so far out as to be immune to current trends. Additionally, constraining the "future" to 15 years precluded conceptions

of miraculous inventions of weapons found in some war games and other future studies, while similarly constraining the geopolitical landscape.

We determined that the study's relevance would be enhanced by interviewing senior leaders inside and outside of the US Air Force. My staff conducted interviews with three-, two-, and one-star flag officers serving in the Air Force Secretariat, Air Staff, combatant commands, major Air Force commands, Air University, Air Force Reserve, Air National Guard, National Security Agency, North Atlantic Treaty Organization, and French Air Force, as well as select retired four- and three-star flag officers, military contractors, Department of Defense (DoD) civilians at the research labs and "think-tanks," interagency officials, and faculty at civilian universities. These interviews helped inform our analysis but did not restrict our thinking—or our recommendations.

We began our analysis with the understanding that every secretary and chief must simultaneously enable the service to fight a "current fight"—the current fight during their tenure—while preparing it for a future fight. The study, grounded in today's realities, proposed such a strategy—one that attempts to prepare the Air Force to meet its near-term commitments while providing vectors for future success. Some would argue that the study is too focused on the issues facing the Air Force today and not sufficiently focused on a strategic vision for the Air Force's future. This argument ignores the reality that the Air Force faces challenges today that, if not resolved in the near term, will adversely impact the 2018–2023 time frame. Further, the criticism ignores the reality that the programs the Air Force will need in 2018–2023 must originate in the near term to be available at that time. Expressed another way, today's actions set the context that will enable tomorrow's Air Force to ensure future success.

The Air Force has long struggled—along with the rest of the national security establishment—to develop an appropriate strategy for the post–Cold War era that helps shape its unique capabilities to secure the nation. Without a focus on a single adversary, consensus on a coherent strategy has been difficult to develop. This study attempted neither to reinvent the Air Force nor to protect the status quo at the expense of common sense. The intent was to understand the unique value of the service's contribution to national security and, where appropriate, offer considerations for change.

In developing a strategy, we first had to agree upon what the world would look like in 10 to 15 years. In developing the study's assumptions,

we relied principally upon *Mapping the Global Future*, the Report of the National Intelligence Council's 2020 Project. The study was thus informed and constrained by the following assumptions:

- Conventional campaign capabilities—foundational for sovereignty;
- The "Long War" and/or other irregular warfare (IW) will continue;
- The Air Force must "partner" to be successful;
- No global military peer, but at times regional peers;
- Diminished US technological lead (peers get a vote);
- WMD problem continues despite US and international organizations' efforts;
- Imbalanced population, have and have-not separation continues;
- Market/labor competition with China, India, the EU;
- DoD budget will be constrained; and
- Popular support uncertain for national security initiatives—fiscal and attitudinal.

The Strategic Framework

The fundamental starting point for any USAF strategic concept should be a framework in which the entire service sees its value and its contribution. It is interdependence within the service that is the critical missing element in current AF strategy—an Air Force seeking to operate in three interdependent domains of air, space, and cyberspace. The basic operational construct of Global Vigilance, Global Reach, and Global Power that forms the operating construct for the Air Force has its origin in the widely acclaimed Air Force white paper on *Global Reach—Global Power*, published in June 1990. That white paper framed the Air Force transition from a nuclear deterrence and forward defense posture born in the Cold War to a more flexible posture predicated on our ability to move forces and employ force anywhere on the globe, as needed. It was a powerful and enduring message for the Air Force.

Capitalizing on this successful Cold War transition document and discussion, Air Force leaders followed a similar pattern with subsequent documents on *Global Presence* (1995), *Global Engagement* (1997), and *Global Vigilance,*

Reach, Power (2000). However, by 2000, the larger message encapsulated in the connected phrase *Global Reach—Global Power* had been substantially lost. The reorganization of the service, resulting in the creation of Air Combat Command and Air Mobility Command, and the increased deployed-operations tempo of the 1990s provided a near-term focus on "mobility" and "power" and generally related those functions to specific organizations. "Global Vigilance" then became the advocacy bumper sticker for Air Force Space Command, "Global Reach" for Air Mobility Command, and "Global Power" for Air Combat Command.

Over time, the three separate AF strategy elements—vigilance, reach, and power—evolved largely into advocacy statements for specific functions within the framework of the service's contributions to national security. Global Vigilance, Global Reach, and Global Power defined as mutually independent fall short of the full range of strategic options that the USAF can bring to the fight. The expansion into cyberspace only exaggerates this disconnect. Cross-domain integration or operations in air, space, and cyberspace should enable greater speed, precision, and reliability than those restricted to a single domain. The potential synergy represented by integrating capabilities across the domains should produce the desired effects with proportionally fewer counterproductive effects.

The service has focused, perhaps over-focused, on the systems and sustainment that can be "purchased" through programming and organization (POM) actions. However, as an organization that has adapted an effects-based mentality linked to the desired outcomes of national policies, the joint presentation of forces, and both kinetic and nonkinetic options, the Air Force needs to rebalance this focus. By "recasting" Global Vigilance, Reach, and Power with an effects-based orientation, all service functions—agile combat operations, information operations, building partnership capacity, and so forth—can integrate logically in a more cohesive strategic framework: one that focuses on the integration of air, space, and cyberspace capabilities across all domains, to include land and maritime, rather than on individual service capabilities.

The proposed redefinitions begin with recasting all three into a more inclusive vision for Air Force capabilities. ***Global Vigilance*** represents **situational awareness** required for understanding both the necessity for action and the character of the effects necessary to achieve a revised condition or end state. It is the underpinning element, the foundational starting point for Global Reach and Global Power. Global Vigilance depends on

Global Reach to gather data and disseminate intelligence. ***Global Reach*** represents the **operational access** required to provide connectivity to the objective through air, space, and cyberspace. Global Reach takes varied forms depending upon circumstances. For instance, it could be a space-based line of communication, an air route for a C-17, or a portal-to-portal Internet connection. ***Global Power*** represents the **ability to create and sustain effects** through air, space, and cyberspace. These effects encompass a full range of kinetic and nonkinetic, lethal and nonlethal, constructive and destructive options prosecuted through air, space, and cyberspace either individually, or more likely, *via* a synergistic, mutually supporting campaign.

With the recast Global Vigilance, Reach, and Power as the three pillars for Air Force strategy, the service must plan for and acquire systems, people, and enabling structures and processes necessary to shape, deter, fight, and win conventional campaigns (also known as major contingency operations)—foundational for US sovereignty—and to play its part in winning the Long War. Should deterrence fail for any reason, the Air Force must be prepared to engage as part of a team in winning that subsequent conflict. But the probability of conventional campaigns, given our dedication to maintaining the deterrent combatant edge, is less likely than the continuation of irregular styles of warfare characteristic of the Long War.

Fielding Regular and Irregular Capabilities

By maintaining a dominant posture for conventional campaigns, America, in essence, has shaped the environment where it will not have to fight. This does not completely rule out the potential for irrational choices or choices borne of desperation that result in a short, intense conflict. In this time frame, however, the probability is low for state-on-state, force-on-force attrition warfare challenging US sovereignty or a significant realignment of national/regional power.

Having denied our adversaries the opportunity for symmetric warfare, their only other option remains asymmetric. America's military forces are engaged globally, not just against terror, but also in a larger context, against the forces that threaten freedom, be it terrorism, drugs, or insurgencies. This asymmetric warfare is otherwise referred to as irregular warfare. However, the United States must not fight IW as an ad hoc, pick-up game but rather

as a conscious choice to achieve strategic goals that contribute to securing our national interests.

Irregular warfare requires a particular mind-set and specific talents not entirely applicable or common to more traditional styles of warfare. The relative lack of predictability and its indifferent boundaries regarding what each fight constitutes in terms of objectives and resources are troublesome characteristics well beyond the numbers involved. By definition, IW offers a weaker opponent an option against a stronger one, thereby attempting to thwart the concepts of Global Vigilance, Reach, and Power. As a result, and by design, IW is warfare in which the stronger opponent must adapt how it brings its traditional strengths to bear against an apparently weaker enemy.

The Air Force has operated with some success in the IW environment before but has lost significant capacities following drawdowns or conversions after each conflict. This should not come as a surprise, given that budgets for unused tools are a luxury not easily afforded in any era. But the extended lead time required to relearn IW when required has significantly affected the Air Force's ability to contribute early and effectively in each IW fight.

In developing an effective IW strategy, the Air Force must first change a strategic objective from successfully *waging IW to enabling a partner to fight IW*. In the absence of other alternatives, the Air Force may serve as a fighting force, but even at that point, the service should adopt the strategic mind-set that it will conduct a holding action while the supported partner builds/enhances its own capabilities. Winning strategies are conducted by, with, and through the supported partner. The *Quadrennial Defense Review Report* of 2006 provides an important framework for this discussion:

> Long-duration, complex operations involving the US military, other government agencies and international partners will be waged simultaneously in multiple countries around the world, relying on a combination of direct (visible) and indirect (clandestine) approaches. . . . Maintaining a long-term, low-visibility presence in many areas of the world where US forces do not traditionally operate will be required. Building and leveraging partner capacity will also be an absolutely essential part of this approach, and the employment of surrogates will be a necessary method for achieving many goals.[1]

For the Air Force to become effective in IW, it should acknowledge the necessity of fulfilling two sometimes competing missions. First, and in the absence of alternatives, the service should have full capability to engage an asymmetric enemy directly—to fight IW engagements as a key component of the national effort. This will inevitably occur in a joint, interagency, and

coalition-based context. Second, our Air Force's fundamental job within most IW scenarios is to help establish a credible host-nation air force. The Air Force should have the capacity to create within a partner nation the requisite skills and disciplines in airpower that enable partners to realize their national goals without the large footprint or heavy hand of a US military presence.

Today, that transfer/training capability exists on a permanent basis in only one relatively small squadron: the 6th Special Operations Squadron in Air Force Special Operations Command (AFSOC). The 6th SOS certainly has the talent but lacks the mass required for engagement and persistence across the breadth of areas affected by the Long War. The Air Force's general-purpose forces have the necessary mass, and with the appropriate force-development programs, can have the requisite talent as well.

The Air Force should meet the challenge by shaping its force for a winning strategy in the Long War that will enable Airmen to *assess*, organize, train, equip, *assist*, and *advise* foreign air forces for success against irregular adversaries. However, with increasing acquisition costs highlighted by recapitalization challenges, fielding the numbers of aircraft required to support all theaters is problematic. Future budget constraints will place aircraft, space, and the cyberspace systems acquisition at risk—not to mention the personnel necessary to support future conventional campaigns. What is required, then, is a "right-tech" solution that meets both immediate Air Force IW requirements and provides enhanced capabilities for partnering with host air services. This is not a "low-tech" alternative but rather providing the right technological solution appropriate for the situation. For example, it will be years before the Iraqi and Afghani air forces are prepared to support even the most basic jet aircraft (e.g., the F-16), and even then it might not be the best platform for their purposes.

The Air Force must consider procuring aircraft specifically designed for IW operations to augment and balance the current force—the same aircraft that best augment and balance a partner's force. New, highly capable right-tech aircraft, to include intratheater transport aircraft, operating beneath the top cover of air superiority, can be acquired at lower cost and in greater numbers than more expensive state-of-the-art aircraft. These new right-tech aircraft also provide opportunities for platforms that can be assimilated by host-nation forces, creating capacity where none may have existed before. This fundamental of IW strategy will enable partnering for

decades through bilateral agreements as the United States provides logistical and advisory support at levels as desired and appropriate for both nations.

Building partnership capacity is not a particularly novel idea. Many coalitions and alliances have formed around similar concepts; for example, the North Atlantic Treaty Organization "interoperability" initiatives provided essentially the same effect. Within the proper context this approach not only extends military tactical and operational proficiency but also contributes when the strategic goals include building and developing a partner-nation's central-government legitimacy and credibility.

Such an enabling strategy produces the immediate benefit of significantly reducing the profile of Americans in contested areas. As seen recently in Iraq, and repeatedly in history, large-power footprints can become a significant rallying factor for disparate, antigovernment groups—the very definition of insurgency. Even groups that would never work together in normal circumstances have formed temporary alliances to eject outsiders. Rather than helping the central government, a large US footprint can become a force multiplier for insurgent recruiting and propaganda. An enabling strategy with the proper emphasis on *by, with, and through* the central government diminishes the risk of the US footprint working against it.

If the nation chooses to engage in IW, the Air Force must be prepared to field forces to wage war effectively in this arena. Thus, its force-development system should produce people qualified for IW as well as more traditional styles of conflict. Force development is a balance of three core efforts—education, training, and experience—designed to ensure that the Air Force has qualified people in place at the right time to fulfill the assigned missions. The Air Force cannot confine IW to a single specialty or set of specialties. Force development for IW, thus, should engage widely across the conventional Air Force.

There are several suggested opportunities for innovation within this environment. For example, F-22 pilots will conduct much of their training in simulators due to that aircraft's complex and multifaceted capabilities. With a companion trainer aircraft available for wider application, pilots could be operationally ready to fulfill multiple missions. Such a dual qualification system would provide airmanship and growth for the crews at much lower flight-hour costs. Additionally, if the companion aircraft were IW suitable—for example, ISR, light attack, battlefield mobility—a ready reserve for IW could become available, to include availability in phase IV of a conventional campaign.

Solutions in IW must be based on flexibility to address the unique local circumstances of each conflict where resolutions are largely generated from political rather than military initiatives. As a part of the joint team, the Air Force will likely find its forces reporting to a joint task force (JTF) commander where ground units will be operating simultaneously in multiple dispersed areas. In most geographic commands, the Air Force has one air operations center (AOC) to support the entire area of responsibility where the Air Force has consolidated the majority of its expertise—air, space, and cyberspace.

When a JTF is created in theater, the Air Force is not currently positioned to send a joint force air component commander (JFACC) supported by an AOC to that JTF. In an attempt to create a presence, the Air Force has chosen to assign an air component coordination element (ACCE) to JTFs. While an ACCE provides air expertise at the JTF level, it is by design not involved in the formal planning process, neither with the JTF nor the AOC. The end result is that JTF staffs do not have adequate airpower planning expertise or the organizational "hooks" into the formal joint air operations planning process within the AOC. This situation is magnified if multiple JTFs are created within a combatant command.

As US Army doctrine evolves, planning is taking place at lower and lower command levels to take advantage of individual and small-unit initiatives. The Army's planning construct, thus, finds Airmen at the end of the planning process, not at the beginning where they can be most effective. For effective operations, the Air Force must have planning expertise at the brigade level and below. This means that while centralized control remains paramount to retaining theater-wide effectiveness, to effectively integrate Air Force capabilities with joint operations at the JTF level and to inform air and ground planning at the earliest stages, the Air Force should move to a distributed planning model to maintain effective centralized control. Distributed planning allows the Air Force to place experts with the appropriate planning tools at the locations where operational plans are born and refined, allowing meaningful prioritization—all of which enable effective centralized control.

To address the air and ground integration challenges below the JTF level, the Air Force must also attend to force development. This will require establishing units that are organized, trained, and equipped to conduct distributed planning. The Air Force can leverage the recently established air ground operations wing at Moody AFB, Georgia, to cre-

ate this organization. By developing subordinate group- and squadron-size structures, the Air Force would create organizations that could align to the US Army division, brigade, and battalion levels. The proper force development model would also allow the Air Force to surge personnel from the AOC and, conversely, reclaim them when the need arises.

The Total Force

Since 1990, global conflicts have demanded a continual commitment from the active duty and Total Force. The Air National Guard (ANG) and Air Force Reserve (AFR) "Citizen-Airman" is the Air Force's closest link to the American people. However, constant overseas deployments have strained the bonds between the two. An unintended consequence of such a high operations tempo is that it has transformed the "Citizen-Airman" into the "Airman-Citizen." To help return the balance, the Guard's primary mission can become homeland defense. The American people expect their military to respond to any national disaster, man-made or natural, and the ANG is exceptionally well positioned to do just that.

The inclusion of the homeland defense mission is not new to the ANG. It has long been a central part of the air capability under the auspices of the North American Aerospace Defense Command. However, the nation must look to broaden the ANG's and the AFR's mission in the post–9/11 era. This can best be accomplished by making select Guard and Reserve units dual capable in at least two mission sets—war fighting and peacetime disaster relief.

An obvious area to begin is with medical personnel and MEDEVAC, where assets have clear dual capability—during a disaster at home and in combat operations when deployed. Existing ANG medical units will require modification to their existing Designed Operational Capability (DOC) statements designating them to perform disaster relief missions. The revised DOC would provide for unique first-response medical needs beyond the typical emergency medical specialties. For example, the Air Force should stress physician certification within the ANG that encompasses all phases of disaster medical delivery—a natural complement to existing unit medical capabilities and psychiatric specialists. Dual-capable units could provide exceptional capabilities at home and during phase IV operations following any conflict.

As current equipment is programmed for retirement in the out years, selected ANG units should be reequipped with dual-capable—for example, IW, conventional campaign, and homeland defense—platforms and be assigned DOCs allowing for use in multiple mission areas. For instance, where ANG units are retiring F-16s, select units could have those platforms replaced by cargo aircraft and other airframes consistent with the homeland defense mission. Thus, DOCs for rescue and airlift could be added for both the ANG and AFR units. This is not to cede the Air Guard and Reserve's fighter mission completely—there will always remain a need for their combat capabilities to meet current operations and any postulated conventional campaign—but rather to review their existing capabilities.

The Nuclear Mission

While IW and homeland defense are critical issues facing the United States, strategic deterrence and national sovereignty remain pressing concerns. Nations, including China, North Korea, Iran, and a multitude of others, continue to pursue nuclear weapons programs and nuclear modernization. During the Cold War, nuclear deterrence was the nation's top priority. Since the end of the Cold War, the United States has struggled with nuclear deterrence as a strategic concept. The recent series of national military strategies has shifted the nuclear issue from that of deterrence to one limiting the proliferation of weapons of mass destruction and downsizing the numbers of nuclear assets.

Numerous options exist to address the Air Force's nuclear surety responsibilities. They range from recommendations to create an organization responsible for overseeing nuclear issues to a complete reorganization of the Air Force around the nuclear mission. Building upon the Air Force's exceptional record through the Cold War, it seems critical for future success to ensure that any organizational remedy be as simple as possible so that even the youngest Airman knows who has command authority for USAF nuclear assets. Accordingly, the most direct organizational solution requires that the Air Force consolidate all nuclear assets under a separate major command, accountable to the chief of staff for organizing, training, and equipping functions, while serving as the force provider to US Strategic Command. One numbered air force for bombers and one for ICBMs would work to ensure a focus on nuclear weapons and improved "checklist discipline." This is not a proposal to "bring back SAC." While

memories of Strategic Air Command warm the hearts of many a Cold Warrior, a SAC construct would not meet the requirements demanded of a twenty-first-century air force. This new command would provide an advocate within the Air Force for its strategic mission and be responsible for organizing, training, and equipping the Air Force's strategic force. This new command might well include space-based assets and, at some point in the future, offensive cyberspace capabilities.

Organizational change alone will not address deeper problems. The larger issue is about leadership and instilling a culture where officers and senior noncommissioned officers will step up immediately to take charge to apply discipline and correction where needed to assure compliance. Leadership has two essential elements—*the mission*, objective, or task to be accomplished, and *the people* who accomplish it. All facets of leadership must support these two basic elements. Effective leadership transforms human potential into effective performance in the present and prepares capable leaders for the future. A leader must never forget that people perform the mission.

Former Air Force chief of staff, Gen Ronald R. Fogleman, once said, "To become successful leaders, we must first learn that no matter how good the technology or how shiny the equipment, people-to-people relations get things done in our organizations. People are the key or fundamental assets that determine our success or failure. If you are to be a good leader, you have to cultivate your skills in the arena of personal relations." The success of nuclear surety and deterrence is dependent on success at the critical junctures in leadership. These critical junctures are at the *officer-to-senior-NCO* level and the *senior-NCO-to-junior-Airman* level.

Human behavior will drive some to attempt to find the "easy way." The Air Force core values form the bedrock of leadership in the Air Force. The core values are a statement of those institutional values and principles of conduct that provide the moral framework within which military activities take place. The three fundamental and enduring values of integrity, service, and excellence require personal focus—one that is face-to-face and directly influences human behavior and values. Successful leaders tailor their behaviors toward their fellow Airmen's needs for motivation, achievement, and sense of belonging, recognition, self-esteem, and control over their lives. Leaders foster growth by insisting that their people focus attention on the aspects of a situation or mission they control. Where Airmen assume away

the responsibilities of leadership, compliance with established procedures and accountability are dramatically impacted.

Nuclear deterrence remains critical to our nation's defense, particularly in light of a resurgent Russia, China adding to its nuclear force, and the posturing of nations like North Korea and Iran. Nuclear deterrence provides the overarching umbrella to national security not offered by any other weapon system. The question with an aging fleet then becomes What does the Air Force do next? Does the nation relinquish the land-based intercontinental ballistic missile (ICBM) force and rely upon its strategic bombers and ballistic-missile submarines for nuclear defense, or, at some point, does it fund modernization of the land-based force?

America constructed the current ICBM command and control structures —launch control centers (LCC) and launch facilities (LF)—during the 1960s. These underground structures that house the crews, equipment, and launch facilities are vulnerable to direct nuclear strike and are subject to environmental pressures, such as underground streams and shifting ground. Ongoing modernization and upgrade programs will allow the existing missiles, warheads, and command and control systems to remain operational through the 2023 time frame, notionally to 2030, but how far beyond that remains unclear.

A significant part of the nation's nuclear surety issue is its aging ICBM force, which it relies upon for strategic defense. At its height, the United States had 1,500 land-based ICBMs. With the closing of the 564th Missile Squadron in Montana, that number is reduced to 450, most of which are single-warhead missiles. If the nation is to go below 450, any new number should be a function of US national policy and should be based upon a reasoned threat analysis. Therefore, we recommend a threat study that would take into account deterrence against rogue-nation attack and future near-peer competitors.

Support for nuclear modernization is problematic. From the public's perspective, ICBMs do not protect the nation from terrorists and have little or no role in the global war on terrorism—much less in Iraq or Afghanistan. Many believe ICBMs will never be used due to the horror of nuclear weapons. Therefore, eliminating one leg of the triad would save money needed for other pressing requirements while at the same time not impeding the nation's progress as it fights the Long War. However, the elimination of the ICBM force would dramatically ease the targeting options for any potential adversary.

At some point, the nation will be faced with the decision to retire or modernize the current ICBM fleet. If it were to eliminate ICBMs it would then be forced to rely upon the remaining two legs—strategic bombers and ballistic missile submarines. The recent Blue Ribbon review of nuclear security commissioned by Secretary of Defense Robert Gates found that "without an alert commitment for 17 years . . . the bomber force has seen a dramatic atrophy of its nuclear operational and academic skills set." Thus, without returning to the Cold War strategy of bombers on alert, the preponderance of reliance and risk then moves to the submarine force, essentially requiring the United States to rely upon a single nuclear system. If a technical fault were to "ground" that system, the United States would be without a viable nuclear deterrent.

The nuclear triad has served America well for over 60 years. The rationale for its existence continues today and will into the future. As horrific as 9/11 was, it did not place the nation's survival at risk; only a nation with strategic nuclear delivery capacity can do so. The October 1998 Defense Science Board Task Force on Nuclear Deterrence concluded that "significant numbers of ICBMs deny any adversary the benefit of a limited attack. Without the ICBMs, surprise attacks against a handful of bomber bases and sea-launched ballistic missile (SLBM) facilities, with plausible deniability, could drastically alter the correlation of forces." Thus, the pressures that exist to eliminate land-based ICBMs are not founded on deterrence or national defense but rather on funding and public perceptions of the utility of nuclear weapons.

Continued reliance on a triad reduces risk and enhances national security through nuclear deterrence. Accordingly, what is required is a sustainable and affordable ICBM modernization program. The first step in creating such a system is upgrading ICBMs with a modern command and control structure. To address the aging, nonsurvivable launch control centers, the Air Force should consider moving the equipment and crews above ground. This move will reduce lifecycle costs (ease of maintenance) while taking advantage of the latest technologies in communication. Vulnerability increases somewhat, making this more of a soft target, but through redundancy, much of the vulnerability can be mitigated. The next step in creating a sustainable force is equally important: modernization of the launch system.

The new launch system should be based on a family of vehicles, one also used for commercial space lift or for wider military application. A missile with wider application allows R&D costs to be spread over a larger number

of vehicles while at the same time reducing maintenance costs by using common hardware. As with command and control facilities, the Air Force should consider returning the new launchers above ground. Essentially the same rationale exists for moving launchers as it does for command and control: reduced lifecycle costs. Again, vulnerability increases somewhat but can be mitigated through leveraging technical means, such as remote surveillance. This concept is not a new proposal, as the Air Force has researched above-ground launchers before—specifically, during the 1970s and 1980s with "rail-garrison."

Acquisition Reform

Ensuring national sovereignty through nuclear deterrence is only one part of a more complex puzzle. Historians have postulated that the twentieth century was an era of air and space and that American dominance derived from its ability to exploit both. To date, the twenty-first century appears to be one of information and communication. Nations such as India, China, and Indonesia seem to be reaping the benefits of understanding a new domain, that of cyberspace. To retain America's technological lead well into the twenty-first century, the nation, and more specifically the Air Force, must reinvigorate an acquisition process that was designed during the postindustrial age, an era that allowed for a 15-year cycle for systems acquisition. Today's era of rapid change and mass information does not allow the United States to remain a world leader in advanced technology unless it increases the pace and reduces the costs involved in the acquisition process.

Most would acknowledge that the DoD acquisition process requires reform. This is not a case where the entire system need be reinvented but rather redirected. In sum the acquisition process has produced numerous successes over the past 50 years. It has enabled the Air Force to sustain a vast technological lead over its nearest competitors in air, space, and cyberspace. It has fielded such marvels as the world's most capable fighter in the F-22A and space launch vehicles, such as the Atlas V and Delta IV, that will assure US access to space for decades to come. These programs, however, come at significant cost. In a time of budget constraints, acquisition reform must occur to ensure the process becomes more efficient, effective, and responsive to guarantee that the Air Force remains the world's preeminent air force.

Some would argue that the acquisition process is too complex for the Air Force to affect; that it is driven by Congress and the DoD. The service

does, however, control systems' requirements and program management. Accordingly, the Air Force must first invest in the right people with appropriate scientific, engineering, and program management expertise. Acquisition is a highly technical arena, and the Air Force is best served by those who have the prerequisite backgrounds to understand the complexity of leading-edge systems. Next, the Air Force must ensure the stability of program manager tour lengths to enhance oversight and accountability. Longevity provides familiarity; personnel with greater technical expertise, staying in place for longer periods of time with the opportunity for career progression, lend stability to the acquisition process. Additionally, Air Force personnel—either uniformed or civilian—must perform the preponderance of program oversight, review, and continuity. Contractors providing oversight of other contractors place stress on the system and potentially bring into question the integrity of the entire acquisition and development process; clearly the Air Force faces this concern today.

Further, the Air Force must look to "right-tech" solutions to simplify the acquisition puzzle. Right-tech need not mean reduced capabilities or "low-tech." A right-tech solution means acquiring the appropriate technological solution for a given requirement. For example, while a single satellite may be less capable than one it replaces, networking less-expensive, less-complex satellites together could result in a more capable and resilient constellation at reduced costs and in less time. Former Secretary of the Air Force, Edward "Pete" Aldridge, once said that the United States launched new, one-of-a-kind Lamborghinis into space while the Soviets launched tried-and-true Chevys. Both accomplished similar missions but at dramatically different costs with a corresponding operational responsiveness—the Soviets could launch on demand; the United States could not.

While system designs may start small, by the time they reach production they have grown in size, complexity, and cost—further complicating acquisition. To solve this problem, the Air Force must improve its requirements definition process and establish clear guidelines that restrict introducing modifications once system development has begun. Certainly, when developing leading-edge systems, it is often difficult to identify all possibilities, but at some point a decision must be reached to move forward—development must become a stable process. The next generation systems are better served by development with the A model followed by B, C, and D models rather than producing the E design as the first available. By adopting a strategy of standardization and an accompanied block

approach to systems acquisition across all three domains, the Air Force can reduce costs and shorten production times, making it possible to take greater advantage of existing technologies. Incremental development allows systems to mature, reducing the need for modifications after system development has begun.

During the 1980s, more than 20 contractors competed for most defense contracts. Today the DoD relies principally on fewer than 10 main contractors. Programs have grown so complex and costly that often the remaining contractors must team to share costs. New technologies give birth to new start-up companies, but these new companies are often merged in cash buyouts or stock swaps. However, certain Air Force systems—such as computer chips and national asset satellite subsystems—are too critical to the nation's defense to allow international competition. To ensure these select components are both available for military use and are reliable (e.g., virus free), domestic development of state-of-the-art manufacturing designed for the most sensitive systems and subsystems is critical. Further, the Air Force must initiate protocols for global partnering that enable a greater degree of oversight and ensure quality control. The marketplace is international, and without proper precautions and safeguards, the Air Force could find itself disadvantaged by inferior craftsmanship or substandard quality control.

Taken together, the aforementioned reforms will reduce both the acquisition cycle and overall program costs. The United States has not lost its technological advantage; however, the gap between it and the rest of the world is shrinking rapidly. To maintain its technological edge, which is the Air Force's combat advantage, the emphasis must be on both the people who provide the scientific and engineering knowledge and on the acquisition process itself that provides a timely return on investment for the American public. The Air Force must pay close attention to these tasks, or it risks being overtaken by its competitors. As baseball great Satchel Paige once said, "Don't look back, someone might be gaining on you."

America's Vulnerability in Space

While ICBMs serve as the backbone of US land-based strategic deterrence, the nation's use of space ensures its international presence. As a unique operating medium, space and military assets in space provide perspective, enabling awareness and responsiveness unconstrained by national

boundaries. As "the ultimate high ground," space truly provides a unique arena for conducting Global Vigilance. To understand space, though, one must first know where and what it is. Space is identified by international treaty as starting at 65,000 feet. It extends upward in all directions from Earth's surface; thus, it is a global common or domain. Operational space consists principally of near space—also known as high altitude—and low and high Earth orbit. While the definitions are not precise, near Earth starts at 65,000 feet, low Earth ranges from about 100 to 1,240 miles, and high Earth orbit generally means geostationary orbit, approximately 22,240 miles up. Near Earth has eddies and wind currents and is capable of sustaining high-altitude balloons. Low Earth orbit is where most satellites and the space shuttle operate, and high orbit, or geostationary, is where the capability exists to position a satellite over a specific area on Earth and keep it geographically stationary.

America established its preeminence in space during the Cold War. It was both necessary for national security and an extension of national pride. Today, no one questions the importance of space operations as an integral part of American national security. In the past 15 years, reliance on space has grown exponentially. Global positioning system (GPS) receivers are commonplace in many of today's vehicles, commercial banking is dependent upon satellite communications, and both land-based and satellite cable television receivers rely upon space-based assets. Military reliance is no less dramatic, as satellites provide the technological infrastructure that enables today's precision strike and superiority of the battlespace. However, the US reliance on space capabilities has also created a vulnerability—thus, a likely target for potential adversaries. The recent launch of the Defense Satellite Communication System (DSCS) follow-on, Wideband Global System (WGS), is an example of this paradox. While each WGS satellite is more capable than the entire DSCS satellite constellation, the planned six-satellite WGS constellation increases US space vulnerabilities by placing greater reliance upon a reduced number of satellites.

The nation's vulnerabilities in space are no more apparent than in the area of assured access to space—a national priority. Presently the United States has limited ability either to protect its space assets or deny the actions of others in space. As more nations field space systems, to include antisatellite technologies, space superiority cannot be assured. Existing vulnerabilities in space could drive a strategy that would lead the United States to place weapons in space—a move that would clearly spark an

arms race. A less volatile and potentially more successful strategy for the 2018–2023 time frame exists; that is, using the entire spectrum of diplomatic, information, military, and economic capabilities to develop a *defense-in-depth* construct for US space operations.

In developing space defense in depth, the Air Force must take the lead in engaging the international community to the fullest extent to create a system of protocols and relationships that encourages beneficial and benign behavior in space. Through economic and technical cooperation, nations become interdependent and much less likely to act against their own interests. America already partners widely with the international community; for example, in such areas as the international space station and space launch—both Russia and China have launched satellites for US-based corporations—and to avoid frequency overlap in the deployment of Galileo, a European version of GPS.

Partnering also lays the foundation for international negotiation, regulation, and governance by the rule of law—powerful concepts appreciated by our allies. Currently, the United States is party to a series of international regulations across land, sea, air, and space. A new round of international agreements could call for the elimination of all weapons in space, which many nations may well find attractive. Precedent exists to regulate space activity through international negotiation and regulation. Following a successful US space-based nuclear weapons test during the early 1960s, the international arena—with US support—moved to ban such weapons in space.

Pres. Ronald Reagan once said, "Trust, but verify." In space this is problematic, for without situational awareness, it is difficult to do either. Currently, adversaries could alter a satellite's orbit by a few degrees, and it might take days or weeks to reacquire. Additionally, microsatellites are becoming an increasing reality, and the United States has little or no ability to track objects that small. The Air Force has taken positive steps to correct that deficiency with the launch in FY09 of the first space-based surveillance system (SBSS), Pathfinder, in an attempt to improve space situational awareness (SSA) of geosynchronous orbiting objects. However, the Air Force must also field a space constellation designed to detect objects in low Earth orbit and integrate space, ground, and maritime systems into a coherent detection architecture. Only with a robust system observing both low and high Earth orbits will the United States

be capable of providing comprehensive SSA—an essential element for ensuring true space superiority.

Another essential element to space control is access to the domain. The Air Force has a rich history as a significant participant in the nation's race to space. It does not, however, have a record of responsive launch. Special handling requirements for lift vehicles and satellites require months or years of planning for any on-time launch. Space systems must become more responsive to support the needs of war-fighting commanders. This can best be accomplished through the concept known as operationally responsive space (ORS). Undersecretary of the Air Force Peter B. Teets defined ORS as a means "to create a more responsive, reliable, and affordable lift family capable of fulfilling both current and future launch requirements, and the corresponding responsive and affordable satellites."[2]

The primary space-launch vehicles in use by the Air Force today are known as evolved expendable launch vehicles (EELV)—the Delta IV and Atlas V families of boosters. These two lift families will continue to be the primary medium and heavy lifters beyond 2023. Becoming operational in 2002 at about $100 million per vehicle, the EELV was designed to standardize and improve space-launch operability, reduce the government's traditional involvement in launch processing, and save a projected $6 billion in launch costs between 2002 and 2020.

In 2006 a congressionally mandated national security space-launch requirements panel addressing DoD lift concluded that "ample evidence suggests that these rockets [Delta IV and Atlas V] can meet the NSS [National Security Strategy] launch needs of the United States through 2020 (the end of the [panel's] study period), barring the emergence of payload requirements that exceed their design lift capability." The report noted, however, that the two launch families were "largely uncompetitive in today's commercial market," and that because ORS concepts were in the formative stages "it was premature to specify launcher requirements."[3] The Air Force objective must be lower cost with responsiveness marked by days and weeks rather than months and years. Less-expensive lifters and satellites that are also operationally responsive must become commonplace in the Air Force inventory.

What is required is a second space-launch modernization study similar to the one in 1995 that produced the requirements for the EELV. This new study would identify the requirements for ORS, bringing divergent Air Force lift and satellite programs together, and focus on light-to-medium *vice*

medium-to-heavy lift. The Air Force must step up to this challenge or it will remain mired in the construct of vulnerable, expensive, one-of-a-kind systems. Only when requirements are established will ORS move from a test program to an operational concept.

To further mitigate vulnerability in space, the United States must also instill greater resiliency in its satellite constellations. This can be accomplished by networking a larger number of satellites together, having spares on orbit, and/or being able to rapidly replace lost assets. The construct is to eliminate any incentive for destroying US space-based assets. If an adversary negates the use of one or more satellites, responsive launch and the ability to rapidly reconstitute capabilities enable the nation to negate its vulnerability. Further, by networking potentially less-complex satellites together, as is done today with computers, operational capability can be enhanced. The nation will always require large and correspondingly more-complex satellites, especially in geostationary orbit. However, what is needed is a mix of both systems to increase capability and simultaneously reduce vulnerability.

The Air Force has one significant gap in its exploitation of space, that being near space—known to some as high altitude. Near space is the region sandwiched between 65,000 feet altitude and the lower limits of low Earth orbit. In this region the air is too thin to support flight by most aircraft, and gravity is too strong for satellites to sustain orbit. Near space provides an arena to further Global Vigilance through theater-wide surveillance and Global Reach *via* new technologies that deliver alternative and potentially more-flexible new lines of communications for theater battlefields.

Former CSAF Gen John Jumper stated that near space vehicles would be an inexpensive substitute "for a low orbiting satellite constellation that would probably have 40 or 50 satellites." The Defense Advanced Research Projects Agency (DARPA) and the Air Force Space Command (AFSPC) have both successfully tested vehicles in near space—DARPA using a "flying wing" and AFSPC high-altitude balloons. The goal of exploiting this arena is to provide greater capability for the war fighter at a substantially reduced cost.

The expectation is that if the Air Force could build a near-space vehicle to hover over a point at an altitude of about 23 miles, it could remain on station for months—far longer than unmanned aerial systems and approaching the mission duration of some satellites—at a greatly reduced cost. Recently, operational enthusiasm for near space has waned. Despite that, leaders should commit now to the use of near space to ensure operational

control of a cost-effective medium for capitalization in the 2018–2023 time frame. Ultimately, near space is awaiting utilization across its entire spectrum with the potential for great return on limited investment.

Cyberspace—A Contested Domain

Moving from space to the third Air Force operational domain, cyberspace, the Air Force again faces numerous challenges. During the earliest days of the computer revolution, cyberspace was largely viewed as a benign, undefined region whose main use was for e-mail and a playground for adolescents and twenty-somethings living in the basement of their parents' houses. By contrast, rapid growth in the popularity of the personal computer and the increased availability of the Internet have generated a new war-fighting domain: cyberspace.

Today, cyberspace binds the international community together, empowering governments and individuals in ways unimaginable only a few years earlier. Cyberspace permeates nearly every aspect of our daily lives to the point where society depends on the use of information technology networks. However, as with space, our reliance on cyberspace has turned a technological advantage into a vulnerability, one adversaries seek to exploit. The challenge, then, is how best to use the medium while simultaneously protecting US national interests from attack across this new domain.

In his 1982 novel, *Burning Chrome*, William Gibson coined the term *cyberspace*. He defined it as "a graphic representation of data abstracted from banks of every computer in the human system." From this fictional beginning, the world would grasp the concept of a real, separate, distinct, and identifiable realm. In 2008, the DoD defined cyberspace as "a global domain within the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers."[4] DoD senior scientist, Dr. Kamal Jabbour, has described cyberspace in military terms as "a domain in which signals hold at risk intelligent systems." As such, cyberspace enables Global Reach—not to mention Global Power and Global Vigilance—through a modern line of communication that connects the other domains with physical infrastructure and the cognitive processes that use the data that is stored, modified, or exchanged.

Cyberspace's distinct characteristics immediately identify it as unique from the other war-fighting domains of land, sea, air, and space. The characteristics are the low cost of entry—anyone with a computer and an Internet connection can launch attacks against global US interests; anonymity of one's action; and uncertain governmental jurisdiction due to international cross-border implications. Threats come from traditional and nontraditional sources, including hackers in search of fame or personal gratification, criminals seeking profit, terrorists looking for ideological gain, and nation-states in quest of political and/or military advantage. At the same time, cyberspace provides the ability to deliver precise effects that enable technologies and tactics to operate simultaneously across a broad range of targets, unconstrained by location or time.

Cyberspace is also distinct from the information that may reside in or be transferred through it. If not properly understood, the Air Force, in attempting to protect information, might err in focusing on the content rather than on the domain itself. A maritime analogy would be the equivalent of guarding the goods onboard a ship rather than patrolling the shipping lanes. Accordingly, the Air Force must not focus solely on protecting its databases, but rather it must also protect its networks and the functioning of electronic devices to enable cyberspace control.

Establishing control over cyberspace does not mean having exclusive use of the domain, nor does it mean that the Air Force is interested in defending all of it. Instead, as with air superiority, control of cyberspace means securing access to certain portions of the domain as needed to conduct desired activities across all domains. Accordingly, the Air Force must be prepared to conduct warfare in cyberspace in order to secure the domain at the time and place of its choosing.

Before the Air Force can function effectively in cyberspace, it must first resolve the issue of jurisdiction, thereby determining the difference between a crime and an act of war. This is not as simple as it might sound. The Posse Comitatus Act generally prohibits DoD personnel from taking law enforcement actions against US citizens, which prompts certain questions. When an attack occurs, is it from inside or outside of the United States? Is it by a US citizen or a foreign national? Is it by a group of unaffiliated private citizens, or is it state sponsored? Where does the Federal Bureau of Investigation's (FBI) or National Security Agency's (NSA) authority begin in relation to that of the Air Force? The answer to these questions will drive

jurisdictional decisions and provide the authority for the Air Force to take offensive or counteroffensive cyber actions.

The Air Force must take an aggressive approach to determine jurisdictional responsibly. Accordingly, the Air Force should work toward an interagency commission that will resolve the issues of jurisdictional authority and, if needed, advocate for Congress to revise Title 10 laws and policies. Without resolving this issue, it will become increasingly difficult to ensure the required operational control of the domain for national defense.

Understanding cyberspace as a war-fighting domain requires focusing on the medium as it relates to military operations and national security. The ability of individuals or states to "hack the system" or "spam the network," resulting in denial of service or corrupted databases, will increase over the next 10 to 15 years. Accordingly, while offense offers a distinct advantage for airpower, in cyberspace deterrence and defense must become co-equal propositions. When attacks can come from all directions at any time, defense becomes paramount.

The Air Force, and consequently the DoD, must move to a truly closed network, one that does not allow interaction with other open systems. By moving to a closed network, the potential for external contamination or external attack from hacking or spamming is mitigated. The Air Force must also defend its critical databases from attack, but firewalls, like castle walls, provide a false security while trapping their residents inside. Rather than seeing Air Force bases as individual entities working in cyberspace, the Air Force must view cyberspace holistically, developing organizations and tactics to defend regardless of location while retaining freedom of action for the nation.

The Air Force must additionally develop resiliency in its systems, where a layered defense in depth reacts to threats and sets in motion procedures for post-attack recovery. Much like the construction of battleships of the early twentieth century, the ability to sustain a direct hit and continue fighting will be paramount. This will mean developing and fielding self-diagnosing and self-healing systems with adequate redundant capacity for survivability. The impetus here is to remove any incentive for an attack. If the effort far exceeds the reward, attacks are further deterred.

Conducting offensive and defensive cyberspace operations will require an increased degree of automation. Cyber operations occur in the compressed time of milliseconds, a pace that demands automating the defensive measures of threat detection, classification, course-of-action selection, and

response. Intelligent systems must be able to react rapidly; instantaneously differentiating between inquiry and attack, communicating resolve or offensive operational intentions to deter the attacker. Further, databases must employ stealth methodologies where, for example, modulating chip technology enables them to hide, morph, and masquerade as effectively as any attacking agent.

If deterrence fails, the Air Force must have the ability to conduct counter cyberspace operations across the entire grid to disable and defeat the attacker's capabilities—returning fire when necessary based on established rules of engagement. Through counter cyberspace operations, the Air Force deters future actions and removes the aggressor's motivation, be it an individual or a nation-state. Without a return on the investment of time and effort, attacks are mitigated, and cyberspace superiority, like air superiority, becomes achievable.

To respond effectively, the Air Force must first know that an attack is taking place, thus counter cyber operations will require generating and maintaining cyberspace situational awareness. Attacks against US systems will likely begin by probing and querying to determine weaknesses and our likely response. Defeating a cyber attack will, then, necessitate internal and external early warning systems, much like the ICBM launch-detection network. Systems residing outside the firewall will identify anomalies, rapidly analyzing an attacker's "forensic fingerprints" to predict future behavior and communicate viable options through reach-back capabilities to avoid the threat.

As an operational career field, cyberwarriors must be part of a highly structured professional development program. An initial weapon system qualification school, similar to undergraduate pilot training (UPT) or undergraduate space and missile training (USMT), must exist. This undergraduate cyberspace training (UCT) school will provide the needed finishing military education required for newly minted second lieutenants. It must be as exacting as a UPT, where the Air Force anticipates a substantial number of washouts as students progress through a highly demanding and rigorous program. The new school would focus on the fundamentals of cyberspace control and operations, furthering student understanding of cyberspace superiority and cyber counter operations.

Following UCT completion, cyber professionals should anticipate a career-long continuing education process. A schoolhouse similar to the National Space Studies Institute in Colorado Springs is required where

100-, 200-, and 300-level courses are available for officers as they progress in rank and responsibility. The courses at the National Cyberspace Studies Institute (NCSI) would provide an increased understanding of cyberspace operations appropriate for success at the advanced ranks. Attendance at NCSI, combined with annual professional development requirements, would help to ensure a career force current in the latest technologies.

The Air Force must also ensure adequate pay, attendance at the right schools (PME and Weapons School), and promotion. Pay must be adequate to avoid the Air Force becoming the postgraduate training ground for industry, thus incentive cyber pay may need to become a reality. The incentive pay need not attempt to offset the difference between an officer's pay and that of industry, but as with flight pay, it must be adequate to reward those who choose to serve their nation but at a reduced wage.

In developing a career path for cyberwarriors, the Air Force should look at its success in air and space. Major commands (MAJCOM), like Air Combat Command, Air Mobility Command, and Air Force Space Command, ensure a nurturing career field for air and space professionals and provide a pyramid rank structure where exceptional young officers have the opportunity for command and promotion with no glass ceiling that may limit their abilities. The Air Force must find a home and advocate for future cyberwarriors, one equal to that of air and space. It will take time for cyber colonels and generals to fill command and senior staff positions, just as it did with AFSPC. However, if managed properly, in less than a generation cyberspace will find its officers on par with those of air and space.

Cyberspace also provides an excellent opportunity for Total Force application. Following the precedent established in air and space, the Air Force should incorporate the Guard and Reserve into the cyberspace mission. The first step is to provide billets within the ANG and AFR for cyberwarriors who separate from active duty. This ensures that the Air Force continues to benefit from their investment in developing this new group of professionals while allowing theses cyberwarriors the opportunity to continue serving their nation in uniform. Further, the Air Force must develop a construct to incorporate the Guard and Reserve into the "fight." Either through stand-alone units or as part of a blended force, Guard and Reserve personnel can play a significant role in defending the nation against cyber warfare. Who would not want the civilian program manager

in a Silicon Valley dot.com providing that same expertise to the nation as a part of the uniformed Total Force?

No operator should ever have to ask, "Will my weapon work?" However, cyberspace warfare creates just this possibility. By embedding positional coordinates on a computer chip, a weapon could be rendered useless when employed against a specific latitude and longitude. Quality control becomes paramount in the acquisition and manufacturing processes. Some weapon systems and subsystems are too important to rely on the lowest bidder. The answer is not increased regulation but rather revitalizing and protecting the US industrial base upon which production of critical systems and software depends. The Air Force must encourage—through DoD—software development and the manufacturing of state-of-the-art computer chips and subsystems inside US borders by US industry. While American production does not guarantee "virus-free" components, it does enable better quality control, which inspires greater confidence.

Cyberspace acquisition will also embrace a new collection of contractors. These contractors will include some of the major aerospace and computer industries, but more often will consist of smaller software and hardware firms whose innovative nature will drive technological development. To ensure a viable acquisition strategy, the Air Force should include these contractors in a new *Industry Council* where senior military and industry representatives convene to establish requirements and propose technological solutions. This council should meet on a regular basis; often enough to encourage an open dialogue between the Air Force and the innovative elements within private industry. Gathering senior leaders together from industry and the military ensures the Air Force is better informed on current technological breakthroughs, thus allowing it to shorten the acquisition timeline for fielding state-of-the-art technologies.

The Air Force must also partner more extensively with the private sector —universities and commercial industry—to leverage American expertise. Despite the extent of expertise within the Air Force, the private sector will continue to define the edges of the technological and cyberspace revolution. In addition to innovation, the job of the new core of cyber professionals will be to translate civilian expertise into national defense capabilities. Thus, partnering will be necessary to provide the Air Force with state-of-the-art hardware and software as well as offensive and countercyberspace operations capabilities. Also, the private sector can provide "on-call" capacity not resident in the Air Force. Once again, space operations provide a viable model.

When a satellite fails to function properly, an "anomaly resolution team" convenes. This team—composed of military, DoD civilians, and contractors —makes recommendations on possible solutions. Following this example, a cyber team could bring together similar experts to develop courses of action against an ongoing network attack or to determine effective counter cyber options. This approach makes expertise available when needed and ultimately reduces operating costs in an era of static or declining budgets.

Just as cyberspace brings enormous challenges, it also promises great reward. In this domain, tremendous power can be exerted through the flow of information—packed as electrons. Reach is immediate and global but requires constant vigilance against attack. Everyone understands the inconvenience when e-mail or the Internet goes down; however, we have ways to cope. From making a phone call, to using a fax machine, to going to the library to look up a reference, we find work-arounds to deal with the loss of connectivity. What the Air Force cannot compensate for as readily is the destruction or theft of classified information or hidden code in weapon systems that activate when least expected. Success will require a new core of cyber professionals: men and women who will not only ensure the Air Force maintains its technological lead in defending the nation, but who will also chart the future in this newest frontier. Their success or failure depends on the actions that the Air Force takes as a cyber force provider today. These actions must lay a strong and supportive foundation for the future.

Conclusion

The challenge ahead continues to require us to question preconceived notions of how to best employ military capabilities to serve the national interests. Our strategy attempts to synthesize the best options for securing the nation and our service's future. While many creative, perceptive, professional, and thoughtful people may disagree with our recommendations, all must conclude that senior leaders, in a time of great turmoil, felt strongly enough about their service to invest resources in an introspective analysis. Coach Paul "Bear" Bryant once said, "[H]ave a plan for everything. A plan for practice, a plan for the game. A plan for being ahead, and a plan for being behind 20–0 at half, with your quarterback hurt and the phones dead, with it raining cats and dogs and no rain gear because the equipment man left it at home."[5] While no plan may cover all con-

tingencies, we offer to the nation and our service a study that evaluates our progress, questions our assumptions, and proposes creative alternatives that help us confront the complex challenges of tomorrow's global security environment. **SSQ**

Notes

1. Department of Defense, *Quadrennial Defense Review Report* (Washington, DC: Office of Secretary of Defense, September 2006), 23.

2. Peter B. Teets, Testimony before House Armed Services Committee, Subcommittee on Strategic Forces, 25 February 2004.

3. Forrest McCartney et al., *National Security Space Launch Report* (Santa Monica, CA: RAND, 2006).

4. Gordon England, deputy secretary of defense, memorandum, to secretaries of the military departments, 12 May 2008. (for official use only)

5. Quoted in Brad Winters, *Leadership Quotes by Coach Bear Bryant*, http://www.coachlikeapro .com/coach-paul-bear-bryant.html.