



S T R A T E G Y F O R T H E L O N G H A U L

CSBA

An Air Force Strategy for the Long Haul

BY THOMAS P. EHRHARD

About the Center for Strategic and Budgetary Assessments

The Center for Strategic and Budgetary Assessments (CSBA) is an independent, nonpartisan policy research institute established to promote innovative thinking and debate about national security strategy and investment options. CSBA's goal is to enable policymakers to make informed decisions on matters of strategy, security policy and resource allocation.

CSBA provides timely, impartial and insightful analyses to senior decision makers in the executive and legislative branches, as well as to the media and the broader national security community. CSBA encourages thoughtful participation in the development of national security strategy and policy, and in the allocation of scarce human and capital resources. CSBA's analysis and outreach focus on key questions related to existing and emerging threats to US national security. Meeting these challenges will require transforming the national security establishment, and we are devoted to helping achieve this end.

About the Author

Thomas P. Ehrhard served as Senior Fellow for CSBA from April 2006 to July 2009. He is an expert on aerospace defense issues, East Asia security, future technology, unmanned aerial vehicles, and national security interagency coordination. Prior to his retirement from the Air Force in 2006, Colonel Ehrhard worked in key Air Staff assignments, including one as chief of the Strategy, Concepts, & Doctrine Division and as a division chief on the Air Force's 2001 QDR staff. His recent published works include *Range, Persistence, Stealth, and Networking: The Case for a Carrier-Based Unmanned Combat Air System*, and *The Unmanned Combat Air System Carrier Demonstration Project: A New Dawn for Naval Aviation* (both coauthored with Robert Work). He earned his Ph.D. in international relations at the Johns Hopkins School of Advanced International Studies. Dr. Ehrhard currently serves as Special Assistant to the Chief of Staff of the Air Force.

AN AIR FORCE STRATEGY FOR THE LONG HAUL

STRATEGY FOR THE LONG HAUL

By Thomas P. Ehrhard

2009

ABOUT THE **STRATEGY FOR THE LONG HAUL** SERIES

This report is one in a series comprising CSBA's Strategy for the Long Haul intended to inform and shape the next administration's defense strategy review.

THE CHALLENGES TO US NATIONAL SECURITY. Translates the principal challenges to US security into a representative set of contingencies in order to determine what resources will be required, and how they should be apportioned among forces and capabilities.

US MILITARY POWER AND CONCEPTS OF OPERATION. Provides the connective tissue between the threats to US security and the capabilities and force elements needed to address the new challenges confronting the nation.

THE DEFENSE BUDGET. Overviews the budget environment and explores a range of options to make the Services' plans more affordable.

THE DEFENSE INDUSTRIAL BASE. Addresses the US defense industry's role as a strategic asset, and how it can best serve in that role.

MANPOWER. Examines recruitment and retention of quality people in sufficient numbers at an acceptable cost.

TRAINING, OPERATIONAL ART, AND STRATEGIC COMPETENCE. Assesses the need for an overhaul of training and education of America's service personnel and the importance of strategic thinking in senior leaders.

RESTRUCTURING THE US ALLIANCE PORTFOLIO. Considers the nature and type of alliances the United States needs in order to meet existing and emerging security challenges.

GROUND FORCES. Explores how the US Army and Marine Corps might best be organized, structured, modernized, and postured to meet existing and emerging challenges to US security.

SPECIAL OPERATIONS FORCES. Addresses the expansion and growing role of US Special Operations Forces.

MARITIME FORCES. Addresses how US maritime forces might best be organized, structured, modernized, and postured to meet existing and emerging challenges to US Security.

AIR AND SPACE FORCES. Explores how Air and Space Forces might best be organized, structured, modernized, and postured to meet existing and emerging challenges to US Security.

STRATEGIC FORCES. Examines the circumstances under which nuclear strategy and force posture decisions must be made today.

MODERNIZATION STRATEGIES. Explores potential modernization strategies that can best support the US defense posture in an era of great geopolitical uncertainty and rapid technological change.

ORGANIZING FOR NATIONAL SECURITY. Assesses how the United States Government can best organize itself to ensure effective strategic planning and execution of strategy.

A GRAND STRATEGY FOR THE UNITED STATES. Synthesizes the findings and insights of the study series.



CONTENTS

vii	Preface
xi	Executive Summary
1	Introduction
5	Chapter 1. State of the Air Force
31	Chapter 2. Implications of the Future Security Environment for the Air Force
47	Chapter 3. Assessment and Recommendations
97	Conclusions and Way Ahead
101	Glossary



PREFACE

CHALLENGES TO US NATIONAL SECURITY

The United States faces three primary existing and emerging strategic challenges that are most likely to preoccupy senior decision-makers in the coming years:¹

- > Defeating both the Sunni Salafi-Takfiri and Shia Khomeinist brands of violent Islamist radicalism;
- > Hedging against the rise of a hostile or more openly confrontational China and the potential challenge posed by authoritarian capitalist states; and
- > Preparing for a world in which there are more nuclear-armed regional powers.

Addressing these specific challenges should be at the forefront of the incoming administration's strategic calculations, particularly during the 2009 Quadrennial Defense Review (QDR), which will help shape US defense strategy, planning, and force structure over the next twenty years.

Although none of these strategic challenges, individually, rivals the danger posed by the Soviet Union during the Cold War, they are certainly graver than the types of threats that prevailed immediately after the Cold War, during the period referred to by some as the "unipolar moment," when the power of the United States was at its peak and its dominance had not yet been put to the test. They are also quite different from the threats the United States confronted throughout the twentieth century (Imperial Germany, Nazi Germany, Imperial Japan, and the Soviet Union), all of which possessed militaries that, by and large, were very similar to the US

¹ For an overview of these strategic challenges, see Andrew Krepinevich, Robert Martinage, and Robert Work, *The Challenges to US National Security*, the first monograph of the Center for Strategic and Budgetary Assessments' series that presents a "Strategy for the Long Haul."

military both in terms of their structure and their *modi operandi*. For example, both the German and Soviet armies focused primarily on conducting combined arms mechanized land operations, as did the US Army. That is not the case with respect to today's threats and potential rivals, who instead focus their principal efforts on exploiting asymmetries to gain an advantage.

Radical Islamist movements, for example, use terror and subversion, engage in modern forms of irregular and insurgency warfare, and pursue weapons of mass destruction (WMD) to inflict catastrophic damage on the United States and its allies. China, who, of the three challenges, presents the military forces most similar to the US military, is emphasizing conventionally armed ballistic missiles, information warfare capabilities, anti-satellite weaponry, submarines, high-speed cruise missiles and other capabilities that could threaten the United States' access to the "global commons" of space, cyberspace, the air, the seas and the undersea, and possibly to US ally and partner nations in Japan, South Korea and Taiwan. Hostile and potentially unstable countries like North Korea and Iran have developed or may soon develop nuclear arsenals with which they could intimidate America's allies and challenge the US military's ability to protect vital national interests. Moreover, if these countries succeed in developing nuclear arsenals, they could spur others to follow suit.

THE KEY ROLE OF MILITARY POWER

Military power is central to the United States' ability to meet these strategic challenges successfully, whether in support of diplomatic and other elements of US security policy, or used in actual conflict. It follows, therefore, that the military means must be compatible and commensurate with the nation's security ends.

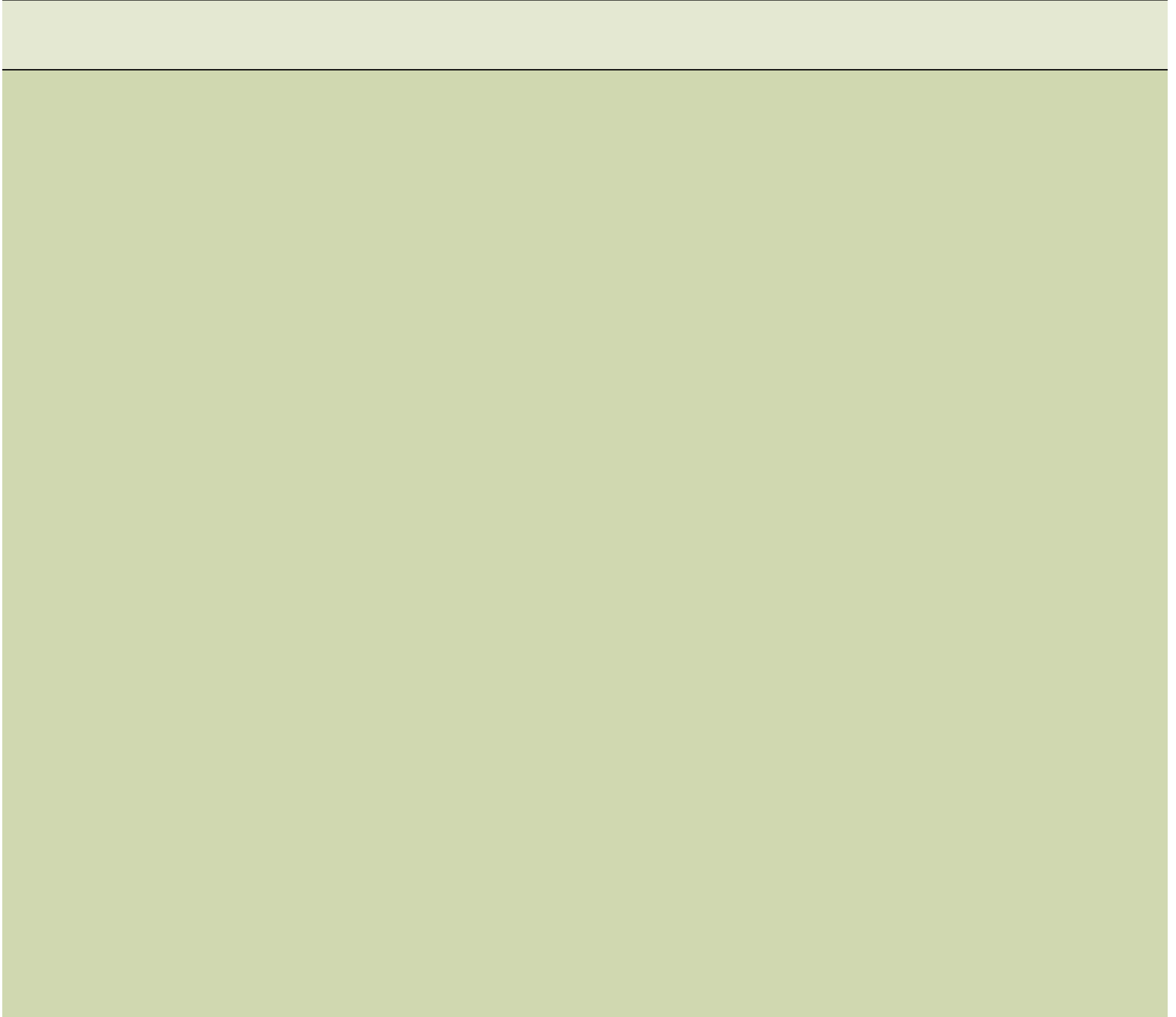
Given the long expected service life of most of its major assets, the US military force structure, which underlies the concepts of operation that drive the US "way of war," is still based primarily on the premises and experience of the Cold War and its immediate aftermath. Arguably, much of the current Program of Record (the forces the Department of Defense seeks to acquire in coming years) remains similarly reflective of that period. Yet the looming strategic challenges look to be significantly different. Thus there is a danger that many of the forces that the Defense Department plans to acquire may prove to be unsuitable for dealing with future threats.

This monograph, and several others in the series comprising the *Strategy for the Long Haul* project, examines the readiness of the four Services, the Special Operations Forces, and the strategic forces to do their parts in meeting the emerging security challenges. Each monograph:

- > Describes the current state of a Service or force;
- > Discusses what that Service or force must be able to do to help meet the emerging strategic challenges successfully; and

- > Assesses problematic areas and issues in the Service's or force's Program of Record and recommends measures to address them.

While these monographs address particular Services or forces, it must be kept in mind that the US military fights as a *joint force*. Accordingly, each Service or force must ensure that the forces it acquires and the operational concepts it employs are interoperable with those of the others, and, equally important, that there is not a major mismatch between the support one Service assumes that it can expect from another, and what is actually the case. These concerns have historically been problematic for the US military, and thus merit particularly close attention.



EXECUTIVE SUMMARY

This monograph discusses the current state of the United States Air Force and how it can better align its institutional identity and force posture to the future security environment. It offers a fiscally-constrained menu of recommendations for how that realignment might be realized over the next twenty years, with a larger force posture in mind. This paper suggests change mechanisms that will foster a break from the incrementalism that has plagued the entire national security establishment since the end of the Cold War. The change of presidential administrations and the Quadrennial Defense Review present an opportunity for Air Force leaders to inject fresh, strategic thinking into their planning to better posture their Service for existing and emerging challenges.

Chapter 1 begins with a review of the command, planning, and decision-making structures of the Air Force, and then highlights key operational constructs, especially the very useful Air and Space Expeditionary Force concept. Force structure is examined, with emphasis on the handicaps of aging assets, diminished foreign basing, and costly excess domestic base structure. Fiscal constraints, including budget pressure and rising costs of fuel and healthcare, are discussed as serious budgetary and operational constraints that are unlikely to diminish. Above all, two daunting challenges are posed: the urgency of recapitalization and modernization despite severe fiscal constraints; and the crisis of institutional confidence that has affected the Service's internal dynamics and influence.

Chapter 2 examines the future security environment and highlights emerging challenges including the rise of China, the protracted conflict against Islamic extremist groups, and the growing risk of nuclear proliferation. China, in particular, poses a pacing challenge to the Air Force. Not only is the China's military aggressively pursuing anti-access/area denial capabilities, it is also taking steps to deny free use of the global commons, encompassing international airspace, international waters, space, and cyberspace. The effects of China's military buildup are not limited to potential combat scenarios. In fact, the impact on US diplomatic leverage might be more

important, as Beijing's buildup weakens two important pillars of Pacific regional security: deterrence and crisis stability. To bolster these pillars, the Air Force urgently needs to improve its strategic reach and force survivability, to include constructing more and harder bases.

The report's most significant finding in measuring current plans against future challenges is that the Air Force is building a "middle-weight" force structure that is much too sophisticated and expensive for relatively low-end or irregular conflicts, while simultaneously lacking needed capabilities and capacities to address challenges at the high-end of the military competition. By way of example, the F-35 Lightning II—by far the Service's most expensive modernization effort—represents a classic "middle" capability that lacks critical performance characteristics (e.g., range) needed to meet high-end challenges, while it is over-specified and overpriced for low-end challenges.

Chapter 3 offers three main prescriptions consistent with the overarching theme of reducing the middle-weight forces and improving Air Force capabilities and capacities at both the low and high ends of the conflict spectrum:

- > Reinvigorating and reestablishing the Service as an influential force in the defense policy debate;
- > Changing the Service's force structure and platform plans; and
- > Adapting the Service's basing plans.

Specifically, the Air Force must overhaul its research and development and acquisition communities to restore the technical expertise and professional excellence lost in the years following the Cold War. A parallel initiative for the Air Force nuclear enterprise would restore the discipline and pride that had been hallmarks of the Strategic Air Command.

Moreover, the Air Force should begin a long-term effort to communicate its ethos and doctrine with other key organizations, to include its sister Services. Advanced education at first-rate institutions of higher learning must become a priority for senior Air Force officers. The Service should also provide more comprehensive officer education on the US national security institutions, starting with their own and the other three Services.

One of the best ways to exert greater influence in joint force management and employment is to develop and advocate compelling ideas. Air Force leaders must begin to develop a set of alternative operational concepts that stake out important perspectives on the entire spectrum of joint military operations, not just ones relating to air and space. Four strong candidate mission areas for conceptual innovation are: high-end, asymmetric warfare; irregular warfare; counter-proliferation; and homeland defense. In each of these areas, the Air Force has an opportunity to take a leading

role in innovation and doctrine. In particular, the service should be the pathfinder for institutionalizing long-term Unmanned Aerial Vehicle (UAV) integration.

Tanker modernization must be sustained. The combined risks of tanker fleet systemic failure, shrinking overseas basing options that mandate greater mission endurance, and the growing need for extremely long-range air operations in irregular warfare and opposed high-end warfare present a compelling case for tanker modernization. Toward that end, Air Force should reformulate its KC-X program to address aerial tanking in the most demanding area of operation, the Pacific theater, under the assumption that most air and sea bases inside 2,000 nautical miles of the Asian mainland will be held at risk.

The Next-Generation Bomber, or B-3, is intended to serve as the backbone of the Air Force's long-range bomber force over the long haul. Along with aerial refueling, stealthy intelligence, surveillance and reconnaissance (ISR), and denied-area communications, the B-3 will constitute a critical and indispensable element of America's long-range penetrating surveillance and strike capability for decades to come. Recently, however, Defense Secretary Robert Gates cancelled the program, evidently to refine B-3 requirements, such as whether it should be unmanned. This report makes the case for full-rate production of twelve aircraft per year from 2018 through 2027, progressing through five block upgrades, the last four being unmanned designs in order to turn it into a truly global surveillance-strike asset.

The Air Force should continue to expand and adapt its airborne intelligence, surveillance, and reconnaissance force to meet the needs of existing threats and emerging challenges. Despite its aggressive fielding of Predator UAVs in recent years, the Service must field a more multi-dimensional ISR force able to surveil a variety of mobile targets ranging from individuals to high-end systems in denied areas. It should start by initiating developmental programs for stealthy follow-on systems to the MQ-9 Reaper and the RQ-4 Global Hawk with the goal of fielding a robust, three-tiered stealthy ISR UAV fleet, the third tier consisting of ISR-optimized Block 50 RB-3s for deep, clandestine penetration into high-threat environments.

As with the Air Force's airborne ISR forces, the US military increasingly depends on Air Force satellite systems. The Service must work to accomplish a minimum of five objectives in the space arena: (1) reverse the atrophy in the US space design and industrial base, and its associated manpower base; (2) address the looming deficit in the joint force's ability to transmit critical information to deployed forces in opposed-network environments via long-haul, high bandwidth protected satellite communications; (3) improve protection for all current and planned space assets, even those in geo-stationary orbit; (4) develop the means to rapidly replenish destroyed or disabled satellites; and (5) tackle the lack of "space reciprocity" in Department of Defense that leads to requirements gold-plating and fractured fiscal incentive structures.

Like the other Services, the Air Force could have been more aggressive in adapting to the demands of long-duration irregular warfare. With the notable exception of the

Predator UAV, it operates with a fleet designed for 1980s major combat operations, accomplishing irregular warfare tasks at an unsustainable cost in fuel and accelerated airframe wear. This report advocates that the Air Force consider expanding its irregular war forces to include armed reconnaissance and short-takeoff, light airlift aircraft.

Given the range of future operational challenges outlined in Chapter 2, emerging threats employing anti-access/area-denial capabilities will likely force an evolution away from massed operations involving short-range, multi-role fighter-bombers. Indeed, at some point over the next two decades, short-range, non-stealthy strike aircraft will likely have lost any meaningful deterrent and operational value as anti-access/area denial systems proliferate. They will also face major limitations in both irregular warfare and operations against nuclear-armed regional adversaries due to the increasing threat to forward air bases and the proliferation of modern air defenses. At the same time, such systems will remain over-designed—and far too expensive to operate—for low-end threats. In short, the so-called “tac-air shortfall” or “fighter gap” is only a problem if one believes that (1) the legacy force fighter-bomber structure replacement is affordable; and (2) its utility will endure in the future security environment. Stealthy air superiority craft—even those with relatively short range, such as the F-22—may retain significant utility over the next twenty years, however, particularly in the near term, given the proliferation of sophisticated Russian air defense systems.

On the other hand, there is a strong case for reducing the total F-35A procurement. The Air Force should consider cutting its planned buy to free up resources for other higher-priority requirements. Reducing the Air Force plan to buy 1,763 F-35As through 2034 by just over half, to 858 F-35As, and increasing the procurement rate to end in 2020 would be a prudent alternative. This would provide 540 combat-coded F-35As on the ramp, or thirty squadrons of F-35s by 2021 in time to allow the Air Force budget to absorb other program ramp-ups like NGB.

Beyond programmatics, much more attention must be given to basing, which has been allowed to atrophy in two ways. First, the Air Force has excess CONUS base capacity for its planned force structure. Another Base Realignment and Closure (BRAC) round in the 2012 timeframe would better enable the Air Force to achieve the recommendations outlined in this report. Second, the emergence of Asia as the new center of geostrategic gravity suggests a draw-down of European bases and an expansion of Asian base *access*. The expanding Chinese long-range strike and ISR capacity will likely place some US forward bases at risk, forcing a pullback from those bases during a crisis. This could overwhelm available capacity at the major US power-projection bases in Alaska, Hawaii, and Guam. Accordingly, just as they did in the Cold War, US strategists must once again rethink the military’s forward-basing posture, incorporating the four most important posture considerations: (1) base dispersal (physically and operationally); (2) base hardening; (3) active defenses; and (4) survivable warning systems.

The proposals contained in this report represent an alternative to the current Air Force program and reflect realistic future budget constraints. Their implementation would result in a 2028 Air Force that is better prepared to address both today's threats and the challenges of the future security environment, and that is much more capable of flying and fighting from long range or against irregular foes. Under current Air Force plans, only 6 percent of its 2028 Air Force air arm will consist of long-range surveillance-strike systems. The plan presented here would see that percentage almost triple, to 17 percent of the strike arm, fielding one hundred additional bombers and eighty additional long-range ISR platforms, most of them of low-observable designs.

This plan provides for a much more stealthy and survivable force across its total range of capabilities. From a force that in 2009 has low-observable or stealthy platforms in only 5 percent of its fighter force, 20 percent of its bomber force, and none of its ISR force, this plan results in a 2028 Air Force with low-observable platforms in 80 percent of its fighter force, over 60 percent of its bomber force, and over 50 percent of its ISR force. Substantial force structure additions in the form of light aircraft and UAVs make this Air Force much more useful and sustainable in protracted, distributed irregular warfare environments.

This plan would also transform the Service's space forces, which are coming under greater threat. The future space force, with better space situation awareness and satellite attack warning, improved passive and active defenses for satellites operating up to geosynchronous orbits, and comprising new operationally responsive tactical replacement satellites, would be much more suited to a future in which opposed space operations seem virtually guaranteed.

In summary, the Air Force needs to undertake a comprehensive, long-term approach to adapting its force posture to meet strategic needs and fiscal realities. By taking bold steps such as those suggested in this report, the Air Force can better align itself with the future security environment, and become a driving force in shaping it as well.



INTRODUCTION

As military scholar Eliot Cohen observed over a decade ago, “The advent of airpower . . . is one of the great revolutions in the conduct of war” which “. . . now permeates all modern military organizations. . . .”¹ Many nations have been characterized as land powers, and others have been notable sea powers; but only one nation — the United States — has managed to adopt airpower in such a comprehensive and dominant fashion.² As evidenced by the force structures of the Army, Navy, and Marine Corps, all of which operate significant air forces, this would still hold even if the United States Air Force had not been created by the National Security Act of 1947.

Even so, the United States Air Force has been the world’s leading proponent and practitioner of the strategic and operational application of aviation in warfare. Starting in World War II and buoyed by a wave of modern technology, the leaders of the fledgling Air Force began to develop a more comprehensive, systemic approach to airpower. While the other three Services developed aviation to provide direct support to their primary missions (for the Army, sustained combat operation on land; for the Navy, sustained combat operations on the sea; and for the Marines, expeditionary operations in support of naval campaigns) it was the Air Force that sought to develop and employ a more integrated approach to air warfare.

At the time of its genesis in 1947, that meant providing reconnaissance, establishing persistent, sustainable air superiority, conducting a wide range of bombing missions, and operating vast tactical and strategic airlift and aerial tanker fleets. But with advances in aerospace technology, the concept expanded into other dimensions as well. In the late 1950s, intercontinental ballistic missiles were incorporated into the US strategic nuclear arsenal, and soon thereafter the launching of man-made

¹ Eliot A. Cohen, “The Meaning and Future of Air Power,” *Orbis* 39, no. 2 (Spring 1995), p. 189.

² The term “airpower” is used in its proper generic sense, meaning the strategic and operational implications of employing “platforms capable of sustained, maneuvering, powered flight.” It is not synonymous with the Air Force, as some would have it.

satellites heralded the age of air and space power. America's strategic competition with the Soviet Union provided the impetus for the exploitation of space, but the information age eventually turned space into a center of global military and commercial activity. Indeed, by the First Gulf War in 1991, the US joint force had come to rely heavily on both military and commercial space for communications, timing, navigation, and targeting information. As a result, access to and control of the orbital space "commons" emerged as a national security imperative, and the Air Force adopted an additional commission as a steward of the nation's space power.

By the time Senator Sam Nunn asked in the early 1990s why America needed four air forces,³ airpower had become so indispensable to US military operations and foreign policy that no single Service could possibly provide the full dimensionality of airpower's contribution to the American Way of War. Airpower had become too important for "just enough" to be a prudent policy. Together the four Services brandished a daunting airpower arsenal that adversaries could not match, and that America's allies counted on for protection.

However, changes in the strategic environment since the 1990s now seem to challenge the unique advantage provided by air and space power, and especially the role played by the US Air Force in its application. Nevertheless, the first underlying premise of this paper is that air and space power will continue to increase in importance to US national security over the coming decades, and that the United States Air Force will continue to play a central role in any "strategy for the long haul." The second premise is that current plans for the future of the Air Force could and should be improved, yielding a stronger force better matched to evolving threats and fiscal constraints.

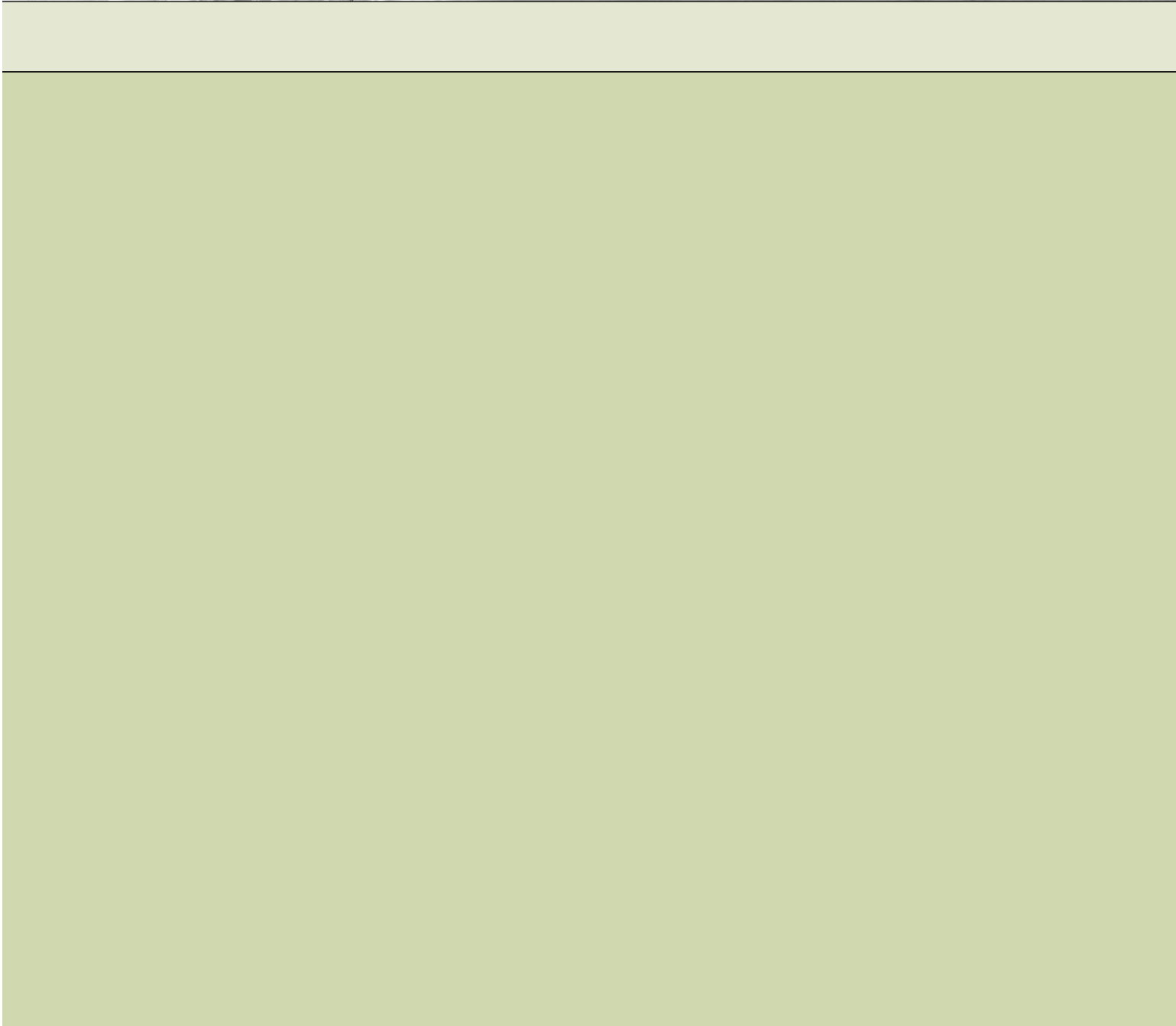
Accordingly, this paper discusses the current state of the United States Air Force and how it can better match its institutional identity and force posture to the future security environment. It then offers a specific menu of recommendations for how that realignment might be realized over the next twenty years. The change of presidential administrations and the Quadrennial Defense Review present an opportunity for Air Force leaders to inject fresh, strategic thinking into their planning so as to better posture their Service for the challenges that lie ahead. This paper suggests change mechanisms that will encourage a break from the incrementalism that has plagued the Air Force, if not the entire national security establishment, since the end of the Cold War.

This paper is divided into three chapters. Chapter 1 discusses the current state of the Air Force with regard to its principal roles and missions, organizational structure,

³ On the floor of the Senate in July 1992, Senator Sam Nunn (D-GA) said, "We're the only military in the world with four air forces...this redundancy and duplication is costing us billions every year." President William Clinton agreed, saying, "I agree with Senator Nunn that it is time to take a fresh look at the basic organization of our armed forces." For a good discussion of the issues surrounding these sentiments, see Michael R. Gordon, "Report By Powell Challenges Calls to Revise Military," *New York Times*, December 31, 1992, accessed on 28 March 2009 at <http://www.nytimes.com/1992/12/31/us/report-by-powell-challenges-calls-to-revise-military.html?n=Top/Reference/Times%20Topics/People/N/Nunn,%20Sam&pagewanted=1>.

manning, force structure, basing posture, budget status, recapitalization and modernization plans, and institutional identity. Chapter 2 summarizes the Air Force's twenty-year strategic direction as Air Force leaders conceive it today, and the fitness of that plan relative to the three strategic challenges that serve as the focal point of CSBA's "Strategy for the Long Haul." The final chapter presents a number of ways to better align the Air Force to these challenges. The goal is to stimulate a vigorous and thoughtful debate that results in an Air Force and a joint force better able to shape and respond to the emerging security environment over the next twenty years.

Ultimately, this paper is an argument for enhancing the current Air Force strategic plan. It aims to set a course that will help the Air Force repair the effects of several decades of Department of Defense-wide incrementalism, and reinvigorate its traditional commitment to crafting innovative approaches to existing and emerging challenges to national security.



CHAPTER 1 > STATE OF THE AIR FORCE

This chapter presents an overview of the Air Force as a Service—its characteristics, functions, organizations, and approach to making decisions. It serves as the point of departure for a new twenty-year strategic plan that unfolds over the next two chapters, and begins with the Air Force’s foundation in US law.

PRINCIPAL ROLES AND MISSIONS

By virtue of US Code, Title 10, the Air Force “. . . shall be organized, trained, and equipped primarily for prompt and sustained offensive and defensive air operations.”⁴ The literal meaning of these words, which have not changed since the Air Force was formed by the National Security Act of 1947, contains only the rough outline of Air Force roles and missions as they have evolved over six decades. Department of Defense Directive (DODD) 5100.1, *Functions of the Department of Defense and its Major Components*, also directs the Air Force to “conduct . . . prompt and sustained offensive and defensive combat operations in the air and space”; to “gain and maintain general air and space supremacy”; and to “provide forces for strategic air and missile warfare,” among numerous other functions.⁵

Two words in Title 10 and DODD 5100.1 merit further elaboration. The reference to “prompt” air operations provides the mandate for the historically high levels of readiness that each Air Force unit strives to maintain. Additionally, “sustained” air operations suggests that the Air Force should be structured, manned, and outfitted to conduct persistent, high-tempo air (and space) operations. As such, the Air Force

⁴ United States Code, 1994 edition, volume 4, (Washington DC: US Government Printing Office, 1995) Title 10, Subtitle D, Chapter 807, Section 8062(c): 367.

⁵ DODD 5100.1, *Functions of the Department of Defense and its Major Components*, 1 August 2002, Section 6.6.3., accessed at <http://www.defenselink.mil/odam/omp/pubs/GuideBook/Pdf/510001.pdf> on 9 November 2008.

traditionally resists the budgetary relief allowed by “tiered” readiness whereby some of its units would accept non-mission capable status as the price for combat-ready levels achieved by others.⁶ The Air Force’s high level of mission readiness and endurance across the force is not only suggested by law, it is embedded in Air Force culture.

Operational Functions

Beyond statutory and directed missions, Air Force doctrine delineates seventeen operational functions that define the “operational constructs Airmen use to apply air and space power to achieve objectives.”⁷ This list does a better job of capturing the multitude of missions the Air Force prepares itself to execute using air and space forces. They are:

1. Nuclear Deterrence Operations
2. Air Superiority
3. Space Superiority
4. Cyberspace Superiority
5. Command and Control
6. Global Integrated Intelligence, Surveillance, and Reconnaissance
7. Global Precision Attack
8. Special Operations
9. Rapid Global Mobility
10. Personnel Recovery
11. Agile Combat Support
12. Building Partnerships

These are the most recent changes (2009) to what Air Force Basic Doctrine defines as the “broad, fundamental, and continuing activities of air and space power.”⁸ The

The Air Force’s high level of mission readiness and endurance across the force is not only suggested by law, it is embedded in Air Force culture.

⁶ The only exception to this has been the Air Expeditionary Force (AEF) concept, adopted in 1999 in response to the personnel tempo and retention stress levied by a series of major conflicts from Deliberate Force to Allied Force, interjected some readiness level differentiation depending on a unit’s position in the AEF rotation.

⁷ AFDD-1, *Air Force Basic Doctrine*, page 39. Accessed at <http://www.e-publishing.af.mil/shared/media/epubs/AFDD1.pdf> on 9 October 2008.

⁸ AFDD-1, page 39.

listed functions may not necessarily be unique to the Air Force, but they encapsulate what the Air Force must prepare and posture itself for over the twenty-year span of this study.

ORGANIZATIONAL STRUCTURE

The Air Force can also be defined by the people it promotes into leadership positions, and the structures these leaders create to best accomplish assigned and implied missions. This section serves as a guide to understanding the organizational and decision-making behavior that shaped the Air Force.

Leadership

The Air Force has what can be called a “monarchic” or centralized organizational structure, as it has been led largely by one of two subgroups throughout its history.⁹ During much of the Cold War, the Air Force was headed by bomber pilots from the Strategic Air Command, typified by General Curtis LeMay. Then, with the appointment of General Charles Gabriel to the position of chief of staff in 1982, the Air Force’s top leadership torch had been passed to the fighter generals.¹⁰ With the single exception of the most recent chief of staff, General Norton Schwartz, who has a special operations airlift background, every chief of staff since General Charles Gabriel was a fighter pilot in his formative years.

Renowned bureaucracy scholar James Q. Wilson has suggested that this sort of centralized structure affects the Air Force’s worldview and the way it approaches change. Wilson observed that any idea embraced and sponsored by the dominant subgroup dictates the types, probabilities, speed, and depth of change in which it is likely to engage.¹¹ Today’s fighter community, heavily influenced by its formative experience in the Tactical Air Command during the latter decades of the Cold War, has exerted decisive influence on the Air Force’s current condition. Indeed, there is reason to believe that General Schwartz’s nomination stemmed from the secretary of defense’s desire to shake up the traditional hierarchy by ending the string of fighter pilot chiefs of staff.

There is reason to believe that General Schwartz’s nomination stemmed from the secretary of defense’s desire to shake up the traditional hierarchy by ending the string of fighter pilot chiefs of staff.

⁹ The Marine Corps centralizes around the infantry subgroup; thus the Commandant always comes from the infantry. The Navy and Army, by contrast, have more decentralized organizational structures with powerful “barons” (e.g., surface warfare or armor) who rotate through the top position.

¹⁰ Mike Warden (now a fighter general) captured this transition in his book, *The Rise of the Fighter Generals: The Problem of Air Force Leadership* (Maxwell Air Force Base, AL: Air University Press, 1998).

¹¹ Wilson also suggested that centralized bureaucracies require external sources to stimulate innovative ideas, since they lack the same caliber of internal competition as more decentralized organizations. James Q. Wilson, “Innovation in Organization: Notes Toward a Theory,” *Approaches to Organizational Design*, ed. James D. Thompson (Pittsburgh, PA: University of Pittsburgh Press, 1966) 195–216.

Command Structure

The Air Force command structure has at its apex the Pentagon-based Headquarters Air Force (HAF, colloquially called the Air Staff), headed by the Secretary of the Air Force, the Air Force Chief of Staff, and their respective staffs. Together they direct the Title 10 “man, organize, train and equip” roles of the Air Force, and prepare the Service’s budget submission to the secretary of defense and Congress.

They also manage seven operational and two support commands, each headed by a three or four-star general. Four-star generals lead five of the seven operational commands, including Air Mobility Command (AMC), Air Combat Command (ACC), Air Force Space Command (AFSPC), and the two most important regional commands, Pacific Air Forces (PACAF) and US Air Forces in Europe (USAFE). Four-star generals also lead two key support commands: the Air Force Materiel Command (AFMC) and the Air Education and Training Command (AETC). Three-star (lieutenant) generals lead the two remaining operational commands: Air Force Special Operations Command (AFSOC) and Air Force Reserve Command (AFRC).¹² Additionally, Air Force leaders recently announced its plan to stand up Global Strike Command by September 2009 in response to the nuclear missteps that led to the firing of its civilian and military leaders.¹³ Global Strike Command will include the Air Force’s intercontinental ballistic missile (ICBM) and nuclear bomber units.¹⁴ Each command exerts authority over subordinate “numbered air forces” that have either functional or regional concentrations, with some numbered air forces serving as Air Force components to the very powerful regional combatant commands (COCOMs).¹⁵

Strategic Decision-Making Structure

The 2008 Air Force Strategic Plan provides the overarching strategic guidance and process for informing decisions made by the Secretary of the Air Force and chief of staff.¹⁶ The Air Force Process Council, chaired by the Secretary of the Air Force and the chief of staff, oversees the implementation of the Strategic Plan and reviews the quarterly reports from various “Priority Champions” consisting of senior appointed officials who focus on the institutional priorities established in the Strategic Plan. In the current plan, the Air Force’s five stated priorities are:

¹² The Air Force also contains several “direct reporting units” such as the Air Force Academy, and over twenty field operating agencies, such as the Air Force Audit Agency, that do not belong to any major command.

¹³ For an overview of the incidents and their aftermath, see http://en.wikipedia.org/wiki/2007_United_States_Air_Force_nuclear_weapons_incident, accessed on August 5, 2008.

¹⁴ Michael Hoffman, “USAF Unveils Global Strike Command,” *Defense News*, 24 October 2008, accessed at <http://www.defensenews.com/story.php?i=3787270> on 3 October 2008.

¹⁵ The Air Force suspended its plan to stand up an Air Force Cyber Command and plans instead to make it a “numbered” air force.

¹⁶ Michael B. Donley and Norton A. Schwartz, “2008 Air Force Strategic Plan,” October 2008.

1. Reinvigorate the Air Force Nuclear Enterprise
2. Partner with the Joint and Coalition Team to Win Today's Fight
3. Develop and Care for Airmen and Their Families
4. Modernize Our Air and Space Inventories, Organizations, and Training
5. Acquisition Excellence

The Air Force Council, chaired by the chief management officer of the Air Force (the undersecretary of the Air Force) and the vice chief of staff, has resource responsibility for ensuring the accomplishment of the five Strategic Plan priorities. In other words, the Air Force Council recommends to the secretary and chief of staff how they might create fiscal balance between the five priorities. The 2008 Air Force Strategic Plan added a chief management officer (CMO), who acts as the executive secretary of the Air Force Process Council and the enterprise process champion, a role in which he or she recommends alignment and improvements to the overall implementation of the Strategic Plan.

In this process, the various councils and champions concern themselves with two different force structure plans. The first is the fiscally-constrained Air Force Program of Record or "Programmed Force" that falls within the current fiscal year defense plan (FYDP). The second, called the "Programmed Force Extended," moves that force out twenty years, coinciding with the time horizon of the congressionally-mandated Quadrennial Defense Review. The Programmed Force Extended considers how the force might look given a relatively incremental strategic and fiscal environment — that is, no major perturbations in the issues facing the Service. Yet another Air Force planning construct, the "Planning Force," is a low- to medium-risk force projection that attempts to take a "resource-informed" perspective allowing more speculation about force levels in the out-years.

Air and Space Expeditionary Forces (AEFs)

The Air Force divides its deployable force into ten AEFs. AEFs present rotational packages of air and space power to the joint force commander. The Air Force has used this rotational construct to deploy units since its inception in 1999. According to historian Richard Davis,

With the EAF Concept and AEF Structure, the USAF attempted to remedy two serious concerns. The first revolved around impaired readiness — the overtaxing of materiel and units in current operations — which deprived the units of resources and training time needed to maintain their capabilities at the required levels. The second involved inad-

equate recruitment and retention—a failure to attract sufficient new recruits and an inability to retain current personnel.¹⁷

The AEF structure catalyzed a cultural shift to a force-wide expeditionary mentality while providing a welcome improvement in deployment predictability for Air Force personnel that resolved retention issues.¹⁸

The ten AEFs are divided into five deployable AEF pairs, enabling them to respond to two different contingencies simultaneously, whether they are different steady-state deployments, or two major contingency operations. The AEF acts as a virtual combat wing bringing together geographically dispersed units into an “AEF bucket” that can conform to one or more joint force commander requests. Most Air Force deployable units are assigned to one of the ten AEFs. Each AEF contains similar capabilities, with each AEF pair nominally consisting of about 180 fighter and bomber aircraft, 60 mobility aircraft (intra-theater airlift and aerial refueling), and 26 reconnaissance and support platforms such as the E-3 Airborne Warning and Control System (AWACS), RC-135 Rivet Joint signals intelligence (SIGINT) aircraft, U-2 reconnaissance aircraft, Predator unmanned aerial systems (UAS), and combat search-and-rescue (CSAR) helicopters. Each AEF employs over 25,000 Airmen.

The AEF construct and force lists do not capture the Air Force’s total deployable combat power, however. Inter-theater mobility platforms, such as the C-17 Globemaster or KC-135 Stratotanker aerial refueler, are not in the AEF structure. Inter-theater airlift forces, which at any given time have half their force deployed delivering the sick and wounded to hospitals, delivering cargo to the front lines and distribution hubs, dropping rapid-reaction airborne troop formations, and performing other critical logistical functions that keep the US military at peak readiness, constitute the largest special air carrier in the world. Nor do the AEFs include command and control or intelligence personnel, who deploy regularly, or the chaplains and medical personnel who contribute immeasurably to force persistence and sustainment. All these people and their equipment fall under the Air Force umbrella, but not all belong to AEFs.

Non-Deployable Forces

Many Air Force elements do not deploy but are still vital to executing the Air Force mission. Nuclear intercontinental ballistic missiles (ICBMs) remain on alert as they did during the Cold War, and a portion of the bomber force remains ready to generate for nuclear alert should the National Command Authority order it. Both help underwrite the US strategic deterrence posture. As discussed earlier, the Air Force operates a

¹⁷ Richard G. Davis, *Anatomy of a Reform: The Expeditionary Aerospace Force* (Washington, DC: Air Force History and Museums Program, 2003), page 11.

¹⁸ Adam J. Hebert, “Eighty-six Combat Wings,” *Air Force Magazine*, Vol. 89, no. 12, December 2006, accessed at <http://www.afa.org/magazine/dec2006/1206wings.pdf> on 30 September 2008.

huge satellite constellation ranging from the Global Positioning System (GPS) to various critical sensors and communications platforms. Although the satellites are constantly “deployed,” the men and women who operate them remain largely on US territory. Finally, a vast array of Air Force support agencies such as laboratories, training and testing agencies, educational institutions, depots, intelligence functions and headquarters staffs comprise the non-deployable foundation from which the Air Force operates every day. In concert with rotational deployment forces in the AEF structure, these elements make up today’s US Air Force.

FORCE MANNING, FORCE STRUCTURE AND BASING POSTURE

This section provides a concise overview of the relevant aspects of the Air Force’s manning, force structure (equipment and units), and global basing posture. It provides a summary assessment of their condition as a baseline for the strategic analysis in the next chapter.

Manning

The Air Force operates today at a historic nadir in terms of manpower. The previously authorized personnel level of just over 316,000 Airmen was the lowest since 1947, the year an independent Air Force was created.¹⁹ With the recent push for greater manning across the Services, the current plan calls for an increase to over 332,000 Airmen in 2010.²⁰

Active-Duty Force

Officers make up about 24 percent of the active-duty Air Force ranks. Contrary to popular belief, the Air Force officer corps does not consist mainly of pilots: they make up less than 20 percent of the officer ranks and only 4 percent of the overall active-duty Air Force. Fighter pilots comprise only 25 percent of the Air Force pilot force, making them only about 1 percent of the active-duty Air Force. The rest of the officer corps consists of navigators (about 5 percent and declining, due to advances in modern navigation technology), space and missile operators, and those serving in intelligence, aircraft maintenance, communications and computer fields, the medical corps, and a wide variety of other specialized roles.

Contrary to popular belief, the Air Force officer corps does not consist mainly of pilots: they make up less than 20 percent of the officer ranks and only 4 percent of the overall active-duty Air Force.

¹⁹ National Defense Budget Estimate, FY 2009, p. 32. The actual Air Force manning level declined to about 325,000 before the 316,000 mandate was overturned.

²⁰ Erik Holmes, “Increase in airmen requires more instructors,” *Air Force Times*, January 9, 2009, accessed at http://www.airforcetimes.com/news/2009/01/airforce_plusup_010809/ on April 13, 2009.

The Air Force enlisted corps stands out in contrast to the other Services'. Whereas the other Services can be said to be recruiting-centric, the Air Force invests more in retention.

The Air Force enlisted corps stands out in contrast to the other Services'. Whereas the other Services can be said to be recruiting-centric, enlisting a large number of recruits who serve only a few years, the Air Force invests more in retention, targeting recruits who generally score higher on the Armed Services Vocational Aptitude Battery (ASVAB), and who typically establish a longer military career than their counterparts.²¹ On average, about 80 percent of Air Force new accessions in the last decade were considered "high quality" compared to the cross-Service average of 60 percent.²² Some 60 percent of Airmen re-enlist after the first term, and of those, over 90 percent make a career enlistment decision after their second term, leading to a high average enlisted age of twenty-nine (US military average: twenty-seven), with an average time in service of nine years (military average: seven years).²³ About 20 percent of the Air Force's enlisted cadre works in the aircraft maintenance field, the largest enlisted specialty. About 60 percent of Air Force enlisted are married (compared to 52 percent DoD-wide), and over 70 percent pursue college credits, contrasted with 10 percent or less of the enlisted ranks in other Services having some college experience.²⁴ Alcohol and drug abuse are also significantly lower in the Air Force.²⁵

Enlisted retention is the lifeblood of the Air Force. In order to retain the caliber of enlisted personnel required to support a force employing leading-edge air and space technology, the Air Force invests heavily in facilities and human services designed to attract and retain highly educated technical professionals. Air Force leaders tend to emphasize quality-of-life investments (such as medical and dental services) for Air

²¹ Secretary of the Air Force Michael W. Wynne and Chief of Staff of the Air Force General T. Michael Moseley, "Air Force Posture Statement 2008," Presentation to the House Armed Services Committee, 27 February 2009; page 21–22.

²² "High Quality" means the recruit scores in AFQT Categories I-III A (50th percentile and above) and is a high school graduate. "Population Representation in the Military Services, FY2006" Office of the Undersecretary of Defense, Personnel and Readiness, Appendix D, Table D-9, http://www.defenselink.mil/prhome/PopRep_FY06/appendixd/d_09.htm, accessed 2 September 2008.

²³ "Air Force Demographics," Air Force Personnel Center, Randolph Air Force Base, Texas. <http://www.afpc.randolph.af.mil/library/airforcepersonnelstatistics.asp>, accessed 12 September 2008. The Air Force has the highest percentage of its enlisted force over the age of 30 in the Department, and the highest percentage of women in its enlisted ranks. "Population Representation FY2006" Appendix B, Table B-22, http://www.defenselink.mil/prhome/PopRep_FY06/appendixb/b_22.htm, and Appendix D, Table D-5, http://www.defenselink.mil/prhome/PopRep_FY06/appendixd/d_05.htm, Appendix D, Table D-12, http://www.defenselink.mil/prhome/PopRep_FY06/appendixd/d_12.htm, accessed 2 September 2008.

²⁴ "Population Representation FY2006" Appendix B, Table B-23, http://www.defenselink.mil/prhome/PopRep_FY06/appendixb/b_23.htm, and "Population Representation in the Military Services," Chapter 3, http://www.defenselink.mil/prhome/poprep2001/chapter3/chapter3_5.htm, accessed 2 September 2008; "The Air Force in Facts and Figures," *Air Force Magazine*, 2008 USAF Almanac (May 2008), pp. 48–51.

²⁵ Air Force alcohol consumption, illicit drug usage, and incidences of hospitalization for unintentional injuries were about half the DoD average, with percentage of smokers at about 2/3 the DoD average. "2005 Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel," Assistant Secretary of Defense (Health Affairs), Office of the Secretary of Defense: December 2006, Tables 4.1, 5.2, 6.1, and Figure 8.1. Accessed on 23 September 2008 at http://www.ha.osd.mil/special_reports/2005_Health_Behaviors_Survey_1-07.pdf.

Force members and their families, which are reflected in the quality and upkeep of facilities at Air Force installations. The USAF 2008 Posture Statement reinforced that point, stating, “Because the nature of our Air Force mission demands a highly educated, trained, and experienced force, we recognize the direct linkages between quality of life issues and their impact on our recruiting, retention, and ultimately, our mission capability.”²⁶ The chairman of the Joint Chiefs of Staff, Admiral Mike Mullen recently testified, “as I benchmark Service support for families, the Air Force does it best.”²⁷ However, “doing it best” has resulted in personnel costs that increased over 50 percent in the last decade, according to one senior Air Force official, primarily due to soaring medical costs.²⁸ Because of its emphasis on retention, the Air Force pays a marginally higher premium for manpower, even as manpower costs soar across the board.

Air Reserve Component (ARC)

The Air Force Reserve Command (AFRC) and Air National Guard (ANG) make up the Air Reserve Component, and their manning also reflects the high quality and professionalism of Air Force personnel. The AFRC counts approximately 72,000 Airmen in its ranks and operates more than thirty flying wings and hundreds of various mission support units, with most of its units performing airlift missions. The ANG accounts for about 107,000 Air Force personnel who are assigned to their respective state governors during peacetime, with a wide variety of flying units including fighter, reconnaissance, and aerial refueling missions. Notably, the ANG is the primary agency responsible for carrying out continental air defense, a role that has taken on great significance since 9/11. Armed ANG fighter aircraft sit on strip alert at eighteen strategically located US bases under the operational control of the North American Aerospace Defense Command, and ANG fighters have conducted missions under Operation Noble Eagle since 9/11, ensuring the security and safety of American airways.²⁹

Air Reserve Component units not only provide a major percentage of the tactical airlift, aerial refueling, and fighter forces, many are also integrated with active-duty

The ANG is the primary agency responsible for carrying out continental air defense, a role that has taken on great significance since 9/11.

²⁶ Secretary of the Air Force Michael W. Wynne and Chief of Staff of the Air Force General T. Michael Moseley, “Air Force Posture Statement 2008,” Presentation to the House Armed Services Committee, 27 February 2009: page 19.

²⁷ Scott Knuteson, “Joint Chiefs chair highlights keys to defense,” speech at Air University accessed at <http://www.aetc.af.mil/news/story.asp?id=123121861> on 31 October 2008.

²⁸ Major General Frank Faykes, quoted in Stew Magnuson, “Aging Aircraft, War Costs Weigh Heavily in Future Budgets,” *National Defense*, January 2007, accessed at <http://www.nationaldefensemagazine.org/archive/2007/January/Pages/AgingAircraft2755.aspx> on 9 November 2008.

²⁹ By mid-2007, the Air Force has conducted over 44,000 Noble Eagle sorties and over 2,000 quick-response sorties scrambled from strip alert in response to threatening activities, at an estimated cost of \$27 billion. Otto Kreisher, “The Years of Noble Eagle,” *Air Force Magazine*, June 2007, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2007/June%202007/0607eagle.aspx> on 9 November 2008.

The level of professionalism, training, and readiness in the Air Reserve Component makes it nearly operationally indistinguishable from the active force, something no other Service can claim.

units. For example, the Air National Guard participates fully in one of the Air Force's elite units, the F-22 Raptors of the 1st Tactical Fighter Wing at Langley Air Force Base (AFB). Reservists are full participants in remote Predator operations at Creech AFB, Nevada, that have proven so successful in Iraq and Afghanistan.³⁰

The Air Reserve Component makes up an increasingly important aspect of US military power. The Guard and Reserve account for approximately 9 percent of the Air Force budget, and some 20 percent of the yearly operations and maintenance expenditure. Together, they account for about 50 percent of all Air Force flying missions, including 46 percent of all strategic airlift flights, with the Air Guard operating 41 percent of critical aerial refueling assets (AFRC accounting for another 16 percent) and over 30 percent of fighter and airlift force structure.³¹ Guard and Reserve units have, in the words of the Commission on the National Guard and Reserves in their January 2008 report, experienced an "unplanned evolution to an operational reserve."³² However unplanned that transition might have been, the level of operational skill exhibited by Guard and Reserve units consistently rates on par with and at times exceeds that of their active-duty counterparts. They also serve as a critical retention reservoir that keeps some of the Air Force's most experienced people from leaving the Service entirely, while they also form a very important link between the Air Force and the civilian community. The level of professionalism, training, and readiness in the Air Reserve Component makes it nearly operationally indistinguishable from the active force, something no other Service can claim.

Civilians

Civilians occupy almost 169,000 Air Force positions and comprise some 20 percent of the Total Force (a term encompassing personnel associated with the active duty Air Force, Air National Guard and Reserve).³³ Like officers and enlisted personnel, they occupy jobs that span a wide range of specialties from senior decision-makers to aircraft mechanics. With the shrinkage in overall Total Force manning and the move toward civilianizing formerly uniformed jobs, civilians (government employees and contractors) have picked up a much bigger load of Air Force work. Starting in

³⁰ Donna Miles, "Air Force Introduces Future Total Force Concept," American Forces Press Service, 2 December 2004, accessed at <http://www.defenselink.mil/news/newsarticle.aspx?id=24693> on 27 September 2008.

³¹ Mackenzie Eaglen and Samuel C. Mahaney, "US Air Force Guard and Reserves are Force Multipliers that Deserve Support," The Heritage Foundation WebMemo #142, accessed at <http://www.heritage.org/Research/nationalSecurity/wm1942.cfm> accessed on 27 September 2008.

³² "Transforming the National Guard and Reserves into a 21st Century Operational Force," Final Report to Congress, Commission on the National Guard and Reserves, Executive Summary, page 9, accessed at http://www.cngr.gov/Final%20Report/CNGR_ExecutiveSummary.pdf on 21 August 2008.

³³ "Air Force in Facts and Figures," *Air Force Magazine*, May 2008, page 48, accessed at

2006, the Air Force significantly upgraded its civilian management system to make it more like the active-duty system with regard to career management, training, and education.³⁴

FORCE STRUCTURE

This section provides a basic overview of the Service's major conventional air, space, and nuclear forces. It also explains how these forces are rapidly aging and must be recapitalized in the near future if the United States is to sustain its current advantage in airpower.

Conventional Air Forces

One way to characterize the Air Force is to divide it into functional areas. The active-duty Air Force operates about forty squadrons of fighters of all types, thirty space squadrons, twenty-nine inter-theater (long-range) and intra-theater (short-range) air-lift squadrons, nineteen Special Operations Forces squadrons, eighteen air refueling squadrons, ten ICBM squadrons, nine reconnaissance units, nine bomber squadrons, and a variety of others, totaling 182 Air Force squadrons. The Reserve Component adds another 192 squadrons, most of which conduct flying missions. The Air Force flies almost 5,600 aircraft of various kinds, the majority being fighter aircraft.³⁵ As hinted at earlier, the rapidly increasing age of this force, along with the slow pace and high cost of new aircraft, are matters of serious concern for senior Air Force leaders.

One way to measure the Air Force's current operational capability is to compare long-range to short-range assets, and low-observable (stealthy) to non-stealthy platforms. Today, the Air Force fields approximately 1,475 combat-coded (operational) fighters and bombers, with only 6 percent of them long-range bombers; many of these are dedicated to nuclear delivery and are thus unavailable for conventional bombing missions. Furthermore, with the retirement of the F-117, less than 6 percent of today's Air Force platforms — only the B-2 and F-22 — have low-observable designs able to hold at risk areas protected by modern integrated air defenses. Only 1 percent of the attack forces (the B-2s) are able to penetrate heavily defended, deep inland targets. Those figures do not include the retirement in 2007 of the stealthy, long-range

³⁴ Erik Holmes, "Air Force launches leadership program for its junior civilians," *Air Force Times*, 17 September 2008, accessed at <http://www.federaltimes.com/index.php?S=3729252> on 25 September 2008. See also, George Cahlink, "Sharp Focus on Air Force Civilians," *Air Force Magazine*, February 2006, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2006/February%202006/0206civilian.aspx> on 25 September 2008.

³⁵ "Air Force in Facts and Figures," page 64.

Air Force space forces represent a major and growing Air Force investment area, but one fraught with controversy.

Advanced Cruise Missile (ACM), leaving a dwindling number of penetrating assets in the Air Force arsenal.³⁶

Space Forces

Air Force space forces represent a major and growing Air Force investment area, but one fraught with controversy. Satellite programs were the third acquisition priority in the latest USAF Posture Statement, and constitute a key capability in the nation's power projection arsenal.³⁷ Open literature describes the current space fleet as being comprised of two Defense Meteorological Support Program (DMSP) satellites, nine Defense Satellite Communication System (DSCS) satellites, an unspecified number of missile launch-detecting Defense Support Program (DSP) spacecraft, five "protected communication" Milstar satellites, and thirty Global Positioning System (GPS) satellites.³⁸ As the former head of the National Security Space Office (NSSO), retired Air Force Major General James Armor, recently stated, "The Air Force has also created a global space infrastructure — launch systems; range; satellite command, control, and tracking; technical schools and graduate education; and a cadre of trained space professionals — that is second to none."³⁹

Nuclear Forces

The Air Force keeps 450 Minuteman III intercontinental ballistic missiles (ICBMs) on alert at bases in Montana, Wyoming, and North Dakota. Each Minuteman ICBM can be promptly launched within minutes of receiving a properly coded message from the President of the United States, and deliver independently-targetable thermonuclear warheads against targets at global distances in approximately thirty minutes. The second leg of the nuclear mission triad, the bomber force, operates in support of US Strategic Command nuclear plans, with designated B-52s and B-2s assuming a nuclear weapon delivery role from bomber bases in Louisiana, Missouri, and North Dakota. A fleet of dedicated aerial refueling tankers stands by to support these bombers in their intercontinental mission.

The most significant development in the Air Force nuclear establishment, however, involved the aforementioned series of errors that ultimately led to the firing of the Air Force Secretary, Michael Wynne, and chief of staff, General T. Michael Moseley, in late 2008. The first incident occurred in August 2007 at Minot AFB, North Dakota,

³⁶ "Air Force Scraps Stealth Missile Fleet," Associated Press report, March 8, 2007, accessed at <http://www.military.com/NewsContent/0,13319,127821,00.html> on 3 August 2008.

³⁷ Satellite systems rank third behind the new tanker and the combat search and rescue (CSAR) helicopter, both of which are currently under protest. "2008 Air Force Posture Statement," page 4.

³⁸ "2008 Air Force Facts and Figures," page 62.

³⁹ James B. Armor, Jr., "The Air Force's other blind spot," *The Space Review*, 15 September 2008, accessed at <http://www.thespacereview.com/article/1213/1> on 15 September 2008.

when munitions personnel mistakenly loaded a nuclear cruise missile on a B-52 that flew to Barksdale AFB, Louisiana, and sat on the tarmac for hours before the mistake was discovered. Later, in March 2008, the Air Force discovered that a fuze component of an Air Force nuclear ballistic missile warhead was shipped to Taiwan in error. Secretary of Defense Robert Gates commissioned two outside investigations, one by a senior Navy admiral, the other a blue-ribbon commission chaired by former Secretary of Defense James Schlesinger. Both incidents revealed a systemic lack of attention to the nuclear mission by the Air Force over a number of years dating back to the dissolution of Strategic Air Command in June 1992.⁴⁰ As the Air Force Strategic Plan codifies, reviving the neglected nuclear forces community constitutes the single highest priority for the new Air Force leadership.

An Aging Force Structure

The increasing age of its air and space fleet across the board continues to be the Air Force's most pressing near-term force structure issue. This problem afflicts both aircraft and satellite systems. A combination of the so-called "procurement holiday" of the 1990s combined with the wartime acceleration of utilization rates are areas of grave concern to Air Force planners.⁴¹

The Air Force has been engaged in nearly continuous combat operations since Saddam Hussein's forces crossed the Kuwaiti border in 1990. The aircraft bearing the brunt of these operations include aerial refueling tankers, most of which are approaching fifty years of age. Also heavily engaged have been the fighter force, consisting of A-10s, F-16s and F-15s, designs which date to the 1970s. They have now exceeded their expected airframe lives and fly in a world of constant "band-aid" modifications and flight restrictions. For the past two decades they have been flying at double their designed flying rate due to persistent enforcement of no-fly zones, periodic high-intensity air campaigns, and, since 9/11, constant homeland defense patrols. The life of an aircraft that routinely pulls nine "Gs" cannot be extended by the same life-support measures applied to 1-G tanker and bomber fleets.⁴² Not only can we expect more fleet-wide groundings due to age-related fatigue problems, but

Reviving the neglected nuclear forces community constitutes the single highest priority for the new Air Force leadership.

⁴⁰ For a thorough overview of the incidents and their aftermath, see http://en.wikipedia.org/wiki/2007_United_States_Air_Force_nuclear_weapons_incident, accessed on 27 March 2009.

⁴¹ The term "procurement holiday," perhaps coined by Cindy Williams at the Congressional Budget Office in 1997 congressional testimony, refers to the slump in weapons purchases that occurred in the 1990s after the Cold War that persists to this day. Cindy Williams, congressional testimony, March 5, 1997, accessed at: http://www.globalsecurity.org/military/library/congress/1997_hr/h970305w.htm on 13 April 2009.

⁴² G-forces measure the multiples of the aircraft's weight when stationary as a result of aircraft maneuvers. Planes that do not perform acrobatic or other high-stress flight maneuvers have airframes stressed to take just over 1 "G," whereas fighter aircraft require much stronger structures to withstand the violent maneuvers of fighter combat, which sometimes exceed 9 "Gs" or nine times the force of gravity, which is approximately the human limit.

increasingly pilots will be asked to reduce their training by restricting high-G fighter maneuvering. The recent groundings of legacy F-15 Eagle and A-10 Warthog aircraft due to age-related fatigue problems are a portent of more problems ahead. As aviation safety expert Peter Field commented, these aircraft have been flown for so long that “It’s like straightening out a paper clip and bending it until it breaks,” adding, “at some point, some poor kid will be up there and yank back [on the stick] and pull the wings off.”⁴³

Rather than attempting to handle the problem internally as the corporate Air Force prefers, in the last few years the top leadership began to publicize the problem in a much more stark way. Former Air Force Secretary Mike Wynne proclaimed: “The Air Force is going out of business. At some time in the future, Air Force aircraft will simply rust out, age out, or fall out of the sky.”⁴⁴ This uncharacteristically apocalyptic language only emerged after the problem had already become acute, even though it had been evident as far back as 1996 when chief of staff General Ronald Fogleman first rang the alarm. Today, the commander of Central Air Forces, Lieutenant General Gary North, reports: “We are flying our planes into extinction,” and Air Force Special Operations Command’s leader, Lieutenant General Donald Wurster, observed, “The question for us is, should a force that is extremely relevant and in high demand . . . have airplanes that are 30 or 40 years old?”⁴⁵ For over a decade, Air Force leaders have not seriously articulated a way to get out of that dilemma other than by hoping for major increases in the Service’s modernization budget.⁴⁶

Satellite age also became a problem at the end of the Cold War when funding constricted to produce the post-Cold War “peace dividend” and replacement rates plummeted. The average age of the Air Force’s satellite constellation in 1993 sat at a comfortable 50 percent of its average design life, a position of relative health given a robust recapitalization schedule. Around 2002, however, Air Force spacecraft average age exceeded average design life, and that gap has continued to grow to a point where today it exceeds it by more than one year. This not only puts the joint force at

⁴³ The most recent groundings of Air Force fighter aircraft include the F-15 Eagle that came apart in flight due to age-related stress on a critical airframe component, severely injuring its pilot. Associated Press, “Air Force Report Details F-15 Disintegration at 18,000 Feet,” January 10, 2008, accessed at <http://www.foxnews.com/story/0,2933,321668,00.html> on October 15, 2008. The A-10 Warthog ground attack fighter was also grounded recently due to wing cracks that could have resulted in wings falling off in flight. “Wing Cracks Ground Many A-10s” *Arizona Daily Star*, October 6, 2008, accessed at <http://www.military.com/news/article/wing-cracks-ground-many-a10s.html> on October 15, 2008.

⁴⁴ Robert S. Dudney, “Catastrophic Failure,” editorial, *Air Force Magazine*, January 2008, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2008/January%202008/0108edit.aspx> on 14 August 2008.

⁴⁵ Phillip Butterfield, “Aging C-130s: the geriatric fleet,” 386th Air Expeditionary Wing, 6 November 2007, accessed at <http://www.globalsecurity.org/military/library/news/2007/11/mil-071106-afpno2.htm> on 9 August 2008.

⁴⁶ The most recent of those was Chief of Staff General Mike Moseley’s assertion that it would take \$20 billion *per year* over six years to begin recovery, in addition to retiring old aircraft such as B-52s, KC-135s and C-130s that Congress kept successive Chiefs from touching. Dudney, “Catastrophic Failure.”

risk, it also suggests that the most advanced technologies are not flying in today's aging satellite fleet. Perhaps the most compelling example of this trend has been the critical Global Positioning System constellation that provides world-wide precision navigation and timing. Over half the GPS satellites on orbit today have exceeded their design life.⁴⁷ Given the increasing reliance of the joint force on space capabilities, this trend cannot help but be worrisome to senior Defense policy-makers.

AIR FORCE GLOBAL BASING POSTURE

Air Force interior bases (inside the continental United States, or CONUS) and exterior bases (overseas) serve as a home and a launch platform for its forces. Again, the Air Force manages bases in a way that contrasts with the other Services. However, the 2005 Base Realignment and Closure (BRAC) round mandated a joint basing concept whereby other Services will assume management of selected, co-located Air Force installations.⁴⁸ This worried Air Force leaders accustomed to enforcing and investing in high standards of base services and support. The long-term viability of the joint basing concept will come under a microscope as it begins in 2009.⁴⁹ In addition to the implementation of joint basing, two major base-related issues should concern defense policy makers over the long-term: an excess in the Air Force's interior basing structure and the atrophy of air bases overseas.

CONUS Basing Surplus

Base management is an important retention issue for Air Force leaders, but too much infrastructure poses a much more insidious problem. The excess capacity in the Air Force's CONUS base infrastructure constitutes a growing burden on the Service's budget. In a 2004 DoD report to Congress, the secretary of defense and the chairman of the Joint Chiefs of Staff stated that "excess infrastructure does exist and is available for reshaping, or needs to be eliminated." They added that the Department

⁴⁷ The average design life of Air Force spacecraft remained at about 8 years since 1991. Spacecraft average age over that time, however, rose from 4 years to over 9 years today. "USAF Space Priorities" Secretary of the Air Force, 19 March 2008.

⁴⁸ The Base Realignment and Closure (BRAC) process originated in the Kennedy Administration when the need for closing World War II and Korean War bases became obvious. Secretary of Defense Robert McNamara closed over sixty bases without consulting with Congress or other governmental agencies. In response, Congress passed rules that virtually precluded base closures during the 1980s. In order to break the deadlock and address the obvious burden on the DoD budget caused by excess CONUS basing, the current system of an independent, bipartisan commission recommending an "all or none" program to Congress was enacted in 1988. A good review of the BRAC decisions since that date can be found at: <http://www.globalsecurity.org/military/facility/brac.htm>, accessed on 27 March 2009.

⁴⁹ Early negotiations concentrated on who would control airfield operations at bases like McChord AFB and Hickam AFB where the Army and Navy, respectively, were given base operations responsibility. The new management arrangements begin in January 2009. Adam J. Hebert, "The Joint Base Dispute," *Air Force Magazine*, Vol. 91, no. 10, October 2008: page 30.

absorbs, in the aggregate, the overhead from “excess installation capacity.”⁵⁰ What this means, plainly put, is that unneeded bases are bleeding away funds the Air Force urgently needs for modernization.

The Air Force share of DoD excess capacity in that 2004 study was right at the departmental average: 24 percent excess base infrastructure.⁵¹ The categories of Air Force installations contributing most to that figure include administrative facilities (31 percent), Air Force Reserve and Air National Guard parking apron space (36 percent and 34 percent, respectively), classroom space (45 percent), large aircraft parking space (27 percent), and space operations facilities (35 percent). The Air Force proposed to the Secretary of Defense that the 2005 BRAC close ten major Air Force installations, three in the active force and seven in the Air Reserve Component, with 20 percent of installations with operational flying missions losing that mission.⁵² That recommendation would have resulted in an estimated \$2.6 billion in annual savings, adding up to an estimated \$14.5 billion over twenty years.⁵³ In the end, however, the 2005 BRAC trimmed only 5 percent of departmental base infrastructure, only a fraction of what is required to rationalize the CONUS excess.⁵⁴

Ironically, the budgetary drag created by excess CONUS base infrastructure masks an even more pressing strategic problem. Overseas air bases long ago passed the point where the operational limitations caused by base shrinkage had become acute, especially in the Pacific region. Addressing that problem constitutes a serious challenge for Air Force leaders who want to posture their forces to better address future strategic requirements.

The Atrophy of Overseas Bases

The Air Force entered the twenty-first century with one third fewer people than during the latter stages of the Cold War and two thirds fewer permanent overseas bases. During the 1990s, it changed from a Cold War garrison force operating from large, sophisticated CONUS and overseas bases to an expeditionary force deploying from home bases to austere “bring your own infrastructure” locations. During the strategic

⁵⁰ “Report Required by Section 2912 of the Defense Base Closure and Realignment Act of 1990, as amended through the National Defense Authorization Act for Fiscal Year 2003,” Department of Defense, March 2004, page 3, accessed at http://www.defenselink.mil/brac/docs/04_o_body032403.pdf on 25 August 2008.

⁵¹ 2004 BRAC Report, page 54.

⁵² “Base Closure and Realignment Report,” Department of Defense, Volume 1, Part 2, May 2005: page Air Force-3 and 4, accessed at http://www.defenselink.mil/brac/pdf/Vol_I_Part_2_DOD_BRAC.pdf on 5 September 2008.

⁵³ 2004 BRAC Report, page 52.

⁵⁴ Even that cut resulted in a forecasted \$5 billion average annual budgetary savings beginning in 2011. “Base Closure and Realignment Report,” Department of Defense, Volume 1, Part 1, May 2005: page Air Force-3 and 4, accessed at http://www.defenselink.mil/brac/pdf/Vol_I_Part_2_DOD_BRAC.pdf on 5 September 2008.

hiatus after the Cold War, the abandonment of many overseas bases seemed to make sense and hardly affected force deployments because the United States' unilateral strength meant that bases immediately surrounding the combat zone could be accessed and exploited relatively easily. That very happy arrangement seems to be fading.

Post-Cold War overseas base constriction now significantly restricts American military power projection. This negative trend is exacerbated by several mutually reinforcing factors. First, US military power projection is increasingly constrained by politically-based access limitations. With the dissolution of the Soviet Union as a major threat, nations have been less receptive to American requests for access and overflight, and more likely to use these requests as a domestic political ploy or bargaining tool.⁵⁵ Second, governments will almost certainly become less willing to accept American forces due to the proliferation of long-range, anti-access and retaliatory threats, as hosting American forces could make them a target.⁵⁶ Furthermore, the imperative for overseas base access has a simple geographical component — distance increases power projection costs and complexity. Some of the most important regions in the future security environment, such as East Asia, Southeast Asia, and especially Central Asia, present acute range challenges that demand either large numbers of dispersed bases for short-range forces, or fewer, more capable bases for longer-range forces. In many key regions, both are in short supply. Finally, the proliferation of precision conventional long-range cruise and ballistic missiles places land and sea bases at risk, stimulating the need to harden and disperse bases and forces, as well as improve warning and active defenses where missile density warrants it. This, in turn, presents a budgetary challenge as defense budgets constrict and the Air Force faces escalating manpower, energy, and operations bills.

In August 2004, President George W. Bush announced a major overseas basing realignment process that the Congressional Research Service called “the most profound reordering of US military troops overseas in about 50 years.”⁵⁷ Although the announcement suggested work would be undertaken to open new bases, the initiative concentrated on closing even more bases and bringing some 70,000 US Service members home. Some of those changes were put on hold due to the wars in Iraq and Afghanistan, but the initiative continues to emphasize the use of bases to facilitate the movement and deployment of ground forces and has done little to increase the flexibility and access provided to key areas in the Pacific and other parts of Asia for

⁵⁵ See Wesley P. Hallman, “Access and Overflight: Strategic Opportunities, Operational Risks,” Master’s thesis (Maxwell AFB, AL: School of Advanced Air and Space Studies, 2004).

⁵⁶ See also, Christopher J. Bowie, *Meeting the Anti-Access and Area-Denial Challenge* (Washington, DC: Center for Strategic and Budgetary Assessments, 2002).

⁵⁷ Jon D. Klaus, “US Military Overseas Basing: Background and Oversight Issues for Congress,” Congressional Research Service report #RS21975, 17 November 2004, page 2.

It is a little-known fact that the Air Force does not control a significant part of its base budget, which serves as a pass-through mechanism for other agency programs.

land-based airpower.⁵⁸ This is a problem that cannot be ignored, as it can take many years to establish meaningful overseas base access.

These are not the only issues impacting the Air Force budget in ways that have strategic effects, however. The next section covers some basic budgetary issues that reveal a set of institutional challenges for the Air Force.

BUDGET STATUS

The Air Force annual budget request for FY 2009 came to \$143.8 billion in FY 2009 dollars, with the largest share (44 percent) going to investment (research, development, testing and evaluation and procurement), and 32 percent and 22 percent going to operations and maintenance (O&M) and personnel, respectively.⁵⁹ By comparison, the combined budget for the Navy and Marine Corps stood at \$149.3 billion and, for the Army, \$140 billion. These figures cause many analysts to observe that all three Services receive comparable base budget shares ranging from 27 to 29 percent.⁶⁰

A closer look, however, reveals that the Air Force lags badly in budget share. Supplemental funding for operations in Iraq and Afghanistan heavily favors the Army and Marine Corps, a reflection of the ground-heavy orientation of the campaigns in these two countries. For example, the FY 2008 supplemental budget amendment provided the Army an additional \$106.4 billion, and the Air Force and Navy only \$23 billion each. Indeed, on several recent occasions, the Office of the Secretary of Defense “taxed” the Air Force and the Navy billions of dollars to help defray the cost of Army operations.⁶¹ The remainder of this section discusses the unique budget pressures confronting the Air Force leadership as it attempts to rationalize current and future requirements.

Budget Pass-Throughs

It is a little-known fact that the Air Force does not control a significant part of its base budget, which serves as a pass-through mechanism for other agency programs. In the

⁵⁸ Although much of the basing discussions proceeded in secret, some suggestion that OSD was going to conduct talks with Thailand, the Philippines, and Singapore about basing options. Klaus, page 2.

⁵⁹ This represents the base budget request only. It does not include supplemental funding for operations in Iraq and Afghanistan. See National Defense Budget Estimate, FY 2009 (Washington, D.C.: Department of the Defense, September 2008), available online at http://www.defenselink.mil/comptroller/defbudget/fy2009/FY09Greenbook/greenbook_2009_updated.pdf, accessed January 2, 2009.

⁶⁰ The Air Force share equates to 28%. The Army’s share equates to 27%, and the Navy/Marine Corps to 29%.”

⁶¹ William H. McMichael, “Air Force, Navy, AF Money keeps Army running until July,” *Army Times*, 13 June 2008, accessed at http://www.armytimes.com/news/2008/06/military_budgetshift_061108w/ on 25 August 2008. Megan Scully, “Chief Says Air Force Must Recover Funds Diverted to Army,” *Congress Daily PM*, 24 April 2007. Jason Sherman, “DOD May Raise Army Budget,” *Inside Defense*, 18 August 2006, accessed at <http://www.military.com/features/0,15240,110349,00.html> on 25 August 2008.

FY 2008 budget submission, for instance, the non-Air Force “pass-through” averaged about \$30 billion annually through FY 2014, reducing the de-facto Air Force budget share (including supplementals) to around 20 percent of the overall DoD budget instead of the often-listed 28 percent. The majority of those funds likely are shifted to the National Foreign Intelligence Program (NFIP), which according to the Congressional Research Service, “funds all foreign intelligence and counter-intelligence activities of the government that respond to ‘national’ needs as opposed to the needs of a single department or agency.”⁶² CSBA’s defense budget analyst Steve Kosiak noted that over 40 percent the Air Force’s procurement budget falls under a classified category, with a significant portion likely going to the Central Intelligence Agency (CIA), the National Security Agency (NSA) and the National Reconnaissance Office (NRO).⁶³ It is thus misleading to say that the three departments generally get equal budget shares, especially since Operation Iraqi Freedom began in 2003.

External Budget Demands and Bureaucratic Penetration

Budget pass-throughs are only one example of how other agencies leverage the Air Force base budget for their own purposes. In addition to its internal corporate structure, the Air Force also has a de facto board of directors that do not wear Air Force blue. Due to the critical and growing utility of air and space power, the other three Services and intelligence agencies not only directly intervene into Air Force matters, but also lobby aggressively in a bid to get increasing shares of the Air Force budget earmarked to support their institutional priorities. As mentioned above, the intelligence community uses a portion of the Air Force budget as a pass-through, but it also exerts operational control over a significant number of Air Force airborne and space ISR assets. Air mobility force structure responds to external demand, primarily to the Army for airlifting ground forces, and the Navy for aerial refueling that extends the range of its fighter-based carrier air wings. Everyone in the government uses Air Force space assets, and many desire (and receive) a say in system design and operations — often resulting in the “gold-plating” of requirements that the Air Force ends up absorbing in its budget. Furthermore, internal Air Force subgroups benefiting from external demands often conspire with these powerful external stake-holders to divide and weaken the Air Force’s ability to pursue its institutional priorities. Unlike market economies, reciprocity (paying for services) does not balance or mitigate

In addition to its internal corporate structure, the Air Force also has a de facto board of directors that do not wear Air Force blue.

⁶² The author notes that the Director of Central Intelligence (DCI) controls the NFIP through tasking authority of the agencies involved, and the Secretary of Defense through operational authority and his Defense Resource Board (DRB) which is expanded to include DCI representation when considering NFIP issues. Stephen Daggett, “The US Intelligence Budget: A Basic Overview,” Congressional Research Service report #RS21945, 24 September 2004: page 1, 4–5.

⁶³ It probably also covers the National Geospatial Intelligence Agency (NGA) as well. Steven M. Kosiak, “Classified Funding in the FY2009 Defense Budget Request,” Center for Strategic and Budgetary Assessments backgrounder, 17 June 2008: 2. Accessed at: http://www.csbaonline.org/4Publications/PubLibrary/U.20080618.Classified_Funding/U.20080618.Classified_Funding.pdf on 8 August 2008.

these pressures, since the Air Force generally does not accrue any budget relief. The desire for more and better “free” services results in outside agencies competing with one another for de facto shares of the Air Force budget, while the Air Force generally lacks the leverage or institutional power to resist these solicitations.

Petroleum Dependence

A final aspect of external pressure on the Air Force’s budget bears noting. The Air Force consumes more petroleum each year than any other agency of the US Government, and thus is more susceptible to rising petroleum prices. According to the *New York Times*, the Air Force burned 3.2 billion gallons of aviation fuel in 2005, over 50 percent of the US government’s total consumption. Due to steadily rising oil prices, Air Force leaders revealed that they paid \$1.4 billion more for aviation fuel in 2005 than the year before, admitting that the higher fuel costs were creating a “budget crisis.”⁶⁴

Higher fuel prices also have a major impact on Air Force combat capability. Higher prices mean the Air Force has to pay a premium for flying hours, which translates directly into combat aviation readiness and proficiency. By 2007, when oil topped \$100 per barrel, Air Combat Command forecasted that higher fuel prices could spur a reduction in the Air Force’s Flying Hour Program by 10% each year through 2013.⁶⁵ As a long-term response, the Air Force planned to certify its entire fleet to fly with 50 percent nonpetroleum fuel sources by 2010, and started looking into other ways to lessen its petroleum vulnerability.⁶⁶ For instance, the Air Force purchased almost 900 million kilowatt-hours of renewable energy in 2008, to include a 14.2 megawatt photovoltaic solar array at Nellis AFB, the largest in the western hemisphere. These initiatives earned them the Environmental Protection Agency’s 2008 Green Power Leadership Award as the top federal government purchaser of renewable power.⁶⁷

Despite these efforts to mitigate the effects of oil prices, however, the global energy market will likely continue to exert a significant influence on the Air Force’s budget that is largely beyond its control. The recent global recession helped to moderate fuel costs. However, over time, it seems a sure bet that, as the economic recovery arrives, energy prices will rise. When combined with rising personnel costs, excess domestic base infrastructure, and unconstrained external resource demands, Air Force acquisition and operations accounts are likely to remain highly stressed over the next twenty years. As a result, the Air Force must explore ways to free substantial resources—perhaps tens of billions of dollars—within its own budget topline to fund its future

The global energy market will likely continue to exert a significant influence on the Air Force’s budget.

⁶⁴ Don Phillips, “Air Force Hopes to Cut Oil’s Role in Fuel,” *New York Times*, 18 June 2007, accessed at <http://www.nytimes.com/2007/06/18/business/18biofuels.html> on 23 July 2008.

⁶⁵ Accessed at <http://www.af.mil/news/story.asp?id=123026679> on 29 August 2008

⁶⁶ Phillips, “Air Force Hopes to Cut Oil’s Role in Fuel.”

⁶⁷ The Air Force purchased green power sources that include photovoltaic solar arrays and wind farms at various Air Force bases. “Air Force Wins EPA Energy Award,” Air Force News Service, October 28, 2008, accessed at <http://www.af.mil/news/story.asp?id=123121416> on October 29, 2008.

program. While Air Force leaders will continue to make the case for an increased budget, they cannot continue planning on a financial windfall that may never come.

RECAPITALIZATION AND MODERNIZATION PLANS

The Air Force's plan to recapitalize and modernize the force rests on the promise of new acquisitions and modifications to legacy platforms. For the purposes of this study, recapitalization refers to a combination of retiring older aircraft and spacecraft and buying new ones. Modernization extends aircraft service life, upgrades capability, and improves safety of flight. Inevitably, technical obstacles and fiscal constraints hinder the pace of recapitalization, forcing leaders to invest even more in upgrades to aging aircraft. The costs of such short-term fixes, along with rising bills for depot maintenance, utilities and fuel, create a "death spiral," in which the rising costs of maintaining existing aircraft rob resources intended for recapitalization. This section reviews the major aspects of the Air Force's modernization plan as articulated in its most recent posture statement to Congress.

Aircraft Retirements Blocked

The first aspect of recapitalization involves retiring old aircraft, because just as it has excess CONUS bases, the Air Force has too many aging planes. Older aircraft are difficult to maintain, and often have operational and training flight restrictions. Congressman Ike Skelton (D-MO) noted last year that some 14 percent of the Air Force inventory "is either grounded or has mission-limiting restrictions."⁶⁸ However, attempts to cut old force structure have consistently encountered stiff resistance from the Congress, whose members are concerned over the prospective impact of such reductions in their Districts.⁶⁹ They also fear that force structure cutbacks could make their bases more likely candidates for closure by the BRAC process. For example, the Air Force successfully cut the F-117 fleet in 2007 after two years of having their request blocked by Congress. Still, Congress restricted the retirement by mandating that ten aircraft be kept in a recall condition, even though there are no longer any pilots trained to fly them. High on the retirement list are the KC-135E, C-130E, U-2 and C-5A.

Modernization

Saddled with an aging aircraft inventory, the Air Force finds itself spending at historically high rates on upgrades and modifications to existing aircraft. Up to one third of total aircraft procurement, and, even more worrisome, one third of R&D spending, go

Attempts to cut old force structure have consistently encountered stiff resistance from the Congress, whose members are concerned over the prospective impact of such reductions in their Districts.

⁶⁸ Otto Kreisher, "Air Force leaders argue need to retire old aircraft," *Congress Daily*, 28 February 2007, accessed at <http://www.govexec.com/dailyfed/0207/022807cdpm2.htm> on 15 August 2008.

⁶⁹ "2008 USAF Posture Statement," page 27–28.

for modifications to legacy systems — and these proportions are rising.⁷⁰ Nearly a billion dollars per year are budgeted for modifications and upgrades to F-15s and F-16s, even though the average F-15E or F-16C will be thirty years old in 2018. The plan also calls for spending \$1.4 billion per year on C-5 modernization.⁷¹

These costs hinder the Service's efforts to maintain its technological edge. The FY 2009 Air Force budget calls for \$381 million on new propulsion technology, including the critically important Adaptive Versatile Engine Technology (ADVENT) program.⁷² Yet the same budget also includes \$151 million for R&D on marginal component improvements for engines on legacy aircraft. In short, the Air Force risks becoming a depot support agency.⁷³

Despite these trends, the Service's rhetoric remains optimistic. The Air Force's most recent public strategic planning document, "Air Force Roadmap 2006–2025," lays out the proposed plan to arrive at a "powerful force structure that will dominate adversaries in the air, space, and cyberspace across the spectrum of conflict, now through 2025."⁷⁴ In February 2008, the Air Force presented Congress an \$18.7 billion unfunded requirements list consisting mostly of aircraft procurement.⁷⁵ That request was in addition to an Air Force effort to increase its top-line budget by an additional \$20 billion per year for the next five years — a windfall that never came. This attempt was made in order to build the "Required Force," or what the Air Force saw as QDR guidance while filling what Service officials called "a fighter gap."⁷⁶ This equated to the

⁷⁰ In FY2009, modifications comprised about 33% of the total R&D budget (minus NFIP). Procurement modifications rose as a percentage of total procurement from 22% in FY2007 to 32% in FY2009. Looked at another way, total modification costs total over 40% of the entire Air Force development budget (minus S&T and test), a rough way of comparing old to new. Data comes from the Air Force FY2009 budget request accessed at www.saffm.hq.af.mil/budget/ on 15 July 2008.

⁷¹ Data comes from the Air Force FY2009 budget request accessed at www.saffm.hq.af.mil/budget/ on 15 July 2008.

⁷² The current ADVENT program could benefit from being expanded to fund two competing companies in order to gain the greatest insight about alternative approaches. For a lucid, persuasive argument for propulsion S&T funding, see: American Institute of Aeronautics & Astronautics (AIAA) Air Breathing Propulsion Technical Committee, "The Versatile Affordable Advanced Turbine Engines (VAATE) Initiative," AIAA position paper, January 2006, accessed at <http://pdf.aiaa.org/downloads/publicpolicypositionpapers/VAATE.pdf> on 10 October 2008.

⁷³ This statement contains more than a bit of irony. As depots and modification projects get more business, those constituencies also gain political power and exert tremendous pressure on Air Force leaders both directly and through Congress to extend and expand those programs.

⁷⁴ "Air Force Roadmap 2006–2025," Headquarters, United States Air Force, June 2006, page 6, accessed at <http://www.af.mil/library/posture/vision/vision.pdf> on 10 August 2008.

⁷⁵ Although the UFL is not entirely comprised of aircraft procurement requests, the vast majority of the funding request involved money for aircraft procurement that mirrors the aircraft in the Required Force. See USAF FY 2009 Unfunded Requirements List, Feb 2008, SAF/FMB, Budget & Appropriations Office; https://www.aef.org/edop/af_unfunded.pdf.

⁷⁶ Robert S. Dudney, "Lurching Toward a Cliff," *Air Force Magazine*, April 2008, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2008/April%202008/0408edit.aspx> on 5 November 2008; Erik Holmes, "Officials say current plans create fighter gap," *Air Force Times*, April 16, 2008.

Air Force asking for over \$40 billion in procurement funds for 2009.⁷⁷ Furthermore, over the next twenty-five years the Air Force plans to retire some 2,300 legacy fighter aircraft from the Active, Reserve and Guard fleets. The current program of record replaces them with 187 F-22s and 1,763 F-35s, but at a pace that requires stretching the legacy fighter force far into the future. At present, the Air Force's long-range plan retains Cold War-era F-15Es and A-10s beyond 2028.

Simple math reveals the infeasibility of this plan. The Air Force plans to procure 750 aircraft over a six-year period, equating to 125 aircraft per year. At that rate it will take about forty-six years to replace every aircraft in the inventory. The Air Force chief of staff recently testified that the Service must buy 160 aircraft per year just to sustain the already record-setting age of the fleet.⁷⁸ One Air Force leader summed up the Service's fears when he stated, "Future preeminence is not guaranteed; instead it must be planned, paid for, developed, and fielded."⁷⁹ Indeed, the past fifteen years of deploying to bases close to overmatched adversaries and conducting surveillance and mass precision attacks with relative impunity may turn out to be a brief, exhilarating, but misleading anomaly.

Fortunately, the 2006 Quadrennial Defense Review presented a strategic vision upon which the Department of Defense could build a more balanced, pragmatic force postured to address irregular warfare, potential rival nations with increasing technological prowess, a growing number of nuclear-armed states, and homeland defense. The QDR could be interpreted as setting requirements on air and space forces for increased range, persistence, low-observability, networking, and inter-Service integration. An incremental approach by the Air Force will not enable it to address these emerging requirements. In the end, the Air Force did very little to adapt its future force plans to the QDR's projected strategic environment. What kept them from making hard choices? The next section discusses some internal problems that must be addressed in order to re-establish greater Air Force institutional strength in the coming years.

A CRISIS IN INSTITUTIONAL CONFIDENCE

The foregoing sections discuss the state of the Air Force in terms of objective categories: roles and missions; organizational structure; manning, force structure, and basing posture; budget; and recapitalization and modernization plans. However, one cannot understand the true state of the Air Force without assessing the state of the

The past fifteen years of deploying to bases close to overmatched adversaries and conducting surveillance and mass precision attacks with relative impunity may turn out to be a brief, exhilarating, but misleading anomaly.

⁷⁷ William Matthews, "Asking for More: Services up the wish-list ante amid fears of a 2009 budget squeeze", *Armed Forces Journal*, January 2008; Emelie Rutherford, "Members lament domestic air defense funding, plug fourth-generation fighters to Air Force," *Defense Daily*, April 16, 2008.

⁷⁸ Megan Scully, "Needed: 200 New Aircraft a Year," *Air Force Magazine*, October 2008, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2008/October%202008/1008aircraft.aspx> on 15 November 2008.

⁷⁹ "2008 USAF Posture Statement," page 8.

Today's Air Force is experiencing an institutional identity crisis that places it at an historical nadir of confidence, reputation, and influence.

Air Force's collective institutional psyche. Today's Air Force is experiencing an institutional identity crisis that places it at an historical nadir of confidence, reputation, and influence.

This institutional crisis has three main components. First, the Air Force retains only marginal, and in some cases not even nominal, control over its acquisition programs despite its Title 10 mandate. After the "Druyun Affair" in which the Air Force's #2 acquisition official, Darleen Druyun, used her position to steer contracts in return for favors and was eventually convicted of corruption, the Air Force voluntarily handed major program acquisition authority for ten of its largest acquisition programs to the Office of the Secretary of Defense in March 2005.⁸⁰ It took almost a year and a half to find a replacement for its top acquisition official.⁸¹ The Air Force regained some oversight of those programs in 2006 but soon experienced a series of contract award protests, the most important being the aerial refueling (tanker) program, which OSD again stripped from the Air Force and currently oversees. Furthermore, OSD retained acquisition authority for formerly Air Force-controlled space programs, and has given no indication that it intends to return them to the Service. For any Service, loss of acquisition authority translates directly to loss of power and influence, and no other Service suffers the same level of intervention into its Title 10 prerogatives.

The Air Force has also lost much of its ability to exert control over its forces in combat. By virtue of their occupying key command and staff positions, both in the Pentagon and through the regional combatant commands, the other three Services exert relatively greater control over when and how their forces engage in military operations. In Operation Enduring Freedom, for instance, the joint force commander stripped the ability of the joint force air component commander (an Air Force general) to set airpower targeting and allocation priorities as had been the long-standing doctrinal precedent.⁸² Instead, combat targets and missions were formulated by the CENTCOM targeting staff led by an Army general, and then merely carried out by the jointly-manned air operations center, a subservient status none of the other components were forced to endure.⁸³ In the major regional combatant command staffs, where force employment decisions are made, the Air Force holds no joint command

⁸⁰ Darleen Druyun was convicted in 2004 of corruption associated with a tanker leasing scheme. Druyun admitted to manipulating the contract award to favor her eventual employer, Boeing, and spent nine months in jail. The incident also led to Boeing paying a \$615 million fine and the resignation of Boeing chief executive officer Phil Condit. For a review of the "Druyun Affair," see John A. Tirpak, "Tanker Twilight Zone," *Air Force Magazine*, February 2004, accessed at: <http://www.airforce-magazine.com/MagazineArchive/Pages/2004/February%202004/0204tanker.aspx> on 23 March 2009.

⁸¹ Sue Payton was nominated for the position of Assistant Secretary of the Air Force for Acquisition, Research and Development in April 2006 after her predecessor resigned in January 2005. Michael Sirak, "Payton Nominated to Fill Long-Vacant Acquisition Post," *Defense Daily*, 27 April 2006, accessed at <http://integrator.hanscom.af.mil/2006/April/04272006/04272006-09.htm> on 19 August 2008.

⁸² The author was the strategy division chief in the Combined Air Operations Center when this occurred.

⁸³ CENTCOM also holds collection tasking authority for all intelligence, surveillance, and reconnaissance tasking in the theater.

positions, having done so only once in the post-Goldwater Nichols era.⁸⁴ In Central Command (CENTCOM) today, the senior Air Force staff officer heads up the strategy directorate, not one involving intelligence or operations. Only one of the last nine Joint Chiefs of Staff chairmen has been an Air Force officer. On the Joint Staff, where the Services maneuver constantly for their force management and employment preferences, the Air Force holds none of the top eleven key positions as of this writing.⁸⁵ While this represents only a snapshot of the command and staff environment, it reflects historical trends and reveals the Air Force's rather profound lack of institutional influence compared to the other three Services.

Finally, the Air Force's identity crisis manifests itself in the lack of a stimulating vision of its future role. Perhaps the Service has suffered from the immediate and continuous demands placed on it, a consequence of conducting combat operations continuously since 1991; but that seems like a thin reed. It also seems trapped in the throes of the "procurement holiday" that locked its sights on one major program — the F-22 — a drama that has stretched out over the past twenty years or more. As mentioned previously, the Air Force is also inextricably harnessed to the strategies and visions of the other three Armed Services, all of which place demands on the Air Force (e.g., airlift, aerial refueling, space) that it has little or no role in formulating. More recently, the Air Force's shortcomings associated with its nuclear mission and the subsequent replacement of both the Air Force secretary and military chief complete a rather dismal institutional picture.

This chapter concludes on that cheery note. Rationalizing its problems will not help an institution in crisis — only a clear diagnosis of the problem and sustained visionary leadership can restore its vitality and agility. To do that, Air Force leaders must align their vision with the future security environment. That future is fraught with danger and challenges, but it is also a future in which air and space power can and must play a key role. That can only happen when its primary custodian is back on its feet and in fighting trim. The following chapter explores the implications of the future strategic environment for the Air Force.

Air Force leaders must align their vision with the future security environment. That future is fraught with danger and challenges, but it is also a future in which air and space power can and must play a key role.

⁸⁴ General Joseph Ralston commanded European Command. See Rebecca Grant, "Why Airmen Don't Command," *Air Force Magazine*, March 2008, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2008/March%202008/0308command.aspx> on 13 August 2008. Air Force Lieutenant General Douglas Fraser was recently nominated to assume command at Southern Command with responsibility for Latin America and the Caribbean. Carol Rosenberg, "Southcom chief Stavridis picked to oversee NATO," *Miami Herald*, accessed on 31 May 2009 at: <http://www.miamiherald.com/news/world/story/959101.html>.

⁸⁵ Those positions include the Chairman, Vice Chairman, Joint Staff Director, and the heads of the eight J-staffs. These key positions used to be rotated to retain a modicum of diversity, but Secretary of Defense Rumsfeld abolished rotation and the eleven positions quickly devolved to exclude Air Force participation.



CHAPTER 2 > IMPLICATIONS OF THE FUTURE SECURITY ENVIRONMENT FOR THE AIR FORCE

Having examined the current structure of the Air Force and some of the challenges confronting its leadership, in this chapter the report assesses the Air Force's strategic plans relative to the three core elements of the future security environment that underpin CSBA's *Strategy for the Long Haul*: opposing violent Islamic radicals; hedging against China's potential rise as a more aggressive military competitor; and countering the possible proliferation of nuclear weapons.⁸⁶

This chapter addresses the operational implications of these three core challenges on the shape, size, and posture of the US Air Force. It concludes with a brief discussion of the emerging "high-low mandate" or the need for the Air Force to shift away from a force dominated by legacy "middle-weight" forces to one optimized for disruptive irregular and high-end challenges. The fundamental problem with the legacy force approach is that it emphasizes capabilities that represent overkill for irregular warfare, yet also lack key attributes required to deter and prevail against sophisticated high-end threats. Legacy "middle-weight" or "general purpose" forces increasingly exist in a no-man's land, with limited ability to address emerging high- or low-intensity challenges effectively and few if any plausible scenarios in which they would add utility compared to other investments. This chapter outlines the rationale for this strategic re-conceptualization of the future Air Force posture, while Chapter 3 presents in menu-style format some options for moving the Air Force in that direction over the next twenty years.

⁸⁶ Andrew Krepinevich, Robert Martinage, Robert Work, "The Challenges to US National Security," Washington, DC: Center for Strategic and Budgetary Assessments, *Strategy for the Long Haul* monograph, 2008, accessed at http://www.csbaonline.org/4Publications/PubLibrary/R.20080821.The_Challenges_to_/R.20080821.The_Challenges_to_.pdf on 23 March 2009.

The Air Force's armed MQ-1 Predator and larger cousin, the MQ-9 Reaper, play pivotal roles in hunting key al Qaeda and other terrorist group leaders.

OPPOSING VIOLENT ISLAMIST RADICALS

If US military operations of the past decade hold any predictive power, the Air Force will continue to play a key role in defeating Islamist brands of terrorism around the globe. If Lawrence of Arabia somehow found himself back in Iraq today, he would find many similarities to the irregular warfare of his day, but he would also find some important differences. One of the most startling would be the swarms of UAVs buzzing overhead, some controlled by operators thousands of miles away, each contributing to a persistent overwatch that greatly diminishes the tactical freedom of insurgents and terrorists.

Indeed, the Air Force's armed MQ-1 Predator and larger cousin, the MQ-9 Reaper, play pivotal roles in hunting key al Qaeda and other terrorist group leaders.⁸⁷ Soon after General David Petraeus assumed command of military forces in Iraq, he concluded that the Predator/Reaper combination was his most prized military platform and lobbied the Secretary of Defense for an emergency increase in Predator orbits.⁸⁸ Petraeus asked for a boost from 240 hours per day of Predator coverage (ten 24-hour "combat air patrols" or CAPs) to 576 hours per day of Predator full-motion video and SIGINT coverage—a 140 percent increase. At the same time, SOCOM commander Admiral Eric Olson asked for an additional 720 hours—a combined increase of 540 percent.⁸⁹

Yet, as the British warrior who gained fame during the Arab Revolt would have quickly ascertained, UAV operations represent only a fraction of the Air Force's involvement in Iraq and Afghanistan. Air Force personnel contribute to almost every American military operation, from satellite support to convoy movement. Every month, Air Force cargo aircraft keep some 3,500 vehicles and over 9,000 personnel off the dangerous roads of Iraq, greatly diminishing the human costs of the occupation.⁹⁰ Airmen respond to thousands of "troops in contact" calls and over 6,000 Airmen are filling Army billets in Iraq and Afghanistan.⁹¹ Indeed, one might surmise

⁸⁷ For a penetrating analysis of how the Air Force weaponized Predator prior to 9/11, see: Sean M. Frisbee, "Weaponizing the Predator UAV," Master's thesis (Maxwell AFB, AL: School of Advanced Air and Space Studies, 2004).

⁸⁸ Matthew Cox and Gina Cavallaro, "Petraeus: ISR Gear is Key to Success," *Army Times* (online), 11 April 2008, accessed at www.armytimes.com/news/2008/04/military_petraeus_gear_042108/ on 14 July 2008.

⁸⁹ Michael Hoffman, "UAV patrols, intell analysts wanted," *Air Force Times*, 22 April 2008, accessed at http://www.airforcetimes.com/news/2008/04/airforce_uav_intel_042108/ on 4 August 2008.

⁹⁰ Megan Scully, "Needed: 200 New Aircraft a Year," *Air Force Magazine*, October 2008, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2008/October%202008/1008aircraft.aspx> on 15 November 2008.

⁹¹ Battlefield Airmen include the pararescue, special tactics, combat control, tactical air control, and battlefield weathermen operational communities that accompany other special forces units on a daily basis. Also, over six thousand Air Force people fill joint expeditionary tasking in ground billets the Army chooses not to fill. See "Battlefield Airmen," accessed at <http://www.af.mil/factsheets/factsheet.asp?id=187> on 23 August 2008, and Otto Kreisher, "Ground Force Taskings Go On," *Air Force Magazine*, March 2008, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2008/March%202008/0308ilo.aspx> on 23 August 2008.

that Lawrence would have prized the strategic and tactical mobility, navigation, timing, communication, precision and lethality provided by the Air Force every day. He would likely observe that although the fundamentals of irregular warfare remain the same, the character of conflict has changed profoundly since his day; in short, Airmen have brought an entirely new look and feel to modern irregular warfare.

This being said, operations in Iraq and Afghanistan have also revealed that sustained operations against non-state actors require a different mix of capabilities and capacities than the Air Force currently provides. Simply stated, the Air Force has been structured primarily for “conventional warfare,” and many airpower advocates believe it should remain so. Yet, the idea that irregular war constitutes a “lesser included case” of conventional warfare, or that the current conflict represents a “one-off” event — an isolated situation not likely to be repeated any time soon — runs counter to the Defense Department’s 2006 QDR, which concluded that the “long war” against non-state terrorist networks is “a struggle that may last for years to come.”⁹² Defense Secretary Robert Gates reinforced this assessment in his 2008 *National Defense Strategy* by emphasizing that this threat would exist “for the foreseeable future.”⁹³ In other words, the global pace of irregular warfare is unlikely to diminish appreciably even after the US withdrawal from Iraq.⁹⁴ Accordingly, the Air Force needs to adapt its force structure and operations to better posture itself for this enduring challenge.

The current Air Force structure also suffers from the operational tempo in Iraq and Afghanistan, which emphasizes the use of aging manned aircraft, which are expensive to operate. The cost of operating alternatives, such as UAV systems, is far lower, especially in environments like Afghanistan where every gallon of aviation fuel must be brought in by armed truck convoys. Shifting toward greater use of unmanned systems makes sense, especially for armed reconnaissance missions.⁹⁵

Under current plans for global irregular war operations, US counter-terrorist efforts will encompass operations in over eighty countries, each with its own requirement for military aviation that will put a premium on less sophisticated and less expensive aerial platforms than those the Air Force emphasizes today. Meeting the burden of this dispersed approach to irregular warfare will require renewed institutional

⁹² 2006 QDR report, page 9.

⁹³ Robert M. Gates, *National Defense Strategy*, Office of the Secretary of Defense, June 2008, page 2.

⁹⁴ One of the most eloquent articulations of this concept can be found in Jim Thomas, “Sustainable Security,” Center for a New American Security, April 2008, accessed at <http://www.cnas.org/node/125> on 2 November 2008.

⁹⁵ Cost per flying hour (CPFH — which includes fuel, consumables such as parts, and modifications and sustainment) for jet fighters and bomber supported by aerial refueling run into the tens of thousands of dollars, while Predator operations run in the low thousands. According to the Defense Science Board, jet fuel generally runs around \$2–\$3 per gallon, but the “fully burdened” costs for aerial refueling are \$42 per gallon. The fuel consumption rate of an F-16 fighter or B-1 bomber versus the snowmobile engine powering the Predator further magnifies cost differentials. Defense Science Board Task Force on DoD Energy Strategy, “More Fight, Less Fuel,” February 2008, page 30. See also, Eric M. Hawkes, “Predicting the Cost Per Flying Hour for the F-16 Using Programmatic and Operational Variables,” master’s thesis, Air Force Institute of Technology, Wright-Patterson Air Force Base, OH, June 2005.

Perhaps the most pressing threat affecting future Air Force irregular warfare operations will be the emergence of paramilitary groups possessing guided rockets, artillery, mortars, and missiles (G-RAMM).

dedication, changes in organizational culture, and the integration of less sophisticated, lower-cost Air Force irregular warfare capabilities. Even the AEF model should be scrutinized with regard to its ability to support an irregular warfare-based steady-state security posture. Another major requirement for the Air Force in this mission area is providing on-call, low-collateral-damage fire support to US and partner ground forces. This will likely require increased persistence, new munitions, and irregular warfare-optimized aircraft that can be provided, as necessary, to foreign air forces. There will also undoubtedly be an increased demand for Battlefield Airmen and Air Force-trained joint terminal attack controllers (JTACs).

Juxtaposed against the need for less expensive Air Force irregular warfare capabilities is the need to account for the steady proliferation of high-technology weapons, which are now making their way into the hands of insurgents and terrorists. In addition to always-deadly surface-to-air missiles, perhaps the most pressing threat affecting future Air Force irregular warfare operations will be the emergence of paramilitary groups possessing guided rockets, artillery, mortars, and missiles (G-RAMM). These weapons are becoming increasingly available. Just as the deadly combination of persistent overhead surveillance, networks and guided weapons puts insurgents and terrorists at risk in new ways, the proliferation of G-RAMM will allow insurgents to challenge US forces in new ways. For example, advanced guided mortars constitute an undeniable near-term threat to US and allied air bases and forces, and cannot be defeated by current terminal defense systems because they maneuver in flight.⁹⁶ However, the Services have given little thought to how these terminally-guided munitions could disrupt military operations. Failing to anticipate and address this looming threat could lead to a situation comparable to the one ground forces faced with the improvised explosive device (IED) during the war in Iraq.⁹⁷

Building a more tailored irregular warfare capability in the Air Force and accounting for the G-RAMM threat need not have a major budgetary impact. However, it is not just a matter of fielding new aircraft. Meeting this challenge will require a monitored recalibration of the Air Force's standard approach to science and technology, research and development, system acquisition, strategic planning, portfolio balancing, operational concepts, and leader development.

⁹⁶ For a published study taking this same position, see James Bonomo, et al., *Stealing the Sword* (Santa Monica, CA: RAND Corporation, 2008).

⁹⁷ Khe Sahn was a Marine Corps base in Vietnam that was surrounded and came under concentrated artillery and mortar assault, requiring a major aerial relief effort to prevent its loss. Despite many near-misses, only a few resupply aircraft were hit by enemy artillery fire. If the enemy had been employing terminally-guided munitions, the aerial resupply effort would likely have been compromised. See http://en.wikipedia.org/wiki/Battle_of_Khe_Sanh, accessed on 4 August 2008.

HEDGING AGAINST A RISING CHINA

Air Force leaders face a similar challenge in preparing for potential future operations against more advanced, sophisticated adversaries. Although some feel such operations lie within the Service's "comfort zone," that may not be the case. A significant cognitive challenge is posed to Airmen lulled into incrementalism by decades of relatively benign air operations against unsophisticated foes, and the budgetary implications dwarf those of irregular warfare.

The 2005 National Defense Strategy identified the need to refashion the US military to better respond to so-called "disruptive" challenges.⁹⁸ Although it defined disruptive challenges in primarily military-technological terms, it focused on the need to address looming counter-commons and anti-access strategies as implemented by adversary states.⁹⁹ The 2006 QDR report went on to say: "Of the major and emerging powers, China has the greatest potential to...field disruptive military technologies that could over time offset traditional US military advantages absent US counter-strategies."¹⁰⁰ Secretary of Defense Robert Gates stated emphatically that "For the foreseeable future, we will need to hedge against China's growing military modernization and the impact of its strategic choices upon international security."¹⁰¹ For a variety of reasons, the Air Force has been slow to take a strategic orientation toward this looming challenge.

China's High-End Challenge

Indeed, the dramatic and continuing military modernization of the People's Liberation Army (PLA) presents a growing challenge to US military power projection, directly impacting US interests in East Asia. The primary thesis of this section is that the Air Force constitutes one of the pillars of US power projection in East Asia, and that it cannot play its role as a hedge against China's growing military capabilities using current methods and capabilities. Importantly, many of the capabilities required to address the China challenge have substantial value in addressing the challenges described above. That is, they add strategic value across each of the anticipated challenges in the future security environment, a characteristic found far less among forces optimized for irregular warfare. Thus, addressing this particular challenge must be accorded priority in Air Force calculations regarding the Service's future force mix

The Air Force constitutes one of the pillars of US power projection in East Asia, but it cannot play its role as a hedge against China's growing military capabilities using current methods and capabilities.

⁹⁸ Donald H. Rumsfeld, Secretary of Defense, "The National Defense Strategy of the United States of America," March 2005, page 2. Accessed at <http://www.defenselink.mil/news/Mar2005/d20050318nds1.pdf> on 4 August 2008.

⁹⁹ Counter-commons strategies seek to disrupt free access to international airspace, the open seas, space, and cyberspace. Anti-access strategies, most notably those articulated by the PRC, aim to keep US forces from operating out of bases by using military or diplomatic means.

¹⁰⁰ Donald H. Rumsfeld, Secretary of Defense, "Quadrennial Defense Review Report," 6 February 2006, page 29. Accessed at <http://www.defenselink.mil/qdr/report/Report20060203.pdf> on 14 July 2008.

¹⁰¹ Gates, *2008 National Defense Strategy*, page 3.

Contrary to commonly-held views, the PLA does not have to meet or exceed US military capabilities in order to achieve its strategic goal of expanding its regional sphere of influence.

and associated capabilities. This section begins by laying out the evolution of China's military power over the past several years, and discusses its implications for the Air Force's future force posture.

The People's Republic of China's (PRC) military expansion accelerated in rough tandem with its rapid economic expansion after the end of the Cold War. Beijing's military buildup was informed by the First Gulf War and the 1995–1996 Taiwan Strait Crisis. The former conflict alerted them to their substantial shortcomings relative to contemporary standards of military power, and the latter event constituted a reminder of their vulnerability to coercion via US naval power projection.¹⁰² Since then, the People's Liberation Army (PLA) has undergone a series of major force posture changes all focused on the dual goals of prevailing against US military power projection and emulating world-class US military capabilities. As Secretary of Defense Robert Gates stated in the National Defense Strategy, "It is likely that China will continue to expand its conventional military capabilities, emphasizing anti-access and area denial assets including developing a full range of long-range strike, space, and information warfare capabilities."¹⁰³ All of this has occurred in an environment in which one small island nation, Taiwan, holds a wild card in PRC-US relations due to the historical difficulties with the PRC combined with its precarious location near the PRC's shores.¹⁰⁴ For all these reasons, the shifting military balance in the region, if continued unchecked, will alter the day-to-day dynamics of regional alliance politics and stability in ways unfavorable to US interests.

Contrary to commonly-held views, the PLA does not have to meet or exceed US military capabilities in order to achieve its strategic goal of expanding its regional sphere of influence. China scholar Thomas Christensen articulated that logic in his seminal article in *International Security* titled "Posing Problems Without Catching Up."¹⁰⁵ PRC leaders are integrating anti-access capabilities that keep the US military from deploying to forward bases from which they can conduct effective operations and through area-denial capabilities that deny any successfully deployed forces the ability to conduct effective operations. Beyond that, they have called into question free access and use of the four global "commons" of air, sea, space, and cyberspace.

Intensifying Anti-Access and Area-Denial Challenges

The PRC clearly intends to deny US forces access to forward bases from which they might project military power into the region—posing the so-called anti-access

¹⁰² Center for Strategic and International Studies (CSIS), "China Balance Sheet: Military Modernization," accessed at www.csis.org/media/csis/pubs/080916_cbs_1_militarymod.pdf on 23 March 2009.

¹⁰³ Robert M. Gates, Secretary of Defense, "National Defense Strategy," June 2008, page 3.

¹⁰⁴ See the 2009 *Military Power of the PRC*, Chapter Five.

¹⁰⁵ Thomas J. Christensen, "Posing Problems Without Catching Up: China's Rise and Challenges for US Security Policy," *International Security*, Vol. 25, No. 4 (Spring 2001), pages 5–40.

problem. Much has been written about this, but suffice it to say that both sea and land bases within the range of PLA ballistic and cruise missile forces will be held at risk, and increasingly so as the Chinese develop forces with greater range, precision, and global surveillance and control. As these capabilities mature, US allies and partners may become more likely to deny base access or overflight rights, forcing US forces to operate from ever greater ranges in an already range-constrained theater of operations.¹⁰⁶ For the Air Force, this means they will be operating from a base-starved region against a foe holding an increasing number of US bases at risk, calling into question the utility of deploying Air Force elements forward as a deterrent to Chinese coercion or aggression. Finally, the Secretary of Defense's 2009 report to Congress concerning the PRC military buildup mentions that Chinese challenges to the US military's access to the "information spheres" (i.e., space and cyberspace) are the "final element" of PRC anti-access capabilities.¹⁰⁷ The depth and sophistication of these anti-access forces mean that the Air Force can no longer fall back on the post-Cold War model of unopposed, optimal basing from which to conduct operations.

China's area-denial capabilities have also undergone an important, rapid evolution. Largely adapting Russian anti-air systems, the PLA has taken advantage of modern microprocessor technology to build modern air defense systems consisting of fighters and surface-to-air missiles, and sophisticated, hardened fiber-optic command and control networks that link them together into an integrated air defense (IAD) network. One expert on these systems, Carlo Kopp, notes that "The Asia-Pacific-Indian region is in the midst of a 'creeping arms race' characterized by the introduction of a very wide range of modern combat aircraft, guided missiles, and precision guided bombs, especially of Russian origin."¹⁰⁸ Exploiting the globalized market in high-technology components, materials, and software, the Chinese are fielding systems incorporating digital processing rather than Cold War analogue systems, allowing them much greater electronic agility and resistance to electronic countermeasures. The Chinese are able to engage airborne surveillance targets by employing long-range missiles, and to terminally defeat US precision weapons like the Joint Direct Attack Munition (JDAM) using missiles and guns. The Chinese can rely on their systems' high mobility to reduce their vulnerability, while degrading US stealth through low-band radars and passive electronic sensors. In summary, Air Force systems will increasingly be held at risk at their bases by PLA missiles and will also face a much more agile, competent foe as they attempt to penetrate an expanding PLA integrated air defense network.

The Air Force will be operating from a base-starved region against a foe holding an increasing number of US bases at risk.

¹⁰⁶ For a thorough, analytical treatment of the anti-access problem, see Christopher J. Bowie, *Meeting the Anti-Access and Area-Denial Challenge* (Washington, DC: Center for Strategic and Budgetary Assessments, 2002).

¹⁰⁷ For more on the anti-access challenge, see the 2009 Military Power of the PRC report, pages 20–24.

¹⁰⁸ Much of the information in this paragraph comes from Carlo Kopp and his Airpower Australia website, an amazing, deep source of up-to-date information about Russian and Chinese air defense systems. See <http://www.ausairpower.net/region.html>, accessed on 23 March 2009.

Commons Denial

Not only is the PLA pursuing an aggressive program of fielding anti-access/area denial capabilities, it is also taking steps to deny US forces free use of the global commons, which comprises international airspace, international waters, space, and cyberspace. All contribute to global economic expansion when freely accessible, as they are major highways of economic exchange. Of significance, the cost of maintaining commons access exceeds the cost of denial by a substantial margin.

Chinese challenges to US access to the global commons are increasing. In April 2000, a PLA Navy F-8 interceptor collided with a US P-3 Orion aircraft as part of a routine PLA operation to harass and impede US aircraft legally operating in international airspace.¹⁰⁹ In January 2007, the PRC's Second Artillery Corps conducted a successful anti-satellite test against one of its decommissioned weather satellites, effectively calling into question the viability of any satellite in low-earth orbit.¹¹⁰ In November 2007, a PLA Navy Song-class diesel submarine surfaced dangerously close to the USS aircraft carrier Kitty Hawk, which was conducting routine operations in international waters. According to the editor of Jane's Fighting Ships, Commodore Stephen Saunders, it was a direct challenge to the US Navy's freedom to operate: "It would tie in with what we see the Chinese trying to do, which appears to be to deter the Americans from interfering or operating in their backyard, particularly in relation to Taiwan."¹¹¹ Finally, the Department of Defense reported in 2009 that the PRC continues to target computer systems with cyber attacks, including those of the US Government and other nations.¹¹² These represent not a series of unrelated incidents, but at best a callous disregard for international convention, and at worst a systematic attempt to challenge the unfettered movement of goods, services and information in the global commons. The effects of China's activities on Air Force operations will be felt in the space and cyberspace areas, which they depend upon for command and control of their forces

Weakening Deterrence and Mounting Crisis Instability

The effects of China's military buildup are not limited to potential combat scenarios. In fact, the impact on US diplomatic leverage might be even more important, because

¹⁰⁹ "An EP-3E Aries II in China," accessed at <http://www.jdunman.com/Intell/hainan.htm> on 12 January 2009.

¹¹⁰ Ashley Tellis, "Punching the US Military's 'Soft Ribs': China's Antisatellite Weapon Test in Perspective," Carnegie Endowment for International Peace Policy Brief #51, June 2007, page 4. Accessed at: http://www.carnegieendowment.org/files/pb_51_tellis_final.pdf, on April 13, 2009.

¹¹¹ Matthew Hickley, "The uninvited guest: Chinese sub pops up in middle of US Navy exercise, leaving military chiefs red-faced," Mail Online, 10 November 2007, accessed at: <http://www.dailymail.co.uk/news/article-492804/The-uninvited-guest-Chinese-sub-pops-middle-U-S-Navy-exercise-leaving-military-chiefs-red-faced.html> on 23 March 2009.

¹¹² See the 2009 *Military Power of the PRC*, pages 52–53.

they weaken two important pillars of security in the Pacific: deterrence and crisis stability.

The shift in the military balance will not be limited to the United States and China. If forward-based US forces increasingly can be held at risk and their deployment and employment survivability called into question, the effect on allies and potential allies in the region could be substantial. PRC leaders might be more tempted to engage in acts of coercion or military aggression. Regional configurations of power will shift as nations calculate whether to balance against China or bandwagon with it as Beijing's sphere of influence grows. Nations like Japan, seeing the US fail to take countervailing action as the US security guarantee loses credibility, may decide to "go it alone" by building offensive systems that might further destabilize the region. A key to preserving stability, then, centers on whether the United States is willing and able to offset China's growing military capability, either alone or in combination with its allies and partners. The Air Force can make a major contribution to peace and stability by adapting its force posture in the region to reflect these emerging realities.

Bolstering Deterrence and Increasing Regional Stability

As discussed earlier, the Air Force's strategic goal in the emerging strategic competition with the PRC should focus on bolstering deterrence and improving regional crisis stability. In the coming years, the balance of power dynamics in the Pacific region will be dominated by the interaction between the PRC's expanding comprehensive national power and influence and the long-distance, but still substantial national power and influence of the United States.¹¹³ The interaction need not be hostile, and to this end, the Air Force should adopt a strategy designed to shape Chinese strategic choices in a direction that minimizes the opportunity for miscalculation.

A US strategy focused on greater crisis stability in East Asia must focus on moderating the effects of China's growing military power by pursuing three primary objectives: (1) deterring a near-term confrontation over Taiwan; (2) dissuading PRC military adventurism elsewhere; and (3) diminishing the incentives for PRC leaders to engage in coercion. Rather than adopting a mutual "war-fighting" posture that would lead to greater instability, the Air Force can take actions that bolster a sense of greater strategic circumspection when inevitable crises occur, and incentivize the PRC to take reciprocal actions that reinforce crisis stability.

To maintain crisis stability in the region and to assure Pacific allies that the United States will not abandon them in the face of Chinese threats or coercion, the US military will have to undertake some major changes in its approach to the military competition. In practical terms, this will demand that the Air Force and Navy components of

Rather than adopting a mutual "war-fighting" posture that would lead to greater instability, the Air Force can take actions that bolster a sense of greater strategic circumspection when inevitable crises occur.

¹¹³ According to the Secretary of Defense's 2009 report on PRC military power, the term comprehensive national power "...is the concept by which China's strategic planners use qualitative and quantitative variables to evaluate and measure China's standing in relation to other nations." Office of the Secretary of Defense, "Military Power of the People's Republic of China 2009," Annual Report to Congress, page 2.

Pacific Command (PACOM) demonstrate an ability to both overcome anti-access and area-denial challenges, as well as maintain access to the commons—all with an eye toward building more crisis-stable force postures.¹¹⁴ Achieving those goals requires PACOM to limit the PRC's growing ability to cripple US or allied forces and bases in the region. As the 2008 National Defense Strategy stated, "We must build our ability to both withstand attack—a fundamental and defensive act of deterrence—and improve our resiliency beyond an attack."¹¹⁵ That, in turn, disincentivizes any adversary to preempt.

The Air Force's Pacific posture has changed somewhat in the past five years, with the introduction of F-22 squadrons at Elmendorf AFB in Alaska, and an agreement to base RQ-4 Global Hawk UAVs in Guam. Yet, despite the growing challenge posed by the People's Liberation Army Air Force (PLAAF) and the PLA's burgeoning land attack missile forces (Second Artillery), the Air Force has generally neglected its forces in the Pacific (compared to those in Europe and the Middle East). It was widely known, for example, that in 2003, when the PACOM commander, backed by the commander of US forces in Korea, requested B-52 rotational basing in Guam in 2003, Air Staff and Air Combat Command resisted. In addition, repeated attempts to obtain military construction funding for the hardening of vulnerable forward base facilities in the Pacific have perennially failed to survive the Air Force budget process.

Many critical investment priorities that would contribute to power projection while bolstering crisis stability, such as building hardened shelters and supporting base infrastructure improvements at Andersen AFB, Guam, or expanding aircraft dispersal sites on islands like Saipan, Tinian, or Wake, are not in the current Air Force program. That program does not even include hardening the Andersen AFB runway, which still suffers from the wear-and-tear incurred during Vietnam-era B-52 operations. This makes it much harder for the Air Force to justify costly fighter programs like F-22 and F-35 when it refuses, at a small fraction of the program cost, to protect those jets and their increasingly vulnerable supporting infrastructure.

The expanding PLA cruise and ballistic missile threat arc and the increasing ability of these weapons to strike US air and naval bases, along with the atrophy of Pacific basing (both in numbers and defenses), threatens to hamstring the US military's ability to project air and naval power across the region.¹¹⁶ However, the risk to US forward bases is not the only challenge to be confronted. Bolstering deterrence and improving

¹¹⁴ Whereas other nations like Russia and Iran pose an emerging threat that must be considered as part of the strategic landscape, due to the daunting range, basing, anti-access and area denial challenges posed by the PRC, any capability that addresses the PRC threat should be adequate to handle those problems, too.

¹¹⁵ 2008 National Defense Strategy, page 12.

¹¹⁶ For a summary of the rapid concentration of US military power in Guam, see Shirley A. Kan and Larry A. Nicksch, "Guam: US Defense Deployments," Congressional Research Service report #RS22570, 26 February 2008.

crisis stability in East Asia will put a premium on survivability, strategic reach, persistence, and sustaining operations in opposed network environments.

Survivability

Survivability is an essential characteristic of effective military forces. To be effective against the kinds of capabilities being developed and fielded by the PLA, Air Force aircraft need to be able to penetrate into and operate within heavily defended airspace. Given the increasing sophistication of the PLA's integrated air defense system, as well as the maturation and global diffusion of modern air defense systems, stealth will likely become increasingly central to force survivability in "high-end" threat environments. Unfortunately, only a small fraction of the Air Force fleet — 16 operational B-2s and fewer than 150 F-22s — exploits the level of modern low-observable characteristics required to attain that level of strategic effect. Moreover, the Air Force has no stealthy, penetrating ISR aircraft, which are the key to knowing what the adversary is doing, and provide timely updates on the location of various key targets. Dense, modern integrated air defenses like those being fielded by Russia and China are so lethal they simply cannot be challenged by non-stealthy platforms. Although sensor systems may emerge that reduce the effectiveness of current signature-reduction technologies, a stealthy aircraft employing traditional tactics, techniques, and procedures for evading enemy sensors — including sensor avoidance, terrain masking, electronic warfare, and high-speed, low-level flight — will almost certainly remain far more useful against a broad range of threats than will non-stealthy aircraft.

It should be noted that there is a powerful synergy between stealth and electronic warfare. Air defense radars and other sensors with the sensitivity required to detect and track a modern low-observable aircraft can be more easily jammed, disrupted, or spoofed than those designed to operate against non-stealthy platforms. US planners must also attend to the survivability of the entire reconnaissance and strike force, including air refueling.

Strategic Reach

Strategic reach constitutes a major weakness in the current Air Force plan, which over-emphasizes short-range, multi-role fighters like the F-35 over platforms with longer effective range. Strategic reach is important because it enhances the US military's freedom of maneuver. In particular, it expands the number of potential bases from which the Air Force can operate, complicating a prospective adversary's planning. Increased reach also increases routing flexibility, reducing the chances that US operations will be stymied owing to the lack of overflight rights. Finally, and most critically, reach in the form of unrefueled combat radius is essential for holding deep-inland targets at risk. Neither the atrophying US overseas basing structure nor the

Dense, modern integrated air defenses like those being fielded by Russia and China are so lethal they simply cannot be challenged by non-stealthy platforms.

emerging anti-access missile threat are conducive to short-range operations, the core element of the current Air Force program.

Persistence

The requirement for persistence stems, in part, from the mobility of many of the key anti-access and area-denial systems employed by the PLA, including various sensor and communication systems, electronic warfare vehicles, and most of all, missile launchers. US aircraft will likely need to loiter for extended periods in order to locate these high-value targets, which will often be difficult to detect. Being in detection range at the right time will be a critical ingredient for operational success. This need for persistence will likely place a premium upon extended mission endurance, which favors unmanned platforms over manned ones. To perform this mission in heavily defended airspace, it will also be essential for aircraft to be stealthy, have great endurance, and have access to protected communications. Unfortunately, the entire Air Force ISR fleet currently lacks either strategic reach or low-observability (stealth).¹¹⁷

Opposed Network Capability and Electronic Warfare

Finally, the Air Force must emphasize the ability to operate in opposed network environments and begin to re-establish itself as the world leader in electronic warfare. Although much of the capabilities in this area are classified, the evidence is strong that the Air Force strategic plan lacks the proper emphasis on protected space communications for a variety of airborne assets. The Service also seems to accept the vulnerability of space assets, and has done little to correct the dearth of developmental work on terrestrial alternatives to space communications. This is worrisome, as the future warfare environment, even in irregular warfare scenarios, will likely be characterized by degraded communications and sophisticated electronic combat. The Air Force cannot wish this problem away. It must embark on a program to develop the necessary capabilities in these warfare areas, and establish a better balance between passive and active warfare in the electromagnetic spectrum.

As mentioned several times in this section, the current Air Force strategic plan and program of record does not fare well when subjected to these criteria. Air Force bases are increasingly held at risk by the PLA, and little is being done to disperse, harden, or defend them, while US space forces are vulnerable to jamming, disruption, and destruction. Air Force platforms lack stealth in numbers, range, and persistence appropriate for the task in the Pacific, and suffer from shortfalls in range and persistence. Finally, the Service's forces are insufficiently configured and trained for realistic, communications-opposed environments.

The Air Force seems to accept the vulnerability of space assets, and has done little to correct the dearth of developmental work on terrestrial alternatives to space communications.

¹¹⁷ Surveillance satellites, by contrast, have strategic reach, but lack the capacity for staring surveillance and travel deterministic orbits easily know to adversaries.

ADAPTING TO A NUCLEAR-PROLIFERATED WORLD

In the next twenty years, it appears likely that more countries will possess nuclear weapons. Although most military planners understand the gravity of this prospect, it remains the most neglected of the three major strategic challenges emphasized in the 2006 QDR. Nevertheless, the Air Force must be ready to address this challenge; doing so will require a return to concepts of deterrence and crisis stability and, in extremis, the conduct of warfare against nuclear-armed entities.

Deterrence is achieved when opponents understand that the United States is willing and able to impose unacceptable costs on them should they commit an act of aggression. Nuclear forces will be an intrinsic element of US deterrence efforts in a more proliferated world. Deterrence will be enhanced if the Air Force remains the global leader in three areas: surveillance/warning, nuclear strike, and science/technology. An adversary who considers employing nuclear weapons against the United States or its allies must know that the response would be overwhelming and devastating — that the costs incurred would far outweigh any conceivable benefits. Finally, rivals must know that the United States retains a credible option for nuclear escalation in the event US national survival is at stake.

With regard to hedging against the prospects of a proliferated (nuclear) world, persistent surveillance emerges — as it does in the other challenges — as a critical capability. The argument to enhance the Services' intelligence, reconnaissance, and surveillance (ISR) platforms is persuasive. Given the growing number of nuclear powers, prudence dictates that future Air Force ISR and strike systems be hardened against nuclear effects and be able to survive in fairly sophisticated air defense environments, suggesting all-aspect stealth characteristics. Stealth is important in three ways that all have strategic consequences: (1) it opens the possibility and increases the probability of unwarned US strike; (2) it contributes to persistence and effectiveness in contested airspace; and (3) it obliges the adversary to invest in air defenses, increasing regional stability due to their inherently defensive nature. Combined with extended range and opposed-area network connectivity, stealth becomes a key force multiplier that boosts crisis stability by providing the US surveillance and interdiction of nuclear-armed adversaries. In addition, the ability of a nuclear-armed regional power to hold nearby regional bases at risk will demand these systems have the inherent ability to operate from extended range.

State actors are not the only potential danger in a proliferated world. As more nations acquire nuclear capabilities, the chances of a non-state group acquiring a nuclear weapon also rise. The importance of detecting, tagging, tracking, and intercepting nuclear materials and weapons becomes clear and compelling. The detection of nuclear materials at range poses an especially challenging problem. If this can be accomplished, the task of tagging, tracking, and locating nuclear materials and forces will benefit from persistent overhead monitoring by space and air platforms. Success will also be dependent upon enhanced integration between various elements of the

The Air Force is building a “middle-weight” force structure that is much too sophisticated and expensive for low-end or irregular conflicts, while also lacking needed capabilities to address challenges at the high end of the military competition.

US intelligence community. Special operations units will not have the organic ability to plan and conduct a wide variety of counter-proliferation and nuclear weapon elimination missions without Air Force help, requiring closer coordination between air, space, and Special Operations Forces (SOF)—much as inter-theater air mobility forces interact with certain SOF elements today.¹¹⁸

IMPLICATIONS: THE HIGH-LOW FORCE CHALLENGE

The fundamental conclusion from the preceding mission analysis is that the Air Force is building a “middle-weight” force structure that is much too sophisticated and expensive for low-end or irregular conflicts, while also lacking needed capabilities to address challenges at the high end of the military competition.

By way of example, the F-35 Lightning II—by far the Service’s most expensive modernization effort—serves as a classic “middle” capability that lacks critical performance characteristics (e.g., range) needed to meet high-end challenges, while it is over-specified and overpriced for the low-end challenges. For example, the F-35’s limited range makes it largely unsuitable for land-based operations in the western Pacific without substantial aerial refueling, which itself will be held at risk. Operating from available bases beyond China’s anti-access/area-denial (A2/AD) umbrella, a large force of F-35s would require far more air refueling support than the Air Force could provide given scarce basing for refueling assets and overall joint refueling requirements. To base the F-35s within the PLA’s (A2/AD) umbrellas is to place them at great risk from Chinese ballistic and cruise missiles.¹¹⁹ Making matters worse, the F-35 does not carry enough air-to-air missiles to deal with mass incursions of modern PLA fighters with greater missile-carrying capacity, and it lacks the multi-azimuth low-observable (i.e., stealth) features to survive in an all-aspect high-threat environment. In sum, if, as the 2006 QDR posits, the PLA is the most dangerous potential future high-end adversary, DoD cannot justify its enormous investment in the F-35 program, since the Lightning II will encounter significant obstacles just getting to the fight, let alone winning it. The same ill fit appears on the other end of the conflict spectrum, where the F-35’s low-observable features, escalating cost, and nineteen million lines of computer code make it a great deal more expensive to buy, and more complicated to operate and sustain, than the Predator or Reaper UAVs, which are

¹¹⁸ Known as special operations low-level II, or SOLL II forces, the crews require unique training and capabilities to carry out their mission. See Richard E. Williamson, Jr., “C-17A Special Operations Low Level II (SOLL II) Supporting the Combatant Commander,” Master’s thesis, Wright-Patterson AFB, OH: Air Force Institute of Technology, 2004).

¹¹⁹ This is not an argument for the F-35B short takeoff-landing (STOVL) version—quite the contrary. The ability to produce any sort of meaningful sortie rate against an adversary like the PRC employing the F-35B is remote. There may not be a better example of a system “lost in the middle” than the F-35B.

performing well beyond expectations and scoring the majority of high-value hits in Iraq and Afghanistan.¹²⁰

US space constellations provide another example of “middle-weight” capabilities. They are far too sophisticated for irregular warfare challenges where terrestrial alternatives cost far less, but are increasingly vulnerable to denial (e.g., jamming) and destruction by sophisticated adversaries. In a recent study for the Air Force’s Center for Strategy and Technology, Lieutenant Colonel Joseph Huntington noted that “Continued technological advances and proliferation of anti-satellite capabilities will enable more adversaries to possess the means to attack or interfere with United States satellite operations.”¹²¹ Although he concentrated on the threat from directed-energy weapons, a variety of means exist or are being developed to hold US satellites at risk, effectively neutralizing unprotected US constellations’ ability to provide global military support.

How can the Air Force modify its program of record and strategic plan to minimize “middle” capabilities and maximize the high-low mix? The next chapter offers some alternatives, including policies, organizations and equipment, that would better orient the Air Force toward key existing and emerging security challenges.

¹²⁰ The Government Accountability Office recently reported that the JSF will require over 19 million lines of computer code and had released only 35 percent of that code as of March 2006, which JSF program officials consider a high risk item. GAO-06-391, “Assessments of Selected Major Weapon Programs,” Government Accountability Office, March 2006: pages 71, 72. A Center for Strategic and International Studies report stated that Predator UAS were “the most critical pacing function and shortfall for man-hunting missions in CENTCOM.” Clark Murdock, et al., “Special Operations Forces Aviation at the Crossroads,” Center for Strategic and International Studies (CSIS), September 2007: p. 7.

¹²¹ Joseph Huntington, “Improving Satellite Protection with Nanotechnology,” Air War College Center for Strategy and Technology, Blue Horizons Paper, December 2007: page 3. Accessed at: <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA474825&Location=U2&doc=GetTRDoc.pdf> on 5 November 2008.



CHAPTER 3 > ASSESSMENT AND RECOMMENDATIONS

Since World War II, the United States Air Force has pursued a consistent and coherent institutional vision based around the strategic and operational employment of air and space power. It continues to provide exceptional service to the nation, recruits and develops some of the most highly trained, educated, and motivated people in government, and remains the envy of the world's air forces. Airmen still project the same enthusiasm and optimism about their profession as did the earliest Signal Corps aviators. The core of that vision is a warfighting philosophy that maximizes US power projection while minimizing vulnerability.

The dimensions of this vision were indelibly etched by the four decade-long competition with the Soviet Union, as well as the extended air campaigns in Korea and Vietnam. The long Cold War competition was one in which the Air Force generally realized that vision and as a result, enjoyed strategic and operational superiority over its Soviet counterparts. The question at this juncture is whether that legacy is sufficient to propel the Air Force into the future as a vibrant, effective national security institution. The Air Force now faces a number of looming operational challenges that cannot be adequately addressed if it remains on its current trajectory.

These challenges are accentuated by the Air Force's institutional identity crisis, aging force structure, and force posture mismatches relative to future challenges. This chapter outlines key assessments and recommendations for the rehabilitation and rationalization of the Air Force, all under budgetary constraints. To stay within those constraints and avoid a wish-list approach, this chapter presents a menu of options that reduce the Service's "middle-weight" forces—those optimized for conventional, high-intensity conflict of the type experienced in the Korean War, Vietnam War, and First Gulf War, and anticipated in the event of a European conflict during the Cold War—and accentuates low-end and high-end forces more congruent with anticipated strategic challenges. It also suggests ideas, concepts, and doctrines that will increase the Air Force's strategic and operational flexibility in order to better address a wide variety of those challenges.

The recommendations are divided into three main sections: one on the steps the Air Force might take to reinvigorate and reestablish Service as a viable, influential force in the defense policy debate; one on recommended changes to force structure and platform plans under budgetary constraints; and one on changes to Air Force basing posture. The following recommendations should be viewed as a catalyst for debate and as a guide to asking the right questions and demanding comprehensive answers from the custodians of American air and space power.

AIR FORCE INSTITUTIONAL IDENTITY

The Air Force cannot begin to address its aging aircraft or force composition problem, its overseas basing atrophy and vulnerability challenges, or a variety of other operational and force structure issues, without attending to its institutional identity crisis. That crisis is not just perceived by outsiders, it is also felt by its members, many of whom have observed or even become a part of an ideological malaise within the Air Force that seems to have accelerated in the past eight years. This situation cannot be turned around solely by a charismatic leader; it must be the product of consistent, principled, committed leadership over many years. To that end, the following recommendations should be considered as rehabilitative measures to be implemented along with force posture (platforms and bases) changes detailed in the next section.

Restore the Legacy of Superior S&T and R&D

In successful technology enterprises, science and technology (S&T) research, and research and development (R&D) are tightly coupled with top management. Organizational strategy and S&T/R&D are inextricably linked, and must be integrated by leaders who fully understand both. The Air Force's early leaders, Generals Hap Arnold, Curtis LeMay, Thomas White, and George Brown, had the same intimate relationship with Air Force S&T/R&D that today's successful technology CEOs have with their R&D enterprises.¹²² Those men built a dominant Air Force technology enterprise, first around Air Research and Development Command (1950) and later, Air Force Systems Command (1961), shaping R&D efforts in accordance with their strategic vision.¹²³

¹²² To understand General Henry H. "Hap" Arnold's seminal influence in this area, see Dik Daso, *Architect of American Air Supremacy: General Hap Arnold and Dr. Theodore von Karmann* (Maxwell AFB, AL: Air University Press, 2003).

¹²³ For a good overview of USAF R&D efforts in the 1950s and 1960s, see Walter J. Boyne, *Beyond the Wild Blue* (NY: St. Martin's Press, 1997) pages 110–124 (describing the dramatic acceleration of the USAF ballistic missile program and revolutionary changes to aviation technology), and 191–197 (AFSC and its broad research agenda that led to success in Operation Desert Storm). To see personal interviews of some giants of Air Force research and development that inform the judgments made in this section, see Jacob Neufeld, ed., *Research and Development in the United States Air Force* (Washington, DC: Center for Air Force History, 1993).

Although it was better to have someone in the chief's chair who was adept at leading warriors and scientists, the most enduring arrangement was developed by nurturing specially-developed and educated leadership at Systems Command. Generals Bernard Schriever (aeronautical engineering, Stanford University), Samuel Phillips (electrical engineering, University of Michigan), Lew Allen (physics, University of Illinois) and Robert Marsh (aeronautical engineering, University of Michigan) each had a vivid understanding of the future operational requirements and technical challenges of the force, and they translated that understanding into specific blueprints for Air Force S&T and R&D.¹²⁴ As historian Walter Boyne noted in his encyclopedic history of the Air Force, the first commander of AFSC, General Bernie Schriever, "launched it on a course that would be responsible for the remarkable flowering of research and development within the Air Force," calling the scope of its work "breath-taking" and highlighting visionary endeavors promoted by Schriever such as Project Forecast, which led to breakthroughs such as precision-guided munitions.¹²⁵ Officers like Schriever stood astride a hierarchy of officers within Systems Command, each on a technology-centered career path that could lead to four-star rank.

Today's Air Force S&T community pales by comparison, a result of the dissolution of Systems Command in 1992 and the steady atrophy of the link between the Service's strategic direction and its R&D activities. Within today's Air Force Material Command, led by a coalition of logistics specialists and rated generals often lacking technical education and serving brief rotations, Air Force S&T appears to be adrift, having essentially outsourced important investment decisions to mid-level technologists in the hope that they produce something useful absent strategic direction.¹²⁶ As a result, while the Air Force still spends an enormous amount on S&T, much of it may be spent unwisely — at great opportunity cost — due to lack of leadership, priorities, and connection to operational needs and emerging threats.

The next-generation bomber (NGB) program presents a classic example of the Air Force's self-induced S&T predicament. New systems like NGB enter the far-term planning horizon and huge amounts of S&T funding are promised to make the next system a transformational marvel. The Air Force S&T community starts working on plans and activities using its own budget, but the big S&T investments keep getting slipped at one-year increments. After several years of deferred, distracted S&T investment, the operational need for this system becomes so dire that its target deployment date is accelerated and, consequently, only "mature" (legacy) technologies can be employed. Thus, the current NGB design suffers from the unavailability of highly-efficient variable bypass engines and super-efficient advanced wing designs (such as Aeroservoelastic, or ASE), two technologies that would have been ready today

¹²⁴ This is especially critical for staying at the cutting edge of cyber operations and electronic warfare, and translating that into operational capabilities.

¹²⁵ Boyne, *Beyond the Wild Blue*, 191–197.

¹²⁶ Only one current Air Force four-star general has an advanced degree in engineering or science.

While curing Air Force S&T and R&D requires strong medicine, correcting the information technology (IT) situation and its operational manifestation, cyber warfare, likely requires surgery.

had they been accorded adequate funding over the past decade.¹²⁷ When the S&T community complains that the S&T is not ready because adequate funds were never provided, they are told that another more advanced follow-on is being planned for some time beyond the planning horizon and the dysfunctional cycle begins anew. The result is that today's Air Force is flying and applying band-aids to airplanes with 1970s-era aero, structural and propulsion technology.

While curing Air Force S&T and R&D requires strong medicine, correcting the information technology (IT) situation and its operational manifestation, cyber warfare, likely requires surgery. A strong case can be made that the development of defense-related IT is incompatible with the current defense acquisition system, if only from a conception-to-fielding timeline perspective. Cyber warfare S&T and R&D appear to require an entirely new approach with greatly accelerated developmental, integration, and modification timelines. The same applies to the dangerous and more encompassing field of electromagnetic spectrum warfare, which has undergone a quiet renaissance that requires institutional focus rather than post-Cold War drift.

Air Force problems in S&T are mirrored by a very large and expensive R&D infrastructure left over from Systems Command and left largely untouched for decades. Air Force Research Laboratory (AFRL) facilities soak up substantial resources, most of which are hidden and unchallenged because they are spread throughout every R&D project, making in-house R&D uncompetitive and expensive.

The Air Force must explore less expensive, more responsive alternatives. Substantial savings might be achieved, for example, by converting laboratory organizations to a more DARPA-like model in which AFRL adopts a venture capitalist role by selecting, funding, directing, and critically overseeing work in specific R&D investment portfolios carried out by contractors and universities. In fact, at least two of AFRL's most productive recent programs, called Integrated High Performance Engine Technology (IHPTET), which led to breakthroughs in the F-22 and F-35 engines, and SensorCraft, which involves revolutionary airborne ISR design concepts,

¹²⁷ Also called Active Aeroelastic Wing (AAW) in its NASA configuration, research in this area "enables thinner, higher-aspect ratio wings... which could result in reduced aerodynamic drag, allowing greater range or payload, and improve fuel efficiency." "Active Aeroelastic Wing," NASA Dryden Flight Research Center, accessed at <http://www.nasa.gov/centers/dryden/news/ResearchUpdate/AAW/index.html> on 1 September 2008. The ASE wing can change its shape through wing distortion that constantly optimizes wing characteristics based on the flight requirement, and does so without the need for ailerons, elevators, or a rudder, improving radar low-observability. This, in turn, can provide higher lift/drag ratios and laminar flow across greater wing areas, reducing propulsion for a given speed and increasing platform endurance. See Sunil C. Patel, "Morphing Wing: A Demonstration of Aero Servo Elastic Distributed Sensing and Control," American Institute of Aeronautics and Astronautics, 2005, accessed at <http://tiims.tamu.edu/2005summerREU/papers/Patel.pdf> on 16 July 2008. The ADVENT engine promises substantial increases in endurance by optimizing jet engine bypass ratios, which for normal jet engines are fixed values. For a thorough discussion of the ADVENT program along with other links to ADVENT information, see "The ADVENT of a Better Jet Engine?" *Defense Industrial Daily*, 1 October 2007, accessed at <http://www.defenseindustrydaily.com/the-advent-of-a-better-jet-engine-03623/> on 18 July 2008.

were executed in exactly this manner.¹²⁸ R&D investments must concentrate on areas with a high potential Air Force return on investment and capabilities effective against relevant threats that can be developed, fielded, and integrated at a reasonable cost. This requires senior uniformed scientific and technological competence, the confidence and discipline to kill weak programs, and the strategic vision to set a technologically achievable course. The Air Force's future cannot be outsourced, nor can it be led by touch-and-go operators. It must come from a cultivated line of experts.

While re-establishing a four-star Systems Command may not be practical in the near term, Air Force leadership must take concrete steps to reconnect with its own S&T and R&D communities. This means recreating career paths for technology professionals and cultivating senior generals who have both warfighting and technology expertise. The Air Force simply must develop a cadre of operator-technologists who can stand confidently with one foot in each world.

The Air Force should also rededicate its S&T and R&D investments to four areas critical to its future: aircraft and spacecraft propulsion, efficient aerodynamics, new sensors, and electromagnetic spectrum competition (e.g., stealth, cyber operations, electronic warfare). Over the past thirty-five years, the Air Force has seen spectacular returns on modest investments in these four areas. As Service leaders and scientists drifted apart after the Cold War, funding for these four pillars was short-changed, with frustrating consequences. In particular, the Air Force should maintain continual funding of prototypes or demonstrator aircraft. A robust and competitive prototyping program can help maintain the US lead in low observability and aircraft performance, and there seems to have been a dangerous lull in prototype funding in the past decade. Prototyping is expensive, but there is no adequate substitute for it, and the historical return on investment has been excellent.

Finally, certain support technologies have the potential for good returns on relatively small R&D investments. New munitions could be great force multipliers. Although quick to develop thermobaric bombs in response to operations in the mountains of Afghanistan after 9/11, the Air Force neglected proposals to develop low-collateral-damage fuze designs that would de-arm guided weapons if they failed to steer properly; failed to put laser-guidance on its low fragmentation "focused lethality munition" (FLM); did not support efforts to develop a 70 millimeter laser-guided rocket for UAV use; and was beaten to the punch by the Navy (which initially lagged in developing

The Air Force simply must develop a cadre of operator-technologists who can stand confidently with one foot in each world.

¹²⁸ Nick Cook, "US global reconnaissance/strike revolution picking up speed: operations in Afghanistan show how far US forces have already progressed along the road to "network-centric" warfare," *Interavia Business and Technology*, January–February 2002, accessed at: http://www.entrepreneur.com/tradejournals/article/83661877_2.html, accessed on 27 March 2009.

The world's preeminent air force cannot survive on a diminishing diet of air and space technology development.

guided weapons) in developing the BLU-126 low collateral damage bomb.¹²⁹ There is also a growing need to explore advanced air-to-air missile propulsion and sensor concepts as other nations develop ways to blunt the air-to-air missile “AMRAAM advantage” that underpinned decades of air dominance.¹³⁰ Also, land-based air forces have proven historically effective in the anti-ship role, and it would seem advisable to pursue new ship attack systems such as cruise missiles and air-delivered mines.¹³¹ Other emerging fields like micro-electromechanical systems (MEMS) and nanotechnology show great promise over the long haul, especially if research is tightly focused on areas like aerodynamics, propulsion, sensors, and electromagnetic warfare.

The need for the Air Force to do large-scale in-house S&T in areas such as munitions and micro/nanotechnology, however, is questionable. Industry and universities are much more agile, and except for test ranges and wind tunnels, there are few expensive infrastructure requirements that warrant direct government participation. In these niche areas, Air Force Materiel Command should focus on two things: providing world-class specialized test facilities, and acting as a venture capitalist: selecting, funding, directing, and overseeing competitive industry projects.¹³²

The world's preeminent air force cannot survive on a diminishing diet of air and space technology development. This enterprise has its own unique language, sociology, and culture. Much is being written about the need to understand foreign languages and cultures, but here is one that requires at least as much focused attention and intervention, and arguably could provide a greater strategic payoff. Reviving this cornerstone establishment by revitalizing its people, focus, and relevance must be a high priority for those interested in the Air Force's long-term rehabilitation.

¹²⁹ For a brief history of the 70mm (2.75”) guided rocket, see “Guided Air-Ground Rockets: Program Halts and New Entries,” *Defense Industry Daily*, July 9, 2008, accessed at <http://www.defenseindustrydaily.com/guided-hydra-rockets-program-halts-new-entries-03157/> on September 7, 2008. FLM uses a composite bomb body to minimize collateral-damage causing fragmentation, but was only produced using a less-accurate GPS guidance system rather than more accurate laser-guidance, which could be incorporated at very little cost or additional program complexity.

¹³⁰ For an example of potential long-range, multi-mode seeker designs, see Carlo Kopp, “Grisha's Missile Shoot-Off,” *Airpower Australia*, April 20, 2008, accessed at <http://www.ausairpower.net/APA-NOTAM-200408-1.html> on 28 July 2008. On Russian work to blunt AMRAAM, see Carlo Kopp, “The Russian Philosophy of Beyond Visual Range Combat,” 25 March 2008, accessed on 27 March 2009 at: <http://www.ausairpower.net/APA-Rus-BVR-AAM.html>. A controversial RAND briefing by John Stillion in 2008 highlighted the vulnerability of US AMRAAM-based air superiority capabilities. See the briefing at <http://www.scribd.com/doc/7774389/Rand-StudyFuture-of-Air-Combat>, accessed on 27 March 2009.

¹³¹ Two attempts to develop maritime strike capabilities — AMSTE and marinized JASSM — were canceled by ACC, and current low-altitude bomber-delivered Quickstrike mines have decades-old designs. For the history of land-based airpower conducting interdiction at sea, see Lawrence J. Spinetta, “Sinking Ships,” *Air Force Magazine*, Vol. 89, No. 7, July 2006, pages 78–82. See also, Carlo Kopp, “Maritime Strike Using the F-22A Raptor,” *Airpower Australia*, April 2007, accessed at <http://www.ausairpower.net/Raptor-ASuW.html> on 14 September 2008.

¹³² Aerospace technology and program expert Terry Mahon and former Air Force scientist Steve Rinaldi made substantive contributions to this section.

Restore the Credibility of Air Force Requirements Generation and Acquisition

As with nuclear operations (covered in a separate CSBA report¹³³), the Air Force's conventional weapon system requirements and acquisition processes fell into post-Cold War neglect and atrophy. Rehabilitating these efforts should focus in the near term on the full restoration of Title 10 "equip" authority for all Service air and space programs. While high-profile Air Force acquisition embarrassments like the "Druyun Affair" taught harsh and sobering lessons, the continuing delays and protests over aerial tankers procurement and combat search and rescue (CSAR) helicopters suggest that, despite top-level focus on this area, all is not well.

Secretary of Defense Robert Gates' decision to once again delay the air refueling tanker contract presents an opportunity for the Air Force to re-assert itself. For a Service to have its number one acquisition program managed by OSD is embarrassing to both the Air Force and OSD. If successful, the Service's efforts to fix the tanker contract process could place Air Force requirements and acquisition efforts back on a positive trajectory.

The Air Force is not the only Service experiencing acquisition difficulties. While hordes of analysts call for acquisition reform, various attempts to improve the process have had questionable effectiveness.¹³⁴ The defense acquisition process continues to experience a debilitating confluence of skyrocketing personnel and platform costs (making program extensions costly), out-of-control software development, and deteriorating government acquisition expertise and assertiveness. These problems affect the Air Force acutely due to its dependence on high-priced acquisition programs. The solution is not a secret: the book on acquisition reform was largely written by the Packard Commission in the mid-1980s. The law has also been written. Title 10 says the Services equip and present their budgets to the Secretary of Defense for top-level scrutiny before becoming a part of the President's budget. The closer the Defense Department can get to adherence to the Packard Commission's recommendations and Title 10, the better off it will be.¹³⁵

For the Air Force, this starts with building and maintaining a competent acquisition corps with senior leader oversight, a cohort that has atrophied dramatically since the end of the Cold War. The most vocal senior Air Force official on this issue has been General Greg "Speedy" Martin, who in his last assignment was the commander

For a Service to have its number one acquisition program managed by OSD is embarrassing to both the Air Force and OSD.

¹³³ Andrew F. Krepinevich, *US Nuclear Forces: Meeting the Challenge of a Proliferated World* (Washington, DC: Center for Strategic and Budgetary Assessments, 2009.)

¹³⁴ The previous administration canceled and rewrote all the acquisition manuals in 2002, which appeared to have little or no effect. Edward W. Rogers and Robert P. Birmingham, "A Ten-Year Review of the Vision for Transforming the Defense Acquisition System," *Defense Acquisition Review Journal*, January–April 2004, see especially page 53, Table 4, which outlines efforts over a decade to induce acquisition reform with little to show for it.

¹³⁵ Find an excellent compendium of 1986 Packard Commission documents at <http://www.ndu.edu/library/pbrc/pbrc.html>, accessed on 15 August 2008.

of Air Force Materiel Command (AFMC). In 2005, General Martin noted that the Air Force cut many of its uniformed program management experts during the 1990s in response to budget pressures, and passed program control over to major contractors, who themselves had cut many of their experienced program managers. Furthermore, he worried that outside agencies' impinging on Air Force budgets and programs (especially space systems) often led to "gold-plating" and spiraling costs. None of this will be easy to fix. As one long-time analyst put it, "...it took us years to get in this hole. It will take years to get us out."¹³⁶

There has also been a breakdown in the Air Force's requirements generation process, especially in the way it communicates with contractors about what it wants, and how it manages contract modifications. This is not just an "acquisition people" problem; it is also a failure of the Air Force staff. Part of that requirements drift can be traced to a lack of strategic vision that makes it difficult for various staffs to coalesce around a set of unifying force posture principles. Air Force senior leaders must continue to focus on fixing weaknesses in the requirements and acquisition system, and take action to earn back full Title 10 acquisition authority.

Restore Focus on Nuclear Operations

Nuclear operations were a — if not *the* — major focus for the Air Force during the Cold War. Executing the Single Integrated Operational Plan (SIOP) for general war against the Soviet Union consumed the efforts of major institutions like the Strategic Air Command (SAC). Dedicated nuclear forces, no-notice alerts, high attention to detail, and low tolerance for error defined the SAC institutional ethos. With the collapse of the Soviet Union and the dissolution of SAC, however, Air Force focus on nuclear operations and training waned. The consequences of that trend have now become a key dimension of the Air Force's institutional identity crisis.

The end of the Cold War brought about a climate of "nuclear denial" or benign neglect which permeated the US nuclear force posture. The Air Force's lack of focus was hastened, in no small part, by internal Service dynamics; the rising Air Force fighter community both supported and welcomed a reduced focus on nuclear weapons. Unquestionably, SAC's disestablishment hastened the decline of Air Force expertise in nuclear programs and nuclear surety. A recent series of public missteps revealed the effect of those years of neglect, culminating in the most significant removal of Service leadership in Department of Defense history with the firing of chief of staff General Buzz Moseley and Secretary of the Air Force Mike Wynne over a perceived lack of Air Force seriousness about nuclear issues. Not coincidentally, it also led to the

¹³⁶ For an excellent article covering Air Force acquisition woes, see Vago Muradian and Michael Fabey, "USAF revamps acquisition force," *Defense News*, July 25, 2005, accessed at <http://integrator.hanscom.af.mil/2005/July/07282005/07282005-06.htm> on 25 September 2008.

appointment of General Norton Schwartz as chief of staff—the first non-fighter pilot Air Force chief since General Lew Allen, Jr. in 1978.

The Air Force is now in the process of instituting tough rehabilitation measures for the nuclear community, to include allocating approximately 2,000 additional people to the nuclear mission and providing badly-needed equipment such as an extra squadron of B-52s. While these will put a dent in the Air Force's budget, they represent a prudent investment if coupled with the right policies, such as the formation of an Air Staff assistant chief of staff for Strategic Deterrence and Nuclear Integration (A10) and a three-star-led Global Strike Command.¹³⁷

Although the current Air Force leadership is instituting aggressive policies to address the decline in Air Force nuclear expertise and professionalism, it should emphasize three things while doing so. First, while a return to the high levels of accountability that reigned in SAC should constitute the therapeutic core of Air Force efforts, it must be balanced by positive incentives signaling that nuclear units and staffs no longer constitute a career “backwater” that should be avoided by the best and brightest. Rebuilding nuclear expertise will be impossible without a steady stream of top-notch people, and that requires career incentives. Second, efforts must be made not just to fix observed problems, but to delve into the entire nuclear enterprise; listening not just to blue-ribbon panels, but to the officers, enlisted people, and civilians who do the job every day. Only through a broad-based, grass-roots, ongoing SAC-caliber feedback and incentive system can problems in nuclear operations be avoided. Finally, nuclear planners must recapture a reinvigorated nuclear force posture vision more in tune with the future security environment, rather than only looking to forestall the next nuclear safety and accountability incident.

Rediscover the Air and Space Expeditionary Force Concept

When the Cold War ended, the Office of the Secretary of Defense imposed a “fighter wing equivalent” (FWE) metric to size the Air Force. Rather than posturing land-based air forces as aggregate, interdependent combat capabilities, the FWE reduced Air Force fighter force structure to numbers of aircraft, with one FWE being seventy-two combat-coded fighter aircraft. This metric did not account for important variables such as stealth, range, payload, aerial refueling, command and control, deployability, or even widely varying combat roles; yet it persisted. For example, in the Bottom-Up Review of the 1990s, major force commitments for various major regional contingencies included Navy carrier battle groups and active Army divisions, both composite

¹³⁷ Michael Hoffman, “A new leader for nuclear weapons,” *Air Force Times*, 2 November 2008, accessed at http://www.airforcetimes.com/news/2008/10/airforce_nuclear_airstaff_103108/ on 2 November 2008. Global Strike Command will incorporate 8th and 20th Air Forces, which will place intercontinental ballistic missile and nuclear bomber units under the same command for the first time since SAC was disbanded in 1992. Michael Hoffman, “USAF Unveils Global Strike Command,” *Defense News*, 24 October 2008, accessed at <http://www.defensenews.com/story.php?i=3787270> on 2 November 2008.

The Air Force today finds itself lacking adequate means of articulating its force structure in a bureaucratically useful, operationally-relevant, aggregated way.

units with broad combat utility, but only employed FWEs to describe the Air Force contribution.¹³⁸ Viewed this way, an A-10 was equivalent to an F-15C. While airpower became increasingly systemic throughout the 1990s, the anachronistic FWE concept persisted.

Although the 2006 QDR outlined a strong construct for thinking about the future, it further confused Air Force planning by suggesting an “86 combat wing” concept for characterizing its force structure.¹³⁹ Unfortunately, the combat wing concept merely substituted one artificial construct for another. Thus, the Air Force today finds itself lacking adequate means of articulating its force structure in a bureaucratically useful, operationally-relevant, aggregated way.

The Air Force should abandon the combat wing concept and adopt the AEF construct as the core of its future force planning methodology. Since its inception in 1999 the AEF rotation concept has served the Air Force extraordinarily well. It is the Air Force construct most familiar to joint force commanders, and is comprised of real forces in a real rotational base. Although a significant portion of the Air Force exists outside the rotational AEF construct, it is not difficult to incorporate those forces into the overall Air Force planning process alongside the AEF. If a capability should be part of a steady-state rotational base, then it should be planned to fit the 10 AEF construct. If not, other measures should be applied.

The Air Force should also explore how its AEFs could be tied more closely to DoD’s “steady-state security posture,” the vignettes that describe the day-to-day scenarios, advisory and partnership building efforts, and long-duration peace-making and peace-keeping efforts that will most likely continue to exert the greatest stress on the Air Force. By testing a current force against those vignettes, its own historical deployment patterns, and larger conventional contingency scenarios, Air Force leaders can explore configurations that would provide more relevant force sizing and composition modules. Such modules would be focused on the three future security challenges emphasized in this report, or on the emerging OSD force planning model. These modules, perhaps subsets of a nominal AEF, serving as analogues to the Navy’s strike groups or the Army’s brigades, would better link the force structure to OSD planning scenarios and improve strategic planning.

Bolster Joint Operational Credibility and Influence

The Air Force has another fundamental problem that can only be fixed by addressing its leader development process: the Air Force, compared to the other Services,

¹³⁸ John T. Correll, “The Legacy of the Bottom-Up Review,” *Air Force Magazine*, October 2003. Accessed at <http://www.airforce-magazine.com/MagazineArchive/Documents/2003/October%202003/1003bur.pdf> on 27 March 2009.

¹³⁹ 2006 QDR Report, page 47. See also, Adam J. Hebert, “Eighty-Six Combat Wings,” *Air Force Magazine*, December 2006, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2006/December%202006/1206wings.aspx> on 14 August 2008.

now exerts marginal influence on the development and implementation of joint operational strategy. As mentioned, Air Force flag officers fill a very small portion of top joint positions, especially regional combatant commanders. As a result, the Service often finds itself far from the center of strategy development. While Air Force leaders seem to have little direct control over the selection and assignment of joint leaders, they can improve their advocacy within the system while they upgrade the strategic competence of their senior officers, making them more attractive for selection to senior joint positions.

To accomplish that, the Air Force should begin a long-term rehabilitation of Air Force ideology, doctrine, messaging, and relationships with other key organizations.¹⁴⁰ First, the Air Force should consider an increased emphasis on graduate education among its general officers. A biographical review of the three- and four-star Air Force officers reveals very few hold advance degrees in science and engineering, business administration, or international relations — all keys to integrating the major strategic aspects of air and space power. Most important, none hold degrees from tier-one educational institutions. The Air Force should provide greater opportunities for in-depth officer education concerning the major processes and institutions of national security, starting by concentrating on their own history, structure, functions, and culture, as well as those of the other three Services.

In the end, however, one of the best ways to exert greater influence in joint force management and employment is to develop and advocate compelling ideas. Air Force leaders must begin to develop a set of alternative operational concepts that stake out important perspectives on the entire spectrum of joint military operations, not just ones relating to air and space. Four strong candidate mission areas for conceptual innovation are: high-end, asymmetric warfare; irregular warfare; counter-proliferation; and homeland defense.

Recapture Warfare Innovation

Because of the current emphasis on irregular warfare, novel operational concepts for warfare against adversaries who possess sophisticated guided weapons and modern networked forces seem to be lacking. The current debate about the future of warfare has been miscast as a duel between irregular and conventional warfare advocates.¹⁴¹ In fact, in the next twenty years, both categories of warfare are likely to diverge substantially from our present conception of them, mainly through the proliferation of advanced threat systems and technologies, and related new methods of operation.

The current debate about the future of warfare has been miscast as a duel between irregular and conventional warfare advocates. In fact, in the next twenty years, both categories of warfare are likely to diverge substantially from our present conception of them.

¹⁴⁰ For a good summary of the DAL process, instituted in 2000 by then Chief of Staff General Mike Ryan, but eventually drowned by institutional myopia, see Mike Thirtle, “Developing Aerospace Leaders for the Twenty-first Century,” *Aerospace Power Journal*, Summer 2001.

¹⁴¹ See, for example, Michael J. Mazarr, “The Folly of ‘Asymmetric War,’” *The Washington Quarterly*, Summer 2008: pages 33–53.

The Air Force should emphasize developing and promulgating innovative operational concepts for high-end warfare. Fighting against an adversary with increasing “network parity,” for instance, will place great stress on the joint force, demanding concepts for maintaining the integrity of friendly networks, collapsing enemy networks, and seeking new forms of cross-domain synergy. The following are but a few examples of areas in which the Air Force could take the lead in joint concept development:

- > **OPPOSED NETWORK OPERATIONS.** American forces will need to operate effectively in network-opposed environments. The decades since the Cold War have been spent optimizing networks for operational environments in which the adversary had little ability to interfere with US battle networks. This condition is unlikely to endure. Instead of trying to reconstitute the “big” joint battle network or trying to provide unaffordable hardening to a huge network, American forces need to think about how to operate and train with minimal bandwidth and episodic connectivity.
- > **GPS INDEPENDENCE.** US forces depend heavily on navigation and timing data from the GPS constellation, and others are working to deny them this capability. Could US military forces accomplish their missions without GPS? Air Force scientists and operators, with help from the Defense Advanced Research Projects Agency (DARPA), should articulate a concept for achieving GPS independence as a means of providing a much more resilient, flexible force.
- > **AIRSEA BATTLE.** The Air Force teamed with the Army during the 1970s and 1980s to develop a highly integrated set of operational and tactical concepts in response to overwhelming Soviet numbers. The result was AirLand Battle, Follow-on Forces Attack (FOFA), and the “31 Initiatives.”¹⁴² The same model could be followed by the Air Force and the Navy to create a more integrated hedge against the rise of an aggressive China: an “AirSea Battle” concept that provides a stabilizing counterweight to the PRC’s growing military reach.
- > **DISTRIBUTED AIR AND SPACE OPERATIONS.** During the Cold War, fighter operations in Europe depended on widely dispersed alert and on-call aircraft, operating from hardened base facilities. The Air Force should once again champion this sort of thinking by pursuing and instituting a multi-tiered operational concept for flying from distributed bases. That concept would cover initiatives for conducting persistent base presence operations wherein small Air Force detachments visit the multitude of potential forward operating sites, cooperative security locations, and foreign bases as part of theater engagement. It would also encompass different

¹⁴² For an authoritative discussion of the evolution of Air Force-Army cooperation that provides a model for joint integration, see Richard G. Davis, “The 31 Initiatives: A Study in Air Force—Army Cooperation,” Air Staff Historical Study, Office of Air Force History, 1987.

dispersed combat operational modes to investigate the various logistic and operational implications of different distributed-basing schemes.

- > COUNTERLAND OPERATIONS. In concert with DARPA, the Air Force should pursue the operational goal of being able to reduce opposing ground forces to dismounted infantry. The Air Force achieved a remarkable ability to interdict mechanized forces by the end of the Cold War, and improved its ability with its continual innovations in precision weapon employment during the 1990s and early 2000s. New technologies might enable the comprehensive disabling of adversary mechanized transport, thereby allowing much lighter, more rapidly deployable friendly ground units to conduct effective maneuver operations.

Irregular Warfare

The Air Force has introduced a number of capabilities and concepts to change the face of irregular warfare, to include the combination of unmanned aerial vehicles and guided weapons for persistent overwatch and manhunting, and the use of ever-smaller, more precise guided weapons to reduce collateral damage. However, operational concepts must be developed to deal with the near-term employment of G-RAMM, especially guided mortars, against friendly forces. Air base defenses, in particular, must adapt to respond to that threat. Toward this end, a family of low collateral damage weapons and fuzes will likely be useful in a number of future irregular warfare environments.

Counter-Proliferation

The joint force may be required to conduct operations against a wide variety of actors possessing varying levels of nuclear weaponry. The Air Force could take the lead in examining this challenge by initiating a systematic effort to think through the operational and strategic implications of WMD proliferation, to include updated concepts of deterrence that build on mature deterrence literature.

Homeland Defense

Homeland defense is a cross-cutting problem that impacts each of the three future strategic challenges, and one generally neglected in the Pentagon. The Air Force should partner with Northern Command and the Department of Homeland Security to develop a series of homeland air defense, homeland airbase defense, and consequence management exercises that help set standards and methods for conducting future homeland defense operations.

Institutionalize Long-Term UAV Staffing and Operational Integration

The Air Force leads the DoD in the institutional integration of UAVs, recently standing up a wing structure at Creech AFB, Nevada, to handle its growing MQ-1 Predator and MQ-9 Reaper fleet. The Air Force must accelerate its focus on long-term institutional integration of its UAV forces by concentrating on four objectives:

- > Expanding the integration of unmanned aircraft into preferred operational routines;
- > Continuing to stand up dedicated (UAV-only) units;
- > Creating a dedicated UAV officer constituency, including viable command and senior leader career paths; and
- > Developing and fielding follow-on UAV systems.¹⁴³

While the Air Force is well on its way to meeting the first two objectives due to the demands of operations in Iraq and Afghanistan, it has not yet dedicated itself to the other two critical aspects of UAV integration, which will ultimately decide the long-term future of UAVs. For example, the Air Force continues to rely on rated pilots as temporary UAV operators. Since they return to their primary platform after a tour in UAV operations, they are unlikely to form a long-term, dedicated officer constituency committed to UAV integration.¹⁴⁴ Barring significant changes in the personnel system, it seems unlikely that the Air Force will ever develop sustained institutional advocacy for UAVs. Consider, for example, that no serious developmental program exists for Predator, Reaper, or Global Hawk follow-on systems.¹⁴⁵ Until the Air Force develops a dedicated UAV officer constituency, UAVs will most likely continue to suffer from sporadic Air Force interest.¹⁴⁶

¹⁴³ For more on integrating disruptive technologies and systems into the US military services, see Tom Ehrhard, "Integrating Disruptive Technologies in DoD...A Bridge Too Far?" briefing to the National Defense Industrial Association Conference on Disruptive Technologies, 4 September 2008, at http://www.csbaonline.org/4Publications/PubLibrary/S.20080904.Integrating_Disrup/S.20080904.Integrating_Disrup.pdf.

¹⁴⁴ Michael Hoffman, "Are enlisted airmen next to pilot UAVs?" *Air Force Times*, 23 December 2008, accessed at http://www.airforcetimes.com/news/2008/12/airforce_enlisted_uas3_122108/ on 27 March 2009.

¹⁴⁵ The Air Force's Aeronautical Systems Center recently released a request for information (RFI) to gather systems concepts for a next-generation UAS (NG UAS). Relative to MQ-1 and MQ-9, the RFI asks for improved maneuverability and endurance, high subsonic dash, self-deployable, survivable in low to medium threat environments, and double the payload capacity. See: <https://www.fbo.gov/index?tab=core&s=opportunity&mode=form&id=1ae64fd2334b47af5955a1c4eb885e1f&cck=1&au=&ck=>

¹⁴⁶ For a comprehensive analysis of UAV development and integration in the US military, see Thomas P. Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapon System Innovation," dissertation, Johns Hopkins SAIS, 2001.

Sophisticated, large UAVs such as the Predator require credentialed, trained, UAV pilots to operate in controlled airspace and make potentially lethal decisions in complex rules of engagement (ROE) environments. However, as noted, the reluctance to create a community of dedicated UAV pilots threatens the long-term integration of UAVs into the Air Force. For example, by first assigning lower-performing or flight-restricted rated pilots as UAV operators, the Air Force created what chief of staff General Norton Schwartz called a “leper colony” environment at the Predator wing operating out of Creech AFB that detracts from the already diminished prestige of a UAV assignment and bodes ill for the long-term viability of the UAV fleet.¹⁴⁷ Moreover, the growing demand for Predator and Reaper orbits in current combat operations siphons off prospective pilots at a rate that current undergraduate pilot training cannot offset, leading to morale-sapping personnel policies that also create force-wide rated shortfalls and staff manning issues. A recent directive from the Secretary of Defense to increase Predator orbits, for instance, stopped the Air Force initiative to open a UAV course at the elite Nellis AFB Weapons School. “All my instructors were ‘deployed’ back to the ops units to assist with the surge,” said Lieutenant Colonel Daniel Turner, the provisional UAV Weapons School commander.¹⁴⁸ This series of band-aid, stop-gap measures cannot continue.

To square the UAV manning circle, the Air Force should ask for captain and lieutenant volunteers as the initial cadre of a *UAV-only* pilot career field—officers designated as UAV pilots *before* their training begins. Candidates would attend abbreviated undergraduate pilot training through the T-6 Texan trainer phase, which allows them to meet rated management requirements for a pilot in command and provides an instrument flight rating for operations in national and international airspace. This would dramatically reduce the life-cycle costs of most current UAV pilots, who went through the entire pilot training program and expensive upgrade into their manned platforms prior to moving to UAVs—a highly inefficient, wasteful practice.

After T-6 training, these pilots would split off into their specific UAV aircraft upgrade training, but they would also continue to fly T-6s (or some other low-cost, efficient airframe) as part of their normal proficiency training, even after arriving at their operational unit. This companion trainer-type program would maintain a bond between UAV operators and the manned flight community, which is critical for institutional congruence and credibility, would provide invaluable “air sense” and airmanship that should improve UAV operational performance, and would attract high-quality officers to UAVs, signaling the Air Force’s dedication to its UAV force. The cost

To square the UAV manning circle, the Air Force should ask for captain and lieutenant volunteers as the initial cadre of a *UAV-only* pilot career field—officers designated as UAV pilots *before* their training begins.

¹⁴⁷ General Schwartz promised to turn around the cultural trend in today’s UAV units during a speech at the Air Force Association annual meeting. See Ben Iannotta, “USAF chief pledges to remake unmanned ISR culture,” *C4ISR Journal*, 18 September 2008, accessed at <http://www.c4isrjournal.com/story.php?F=3731318> on 2 October 2008.

¹⁴⁸ Adam J. Hebert, “Weapons School Rising,” *Air Force Magazine*, September 2008, accessed at <http://www.airforce-magazine.com/MagazineArchive/Pages/2008/September%202008/0908weapons.aspx> on 3 November 2008.

to maintain T-6 flight operations in UAV squadrons would be marginal relative to the benefits. Air National Guard units in particular would benefit from the addition of T-6s to their fleet as those aircraft could also support state missions. The collocated manned aircraft could also help with domestic controlled airspace transition by presenting a readily-available source for UAV escorts until unescorted UAV operations become normalized.¹⁴⁹

By creating a UAV-only career field, UAV pilots could enjoy increased access to command positions as they progressed, hastening the day when UAV-only officers could assume squadron and wing command. In the interim, rated commanders would provide a critical transitional link between the UAV units and the rated force, promoting a smooth transition from today's unsustainable, stop-gap manning policy to one that promotes UAV integration for the long haul.

Additionally, to relieve the pressure affecting under-manned Predator and Reaper enlisted sensor operators, the Air Force should request sensor operators from Army RQ-5 Hunter and Army RQ-7 Shadow UAS units to augment over-tasked, under-manned Predator sensor operators and provide an Army liaison presence at Creech AFB. With the teaming MQ-1 and MQ-9 crews are currently doing with Army units in the field, it makes sense to increase cross-service exchange opportunities that would increase combat air patrols over Iraq and Afghanistan and promote interservice synergy.

FORCE STRUCTURE AND PLATFORM CHALLENGES

Programs do not define the Air Force; its people do. By restoring excellence in its S&T/R&D efforts, recapturing seriousness about nuclear operations, reestablishing credibility as an acquisition executive, restoring its influence in the joint arena, becoming a leader in the development of joint operational concepts, rediscovering the AEF concept, and creating an enduring UAV manning structure, the Air Force will go a long way toward solving its current institutional identity crisis. However, these steps must be accompanied by a coordinated, strategy-based review of force structure plans. The goal of this review should be a long-term program plan that “squeezes the middle” to create capabilities and capacities for both the high and low end of future warfare.

This section proposes a menu of options for reconceptualizing Air Force programs that addresses the plans-funding mismatch that led the last chief of staff to ask for an additional \$20 billion per year, and simultaneously rationalizes the force posture to one that is more congruent with the future security environment. This monograph

¹⁴⁹ Global Hawk is the only military UAV cleared by the Federal Aviation Administration for use in national airspace according to an official Certificate of Authorization. “FAA Clears Global Hawk For Routine Operations in US National Airspace,” Space Daily, 18 August 2003, accessed on 27 March 2009 at: <http://www.spacedaily.com/news/uav-03zl.html>.

operates under a key assumption — that the Air Force will likely operate under a flat or declining budget over the next twenty years. While it does not prescribe an all-encompassing set of specific programmatic decisions to fit under a notional topline, it does present offsets that would result in a significantly improved force structure.

The initial discussion covers air mobility force structure, concentrating on the aerial refueling (KC-X) tanker program, followed by some solutions to the Air Force’s languishing bomber program. After that, the paper opens up a fresh debate about airborne ISR and advocates a tiered approach to stealthy ISR — a key missing element of today’s force structure. This is followed by some concrete options to address the much-maligned space force, followed by a prescription for a more substantial, distributed irregular warfare force structure. Finally, there is a section about fighter force structure, which has dominated the debate about the future of the Air Force to the detriment of a more systemic approach. Perhaps the most important message of this section is that Air Force leaders cannot allow themselves to become entangled in programmatics to the detriment of an broad-based approach airpower’s role in meeting today’s threats and tomorrow’s challenges.

AIR MOBILITY FORCE STRUCTURE

Air mobility combines two key elements of US military power projection — aerial refueling and airlift. Together they constitute a key capability that impacts almost any conceivable joint military operation. The future configuration of these forces must constitute a primary focus of any long-term strategy-based analysis.

Aerial Refueling Recapitalization

The single most compelling air mobility requirement is also the most critical aviation program for the Air Force — the recapitalization of the aerial refueling fleet. Consequently, the Air Force considers the recapitalization of the tanker fleet its number one acquisition priority. Once built to support the US nuclear strike plan when the Soviet missile threat expanded to threaten forward bases with a devastating preemptive strike, today’s tanker fleet emerged after the Cold War as the backbone of US military power projection, finding itself involved at unprecedented levels in the conflicts of the last twenty years. Almost every modern joint military operation benefits from the flexibility of being able to refuel aircraft in-flight.¹⁵⁰ Most would be surprised to find, for example, that the Navy depends on Air Force tankers to conduct long-range aircraft carrier flight operations.

¹⁵⁰ CRS #RL34398, page 6.

The current tanker fleet consists of twenty-nine 1950's-era mid-sized KC-135E and 417 KC-135R Stratotankers, augmented by fifty-nine larger KC-10 Extenders.¹⁵¹ All have commercially obsolete airframes.¹⁵² The average age of the backbone Stratotanker fleet is over forty-eight years, while the younger KC-10 fleet averages over twenty-four years. Maintenance costs per flight hour for this aging tanker force are high and steadily increasing, and mission-capable rates decreasing.¹⁵³

The ultimate size of the overall future tanker force remains an open question.¹⁵⁴ Many of the recommendations made in this report, for example, would result in a smaller, more fuel-efficient force structure, with a higher relative percentage of long-range systems. In theory, this would argue for a smaller air refueling fleet. However, operational experience after the Cold War suggests otherwise. Every conflict from Desert Storm onward quickly turned into a “tanker war” due to the operational criticality of the air refueling mission to sustaining the “air bridge” that formed an inter-theater air logistical lifeline, and that provided essential support to Air Force and Navy day-to-day air operations. Moreover, given the extreme range demands of the Pacific theater, including the growing range of PRC missile systems, cutting the overall size of the tanker force or allowing it to atrophy cannot be considered operationally prudent. As a result, the current level of “KC-135 tanker equivalents” amounting to approximately five hundred, a number reinforced by numerous studies, should continue to form the basis of tanker recapitalization, as a hedge against fleet obsolescence and as a guarantee that future demands for aircraft range, endurance, and persistence are met.¹⁵⁵

The Air Force recapitalization plan included a three-stage purchase of approximately 540 aerial refueling aircraft over several decades to replace the aging KC-135 and KC-10 fleet.¹⁵⁶ The thirty-year acquisition cost of total recapitalization has been estimated at over \$100 billion, making it one of the most expensive and important Air Force programs over the next twenty years.¹⁵⁷ Despite its high priority, tanker modernization is far from a “done deal.” Moreover, tanker advocates are hard to find.

¹⁵¹ William Knight and Chris Bolkcom, “Air Force Air Refueling: The KC-X Aircraft Acquisition Program,” Congressional Research Service (CRS) report #RL34398, April 4, 2008, page 5.

¹⁵² See “Boeing 707,” at http://en.wikipedia.org/wiki/Boeing_707 accessed on 4 August 2008.

¹⁵³ For aircraft age, see <http://www.gao.gov/new.items/d03938t.pdf>, both accessed on August 7, 2008. Also, see CRS #RL34398, pages 4–5.

¹⁵⁴ For an excellent analysis of historical and future tanker requirements, see Rebecca Grant, “The Tanker Imperative,” Mitchell Institute for Airpower Studies, Mitchell Paper #2, April 2009, accessed at http://www.afa.org/Mitchell/Reports/MP2_TankerImperative0409.pdf on 5 May 2009.

¹⁵⁵ CRS #RL34398, pages 13–15.

¹⁵⁶ The “KC-X, Y, and Z” program involved buying three separate lots of 179 aircraft. This concept injected some future flexibility into the plan while attempting to reinforce that the tanker fleet must be recapitalized at a steady rate for a number of years in order to retain operational flexibility. CRS #RL34398, page 2.

¹⁵⁷ Associated Press, “Boeing: Tanker costs miscalculated,” July 13, 2008, accessed at: http://www.airforcetimes.com/news/2008/06/ap_boeing_tanker_fight_061208/ on April 13, 2009.

Within the Air Force, the tanker community, plays second fiddle to the C-17 community in the political hierarchy of Air Mobility Command, just as it did for decades in the Strategic Air Command. Furthermore, the Navy and Marine Corps rarely support more tankers because they are loath to admit their reliance on the Air Force. The Army constantly lobbies for C-17s and other airlift assets, but ignores the critical link between air refueling and essential missions like airlift or close air support.

Yet tanker modernization must be sustained. The combined risks of crippling fleet systemic failure, shrinking overseas basing options that mandate longer mission ranges, and the growing need for extremely long-range air operations in irregular warfare and future high-end warfare combine to present a compelling case for tanker modernization. Taking back full responsibility for the air refueling acquisition program should be a major Air Force leadership objective in 2009–2010. Given the many problems and delays in the tanker program, the Air Force should reformulate its KC-X program to address aerial tanking in the most demanding contingency, that of the Pacific theater, with the assumption that air and sea bases inside 2,000 nautical miles of the Asian mainland will likely be held at risk.

Intra-theater Airlift Fleet

This discussion tables inter-theater airlift issues such as the disposition of the C-17 production line and the C-5 modification program for one simple reason: relatively speaking, airlift is one of the only healthy Air Force capability areas. Therefore, other air mobility priorities take precedence.

With regard to the intra-theater airlift fleet, the Air Force must follow two different paths driven by the needs of the current and emerging security environment. First, it must begin to replace its oldest C-130E airframes, many of which have burdensome flight restrictions, with newer C-130Js. These older aircraft, already identified for retirement, would be included in the “force structure BRAC” recommended later in this chapter. The newer, much longer-range C-130J’s take on elevated importance in the Pacific as the Air Force transitions to more distributed operations, requiring a denser logistical network to maintain far-flung operations.

Second, the Air Force needs to begin thinking about a C-130J replacement, and whether it should be designed to support the Army’s push for mounted vertical maneuver (MVM) that suggests a very heavy vertical takeoff and landing (VTOL) platform. It is clear from a recent Defense Science Board (DSB) investigation that the platform itself would be unbearably expensive, and could not be built in numbers large enough to move a sizeable force.¹⁵⁸ RAND analysts conservatively estimated that it would cost more than \$100 billion over many decades to build the vertical lift

Taking back full responsibility for the air refueling acquisition program should be a major Air Force leadership objective in 2009–2010.

¹⁵⁸ Defense Science Board, “Future Need for VTOL/STOL Aircraft,” July 2007; Defense Science Board Task Force on DoD Energy Strategy, “More Fight—Less Fuel,” February 2008, pages 39–40.

**Air Force leaders
must challenge
Army attempts to
adopt the mounted
vertical maneuver
concept.**

force sufficient to insert only one brigade.¹⁵⁹ Furthermore, the DSB report showed that the technologies underpinning such a large craft require substantial research and development, and would involve much more engineering complexity than today's much smaller V-22 Osprey tilt-rotor aircraft, which went through an extended, very expensive, and troubled development program.¹⁶⁰ Future Combat Systems armored vehicles have already far exceeded their twenty-ton weight limit. Although these ground systems were recently cancelled, successor systems are likely to weigh at least thirty tons, and probably significantly more. Every additional pound requires a larger, more expensive VTOL platform, and one that is also more vulnerable to ground fire and missiles. Moreover, the flight reliability of vertical takeoff and landing aircraft has always been relatively poor. For example, Special Operations Forces have long required helicopter-borne assaults to have 100 percent airframe redundancy to account for aircraft that go down for maintenance problems. A VTOL fleet supporting MVM would either require much higher levels of flight reliability than past vertical takeoff and landing platforms (with the associated increases in expense), or be much larger than a comparable force of conventional take-off and landing aircraft, resulting in intolerable program costs. Finally, while using giant tiltrotor aircraft to lift ground troops behind enemy lines on a distributed battlefield may sound alluring, the fact is that US commanders have steered away from large-scale vertical maneuvers since the Vietnam War due to tactically untenable platform vulnerability. As a 2004 article in *Parameters* put it, "Given the reluctance to employ even small numbers of attack helicopters in deep attacks against opponents like the Iraqis and Serbs, the idea that the Army would be willing to send large numbers of cargo-type aircraft deep into enemy airspace for vertical envelopment operations seems highly implausible."¹⁶¹ Moreover, the tactical vulnerability of mass deep insertion operations will only increase as guided G-RAMM technologies proliferate.

For these reasons, Air Force leaders must challenge Army attempts to adopt the mounted vertical maneuver concept. Rather, the Air Force should continue exploring new conventional take-off and landing aircraft, such as a fleet of super-short takeoff and landing (SSTOL) aircraft to serve as a follow-on to the C-130J. The Service should also investigate the near-term, off-the-shelf acquisition of short-takeoff and landing

¹⁵⁹ The RAND cost estimate does not consider the cost of escort vehicles and defense suppression and other required elements of a brigade insertion. Peter A. Wilson, John Gordon IV, and David E. Johnson, "An Alternative Future Force: Building a Better Army," *Parameters*, Winter 2003–2004, page 30.

¹⁶⁰ The V-22 spent over twenty-five years in development and was canceled by the Secretary of Defense but repeatedly revived by Congress, despite suffering numerous cost overruns, fatal crashes, and major design revisions. The Air Force now flies an improved special forces version of the Osprey called the CV-22. See Mark Thompson, "V-22 Osprey: A Flying Shame," *Time*, September 26, 2007. Accessed at <http://www.time.com/time/politics/article/0,8599,1665835,00.html> on April 7, 2009.

¹⁶¹ Peter A. Wilson, John Gordon IV, and David E. Johnson, "An Alternative Future Force: Building a Better Army," *Parameters*, Winter 2003–2004, page 26.

aircraft designed for rough field operations (STOL-RF) to enhance its capability for irregular warfare and the foreign aviation advisory mission.¹⁶²

BOMBER FORCE STRUCTURE

The United States operates over one hundred long-range bomber aircraft, including the venerable B-52H Stratofortress, the B-1B Lancer, and the B-2A Spirit. These aircraft represent the largest bomber force in the world, and provide the United States an asymmetric strike advantage over any opponent. The bomber is, in many ways, the signature Air Force platform and mission — but again, it cannot be thought of in isolation from the basing, refueling, ISR, and network connectivity elements of bomber operations.

Bombers are likely to become even more important over time. The United States faces a basing disadvantage in the Western Pacific, with only one major US main operating base on Guam. The Air Force has access to many other bases in the region in peacetime, but their availability during crises is uncertain. Coupled with the increasing threat to forward operating bases from both short and long-range guided weapons and nuclear weapons, aircraft with extremely long unrefueled operating range (greater than 3,000 nautical miles), long endurance, and a heavy payload will be especially valuable. This also holds true for legacy, non-stealthy bombers, which operate far above most irregular air defense threats and can employ stand-off weapons against adversaries with advanced air defenses.

The constituency for bombers within the Air Force has atrophied since the last bomber pilot chief of staff departed in 1982. The “bomber mafia’s” fall from grace accelerated after the end of the Cold War, and with the additional burden and internal focus caused by the recent nuclear problems, the bomber community has become even more atomized and lacking in focus. As with air refueling, no other Service can be counted on to serve as an outside advocate. The following recommendations capitalize on the Air Force’s demonstrated but diminishing core competency in long-range strike aviation by outlining a multi-phased upgrade and expansion of the Air Force bomber force, to include extending the life and vitality of the legacy bomber fleet, and fielding the Next-Generation Bomber (NGB).

The bomber is, in many ways, the signature Air Force platform and mission — but it cannot be thought of in isolation from the basing, refueling, ISR, and network connectivity elements of bomber operations.

¹⁶² SSTOL designs focus on lifting two of the Army’s Future Combat Systems vehicles from runways less than one thousand feet in length. See “Super Short Takeoff and Landing (SSTOL) Aircraft” at <http://www.globalsecurity.org/military/systems/aircraft/sstol.htm>, accessed on April 7, 2009. On the advisability of STOL-RF aircraft for the aviation advisory mission, see Karl P. Mueller and Robert C. Owen, *Airlift Capabilities for Future U.S. Counterinsurgency Operations* (Santa Monica, CA: RAND Corporation, 2007).

All the relevant analysis points toward B-52H re-engining as a prudent, cost-effective upgrade that would pump life back into the slowly dying bomber force.

Complete Legacy Bomber Upgrades

Phase One of the Air Force's long-range strike program modifies legacy bombers to keep them relevant, improves their capability, and increases their mission reliability. Whereas continual modifications to legacy fighter and airlift forces generally represent questionable investments given the character of existing and emerging security challenges, modifications and upgrades to the bomber force are needed because its long-range capability is so sorely needed. While the B-2A Spirit low-observable bomber is now being upgraded to allow Extremely High Frequency (EHF) communications in network-opposed environments, and the B-1B Lancer now employs third-generation Sniper XP targeting pods to allow pinpoint strikes against targets, other needed logistical and platform modifications have been ignored, threatening the fleet's long-term viability.

Two further modifications to the legacy bomber force bear special consideration. The Air Force plans to keep forty-four combat-coded (operational) B-52H bombers in service for three more decades. However, the aircraft still flies using eight 1950s-era TF-33 turbojet engines. Various DoD agencies conducted studies investigating the feasibility of re-engining the B-52 with four high-bypass turbofans and providing the aircraft with updated cockpit avionics, and concluded that the entire cost of the modernization program could be recouped well within the remaining operational life of the aircraft. The National Research Council, for instance, estimated it would take thirteen to sixteen years to recoup the cost of replacing eight TF-33 engines with four modern turbofans.¹⁶³ Given that the planned retirement date for the B-52s is 2040, the break-even date for a B-52 re-engining program would occur around 2020. Furthermore, in agreement with a Defense Science Board task force that recommended an acquisition fast-track for re-engining, the National Research Council report noted that the operational benefits would include "access to shorter runways, higher takeoff weights at high ambient temperatures, and longer range and endurance," with a 45 percent increase in unrefueled combat radius and reduced demand on the over-taxed aerial refueling fleet.¹⁶⁴ All the relevant analysis points toward B-52H re-engining as a prudent, cost-effective upgrade that would pump life back into the slowly dying bomber force.

¹⁶³ Re-engining the B-52 showed the lowest time-to-recoup of any large body aircraft in the study. Also, the study assumed aviation fuel (JP-8) prices would stay at \$2.50 per gallon with only moderate (at most 9%) inflation over the period. Today's higher aviation fuel prices substantially decrease the time to recoup the investment. *Improving the Efficiency of Engines for Large Non-Fighter Aircraft*, National Research Council, 2007, page 3.

¹⁶⁴ *Improving the Efficiency of Engines for Large Non-Fighter Aircraft*, National Research Council, 2007, page 49. See also, "Defense Science Board Task Force on B-52H Re-Engining," Defense Science Board revised and updated report, 2004, accessed at http://www.acq.osd.mil/dsb/reports/2004-06-b52h_re-engining.pdf, on November 5, 2008. See also, "More Capable Warfighting Through Reduced Fuel Burden," Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms, January 2001, pages 31–35.

Of course, these bombers' utility depends to a great extent on the weapons they employ. The current Air Force plan includes significant investment in stand-in (i.e., close-range) GPS and laser-guided precision weapons, as well as stand-off guided missiles like the Joint Air-to-Surface Standoff Missile (JASSM) and an extended range (approximately 600 nautical mile) version of the same missile, called JASSM-ER.¹⁶⁵ It would make great sense, therefore, to modify the B-52 to carry as many of these weapons as possible. For example, by installing the newest MIL-STD 1760 data bus internally in the B-52, it could carry up to twenty-eight JASSMs or JASSM-ERs (twelve on wing pylons).¹⁶⁶ This would allow the non-stealthy B-52 to operate at the periphery of advanced air defenses, enhancing penetrating strike and ISR operations.

Another significant augmentation to the legacy bomber fleet to hedge against a growing list of stealth detection methods involves designing and procuring new, long-range penetrating, standoff cruise missiles. In 2007, the Air Force retired the nuclear-only AGM-129 Advanced Cruise Missile (ACM) and five hundred nuclear Air-Launched Cruise Missiles (ALCMs). Moreover, the inventory of conventional AGM-86C/D ALCMs is increasingly obsolescent. This will soon leave JASSM-ER as the longest range cruise missile in the Air Force inventory at 600 nautical miles. Given the premium on range in the future security environment, the Air Force should pursue new low-observable conventional and nuclear cruise missile programs with ranges from 1,500 up to 3,000 nautical miles.

Field the “B-3” Next-Generation Bomber

The 2006 QDR directed the Air Force to develop a new long-range precision strike capability by 2018. Since then, the Air Force and Strategic Command decided the best initial option is to pursue a manned bomber which it has designated the B-3. Under current plans, which remain cloistered in a black (special access) program, the date for the B-3's initial operational capability (IOC) remains 2018, with a planned force of perhaps one hundred bombers. The cost of the program can be estimated to range from \$60–\$65 billion, with production ceasing in 2025.¹⁶⁷

The Next-Generation Bomber (NGB), or B-3, is intended to serve as the backbone of the Air Force's long-range bomber force. Along with aerial refueling, stealthy ISR, and denied-area communications, the B-3 will constitute an indispensable element of America's long-range penetrating strike capability for decades to come. Recently,

Given the premium on range in the future security environment, the Air Force should pursue new low-observable conventional and nuclear cruise missile programs with ranges up to 3,000 nautical miles.

¹⁶⁵ The JASSM is a stealthy standoff cruise missile with a 200 nautical mile range designed to hold modern surface-to-air systems and the facilities protected by them at risk. The JASSM-ER incorporates a more efficient engine to achieve 600 nautical mile range. For more detail on JASSM, see: <http://www.designation-systems.net/dusrm/m-158.html>, accessed on 13 April 2009.

¹⁶⁶ For a list of B-52 modifications in the Air Force program, see <http://www.dtic.mil/descriptivesum/Y2008/AirForce/0101113F.pdf>, accessed on 13 April 2009.

¹⁶⁷ This estimate is based on an average unit procurement cost of less than \$580 million, an average unit flyaway cost of approximately \$425 million, development costs of \$16 billion and associated production costs of \$5 billion.

however, Defense Secretary Robert Gates cancelled the program, evidently to explore whether the B-3 (or its successor) should be an unmanned system. Whether the next US bomber should be manned or unmanned – and not whether a bomber is needed by the end of the next decade – appears to be the major issue behind the NGB termination decision.

Lacking access to classified Air Force plans, it is impossible to assess them. Accordingly, this report presents a notional plan for 130 B-3s at a total program cost estimated at \$75 billion. This B-3 plan calls for full-rate production of twelve aircraft per year from 2018 through 2027, progressing through five block upgrades:

- > BLOCK 10 (twenty-four aircraft) would be an extremely stealthy, manned, nuclear-capable bomber with low-risk components such as F-35 engines, sensors, and data links; and B-2 weapons, conformal sensors, and advanced laser infrared countermeasures (LAIRCM), towed decoys and jammers for self-protection. These would represent the last manned bombers in the Air Force inventory. The Air Force should be wary of allowing immature technologies to creep into the Block 10 design, such as sophisticated end-game sensors with problematic stealthy apertures, lest they compromise an early IOC date.¹⁶⁸ Having said that, delaying the bomber program in order to skip this initial manned block, wait for some key Block 20 technologies to mature, and allow a clarification of requirements might be worth considering. The delay would result in a much more strategically powerful global surveillance-strike system due to the inherently superior design and performance attributes obtainable in an unmanned version, as may be desired by Secretary Gates.¹⁶⁹
- > The next thirty-six aircraft would be in an *unmanned* BLOCK 20 configuration, integrating first-generation variable-bypass engines (based on AFRL's Adaptive Versatile Engine Technology or ADVENT program) that would increase aircraft endurance by 30 percent. Notionally, if Block 10 aircraft possessed a 2,500 nautical mile combat radius after aerial refueling (the best measure of endurance for this aircraft), Block 20 would expand that to well over 3,200 nautical miles. This new unmanned long-range system would incorporate active low-observable features and a modular payload bay with advanced weapons and combat system in-

¹⁶⁸ Stealthy sensor apertures are some of the most difficult technology integration challenges in a stealthy aircraft. Any attempt to allow an antenna or sensor access to the outside theoretically allows another sensor to pick up that antenna's location. Engineering apertures to do their job while retaining adequate low observability requires highly sophisticated engineering. Bill Sweetman, *Inside the Stealth Bomber* (NY: Zenith Press, 1999) page 49.

¹⁶⁹ An unmanned, land-based B-3 operating in concert with a carrier-based N-UCAS flying from well outside anti-ship missile range would pose a truly global, strategically indispensable surveillance-strike system that would stand head-and-shoulders above the strategic utility of today's planned force. For more on the vital N-UCAS program, see Thomas P. Ehrhard and Robert O. Work, *Range, Persistence, Stealth, and Networking: The Case for a Carrier-Based Unmanned Combat Air System*, Washington, DC: Center for Strategic and Budgetary Assessments, 2008, accessed on 23 March 2009 at http://www.csbaonline.org/4Publications/PubLibrary/R.20080618.Range_Persistence_/R.20080618.Range_Persistence_.pdf.

tegration. These features would allow Block 20 aircraft to perform a variety of penetrating roles, including intelligence, surveillance, reconnaissance, strike, and support to special operations forces (SOF), such as the stealthy insertion or resupply of SOF personnel.¹⁷⁰

- > The next twenty-four unmanned BLOCK 30 aircraft would be the most advanced B-3 platform, capable of achieving greater endurance and superior altitude performance over Block 10 and 20 aircraft by incorporating improved variable-bypass engines, high-altitude, low-drag “Aeroservoelastic” (ASE) wings (described earlier), and sophisticated adaptable automated flight controls. The Block 30 might also incorporate increased electrical power generation in order to accommodate a solid-state laser for self-protection and advanced sensors and apertures.
- > BLOCK 40 (thirty-six aircraft) would add state-of-the-art processors, autonomous mission planning and avionics software and order-of-magnitude flight reliability upgrades to Block 30 aircraft. There is no reason why an unmanned system of this complexity and built in this timeframe cannot approach the flight reliability engineered into today’s wide-body airliners, which are two orders of magnitude greater than current military aircraft.¹⁷¹
- > The last ten BLOCK 50 aircraft would be very long endurance, high-flying ISR-only versions (RB-3) for deep, clandestine penetration into high-threat environments, as suggested by senior Air Force officials as late as April 2008.¹⁷²

This progressive block upgrade of the B-3 satisfies the long-range, denied-area unwarned surveillance and strike capability for the second decade of the twenty-year time span of this project, and has only minimum overlap with proposed changes to F-35A production as recommended later in this chapter, smoothing out Air Force production funding in the out-years.

To avoid another long-range strike system production hiatus, the Air Force should immediately begin a “bomber after next” (BANX) program to consider replacements for the B-52H and B-1B fleets, which are expected to come to the end of their

¹⁷⁰ The SOCOM version would be a stealthy adjunct to the MC-130 Combat Talon mission.

¹⁷¹ F-16 and F-18 fighter aircraft experience about three Class A (major) mishaps per one hundred thousand flight hours, while the planned flight reliability of the Boeing 747 and 777 airliners is .013 Class A mishaps per one hundred thousand flight hours. Flight reliability costs more initially, but equates to lower operations and maintenance costs and longer airframe life spans, and is critical in avoiding non-threat-based aircraft losses in denied territory. Office of the Secretary of Defense, “Unmanned Aerial Vehicle Flight Reliability Study,” February 2003, page 31, Table 3-3 “Examples of Manned Aircraft Reliability.”

¹⁷² Secretary of the Air Force Michael Wynne, quoted in Douglas Barrie and Amy Butler, “Next-Generation Bomber Sets Stage for ISR,” *Aviation Week and Space Technology*, April 27, 2008, accessed at http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/awo42808p2.xml&headline=Next-Generation%20Bomber%20Sets%20Stage%20for%20ISR%20Penetrator on 9 August 2008.

The old-school concept of separate fighter, bomber, and ISR force structures should change as the Air Force reconceptualizes future operational requirements.

service lives around 2040, assuming peacetime utilization rates. Even under that assumption, which seems utterly flawed for any combat system, the likelihood of those platforms retaining operational viability in 2040 seems remote. Indeed, a logical follow-on to both the B-52H and B-1B fleets might be a wide-body commercial derivative “missileer” aircraft designed specifically for the employment of long-range, stand-off missiles.¹⁷³ The development of a much more capable and less expensive standoff cruise missile bomber force would be a strategically valuable complement to a penetrating bomber fleet. Planners should commence a mission area assessment, mission need statement, and concept exploration in the 2013–2016 timeframe, with a program go-ahead set for 2018, and production starting in 2032 for an IOC of 2035. Realistically, the BANX program needs to meet its planned 2035 full operating capability (FOC) to avoid the entire bomber force depending on one platform, the B-3, for a significant period of time.

AIRBORNE ISR FORCE STRUCTURE

The old-school concept of separate fighter, bomber, and ISR force structures should change as the Air Force reconceptualizes future operational requirements. Modern technology allows fighters and bombers to serve as important sensors in the battle network, and likewise, sensor-optimized platforms increasingly incorporate a suite of lethal capabilities. However, one size does not fit all in aircraft design, and some platforms must continue to be optimized for sensors and networking. For instance, long-endurance high-altitude flight operations require very long, high aspect-ratio (low drag) wings, which also can house large communications or sensor antennas. Furthermore, the post-Cold War world decisively reinforced the importance of persistent overhead surveillance as the numbers of fleeting, mobile targets increased in response to the development of US precision attack operations. Moreover, UAV technology allows endurance that far exceeds what a human can endure, paving the way to air vehicles with operational characteristics impossible in manned aircraft. Bringing all those concepts together should be the goal of Air Force airborne ISR plans.

However, the defense airborne ISR community has suffered from weak institutional support, with platform acquisition handled exclusively by the intelligence community up to 1974.¹⁷⁴ This internal constituency shortfall became acute after the end of the Cold War when persistent surveillance demand exceeded supply, leading to the establishment of the ill-fated Defense Airborne Reconnaissance Office (DARO)

¹⁷³ As a follow-on to the obsolescence of the B-52 fleet, a nominal fleet of 40 widebody commercial aircraft could be considered for around \$200 million to \$300 million per aircraft including internal missile carriage and dispensing modifications, totaling anywhere from \$8–\$12 billion.

¹⁷⁴ Airborne ISR programs like U-2, SR-71 and drone reconnaissance platforms were initially funded and managed by the National Reconnaissance Office (Program D) until they abandoned them in 1974 to concentrate on satellite programs. Jeffrey T. Richelson, *The Wizards of Langley: Inside the CIA's Directorate of Science and Technology* (Boulder, CO: Westview, 2001), pages 172–174.

in the 1990s.¹⁷⁵ The unmanned revolution, which reduced the need for pilots, only stiffened the institutional barriers to fielding the right number of modern ISR assets. DoD must increase the external and internal incentives to the Services (e.g., career fields, command structures, industrial maturity) to support the fielding of more sophisticated, more survivable, more networked overhead surveillance capabilities over the long term.

The Air Force should expand and adapt its ISR force to meet the needs of existing threats and emerging challenges. It has a lot of catching-up to do. It should start by initiating developmental programs for *stealthy* follow-on systems to the MQ-9 Reaper and the RQ-4 Global Hawk with the goal of fielding a robust, three-tiered stealthy ISR UAV fleet by 2025.

Tier I—Stealthy Theater UAV

The Air Force currently operates a growing fleet of long-endurance, medium-altitude, but non-stealthy MQ-1 Predators; and the larger, turboprop-powered MQ-9 Reapers.¹⁷⁶ To transition this fleet into one more consistent with operations in an opposed environment or for clandestine operations demanded by all three future security challenges, the first tier would be based on a fleet of one hundred moderately low-observable Reaper-class follow-on aircraft. Based on the Air Force's next-generation UAS (NG UAS) request for information (RFI) released earlier this year by Aeronautical Systems Center (ASC), this moderately stealthy version of the MQ-9 should be notionally designed to cost around \$30 million apiece (production flyaway cost). The cost would be partially offset by retiring the first generation MQ-1 Predators, which are rapidly running out of operational life.¹⁷⁷ This next-generation medium altitude/endurance UAV should serve as a moderately stealthy adjunct to the MQ-9, and aim for a 2015 IOC. Having divested of MQ-1s and replaced them with a 275 MQ-9 Reaper force structure by 2016, the Air Force would add one hundred stealthy, possibly air-refuelable versions to the force.¹⁷⁸

The likely competitors for the Next-Generation UAS program include the UCAS-D and Global Hawk programs, the low-observable Predator-C, and the advanced

¹⁷⁵ For a study of the birth, life, and death of DARO, see: Thomas P. Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapon System Innovation," dissertation, Johns Hopkins SAIS, 2001, Chapter 9.

¹⁷⁶ The MQ-1 Predator flies very slowly, but for approximately 24 hours at altitudes up to 25,000 feet, and can carry the Hellfire missile. The MQ-9 Reaper is turboprop-powered UAV able to fly up to 50,000 feet, and carries four Hellfire missiles and a variety of laser- and GPS-guided bombs. <http://www.airforce-technology.com/projects/predator/>, accessed on April 13, 2009.

¹⁷⁷ For a comprehensive list of requirements, missions, and features, see the Aeronautical Systems Center (ASC) preliminary request for information, which is on hold pending a funding decision, at https://www.fbo.gov/index?s=opportunity&mode=form&id=46ad1e544dabaac744f6d683c16adc71&tab=core&_cview=1, accessed on 1 October 2008.

¹⁷⁸ The planned MQ-9 force will require about 275 air vehicles and associated control systems.

affordable low-observable manufacturing demonstrated by the innovative, stealthy P-175 Polecat UAS.¹⁷⁹ Ongoing aerospace contractor internal research and development efforts could be exploited to field an aircraft that can achieve low-observable characteristics in specific, forecasted medium threat environments, yet still operate in the medium altitude (15,000–40,000 foot) regime to accomplish a broad set of missions, from full-motion video surveillance to direct action. This self-deployable air vehicle would offer clandestine access to a number of key areas associated with the Long War against Islamist terrorists as well as to places where more sophisticated anti-aircraft capability has proliferated.

Tier II—Stealthy Regional UAV

Although plugging the medium-altitude stealthy ISR gap is vital, the single most important UAS shortfall in the projected Air Force inventory is a very stealthy, air-refuelable Global Hawk Block 40-caliber air vehicle able to operate with 48-hour unrefueled endurance at altitudes exceeding 60,000 feet with a mixed set of sensors providing strategic (national) and theater-level surveillance. The stated joint requirement for this caliber of air vehicle has been on the books since January 1990, in a Joint Requirements Oversight Council (JROC)-approved mission-need statement for a “long reconnaissance, surveillance, and target acquisition (RSTA) capability” able to conduct missions in denied areas for “extended” periods of time.¹⁸⁰ Yet, for a variety of reasons, despite the dramatically increased need for persistent surveillance highlighted in Desert Storm and reinforced in every conflict since then, this requirement remains unfilled.¹⁸¹ That situation must change, and it is clear that internal constituencies are too weak to make it happen without outside support or the personal intervention of senior Air Force leaders.

The goal should be to begin fielding this caliber of stealthy UAV by 2015. Although it is unknown how much classified work on flight demonstrators has already been accomplished since the stealthy UAV DarkStar program’s demise in 1998, the assumption behind this recommendation is that a program can be resurrected or accelerated by using updates to an existing, partly-tested design. The main issue may not actually

¹⁷⁹ Polecat was a 90-foot wingspan UAV assembled with highly innovative composite techniques and possessing very high flight reliability features and a “twisted strut” wing to optimize low-drag laminar flow over the airfoil. Amy Butler, “Lockheed Martin Skunk Works is in the UAV race with Polecat demonstrator,” *Aviation Week & Space Technology*, 23 July 2006, accessed on 23 July 2008 at http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/awo72406p1.xml.

¹⁸⁰ JROC briefing quoted in Geoffrey Sommer, et al., *The Global Hawk Unmanned Aerial Vehicle Acquisition Process* (Santa Monica, CA: RAND Corporation, 1997) page 12.

¹⁸¹ The stealthy Tier III-minus DarkStar program in the mid-1990s offered one answer and was actually a 1/3 scale demonstrator for the canceled AARS program. DarkStar was canceled by the Air Force in 1998. The rationale for cancellation included the rosy projection that the Air Force faced a future with relatively benign air defenses. Eric J. Labs, et al., “Options for Advancing the Department of Defense’s Unmanned Aerial Vehicle Programs,” Congressional Budget Office paper, September 1998: pages 60–64.

be the time to IOC, which on the surface seems rather aggressive given the pace of air and space acquisition, but the ultimate force size and pace of procurement. The plan envisioned here calls for five squadrons (one for each rotational AEF pair) of ten operational air vehicles, costing about \$200 million each, at a procurement cost of about \$10 billion and O&M costs estimated at about \$2.5 billion by 2028, for a \$12.5 billion outlay over twenty-years.¹⁸² The value added through this investment, when measured against others many times larger, makes this program a high-priority Air Force effort.

Tier III—Stealthy Global UAV

The third tier of the 2028 Air Force stealthy ISR family would come from the Block 50 next-generation bomber (NGB) program, fielded sometime after 2025. It might also be prudent to consider accelerating the ISR variant of NGB as a risk-reduction measure. Moving the ISR version to the first NGB block makes strategic sense, as it is probably more useful for a broader spectrum of key scenarios than the bomber and would likely also possess a strike capability. Regardless, work should be either continued, or initiated now, to find designs for an advanced version of a Tier III stealthy global UAV with endurance measured in weeks or months without the need for refueling. A large, very stealthy, truly global UAV would be a major step forward in strategic warning, high-caliber manhunting, and communications relay, and would have utility across the various strategic challenges highlighted in this study.

SPACE FORCE STRUCTURE

Space capabilities have long been an American asymmetric advantage, and they will remain important. However, it also seems likely that space will become an increasingly contested operating medium. Adversaries will attempt to diminish the US advantage in space. The PRC could, as noted, hold all US space assets at risk, but this could expand to much less sophisticated adversaries who could jam or interrupt unprotected space communications bands.

Arriving at a coherent national security space vision will be a difficult task given the fractured, over-compartmented (highly classified) space community. The space community's state of disorganization, along with the continuing atrophy of basic aerospace infrastructure and human capital, will make it extremely difficult to conduct the thorough reforms outlined below. Moreover, OSD is now a major player in the de-

¹⁸² Air vehicle cost estimates are based on experience from the Global Hawk program and lessons learned from other stealthy aircraft prototypes, and include O&M estimates based on a conservative \$5 million per aircraft per year, which assumes high operational tempos throughout its lifespan.

velopment of space capabilities, having stripped acquisition and executive agent authority from the Air Force, making the following discussion somewhat speculative.¹⁸³

The Air Force must work to accomplish a minimum of five objectives: (1) reverse the atrophy in the US space design and industrial base, and its associated manpower base; (2) address the looming deficit in the joint force's ability to transmit critical information to deployed forces in opposed-network environments via long-haul, high bandwidth protected satellite communications (SATCOM); (3) improve protection for all current and planned space assets, even those in geo-stationary orbit (GEO); (4) develop the means to rapidly replenish destroyed or disabled satellites; and (5) tackle the lack of "space reciprocity" in the DoD bureaucracy that leads to requirements gold-plating and fractured fiscal incentives.

Address Space Human Capital Atrophy

The national security space design and industrial base suffers from a progressive erosion of America's aerospace S&T intellectual, skill, and engineering design talent base. Unfortunately, space sits at the leading edge of that trend, and has been the first to feel its debilitating effects.

Carl von Clausewitz defined a culmination point as that moment in an attack when one can no longer mount an effective defense because the logistical supply lines cannot support it. After Sputnik, America went on a space offensive that imposed terrible costs on the Soviet Union for decades. Now, the US space offensive has exhausted its key "logistical" supply line: security-clearable, top-notch scientists and engineers able to design, build, manage and oversee satellite programs — it has reached its culmination point. Indeed, the talent pool of scientists and engineers who can get the appropriate security clearances and follow through with effective conceptual, design, manufacturing, and launch work on satellites and subsystems probably passed that point some time ago. The space world's Byzantine labyrinth of shifting security programs exacerbates the problem by locking out whole cadres of experienced scientists and engineers from various programs.

Worse yet, US universities are no longer producing enough scientists and engineers to feed the US aerospace design and industrial base, primarily because an increasing number of science and engineering graduates, often the best ones, are foreign nationals who have difficulty obtaining security clearances. Consequently, satellite contractors bid for contracts under the assumption (or hope) that they can hire enough talent from the non-selected companies, or use them as subcontractors, in order to complete the program. More often than not, they fail because there just is not enough scientific

¹⁸³ After the 2005 Druyun Affair, the Air Force transferred all of its major acquisition programs to OSD AT&L, but OSD never transferred milestone decision authority for space programs back to the Air Force. Gail Putrich, "Pentagon pulls space decisions from USAF, NRO," *Defense News*, July 8, 2008, accessed at <http://www.vnfawing.com/forum/viewtopic.php?t=1908&start=210&sid=ad831a136e9e5b60c73fco8f657aef5> on 4 September 2008.

and engineering talent to go around. As a result, while relatively high-technology, unclassified aeronautical systems like the Boeing 787 progress at an acceptable pace, similarly complex classified defense systems cannot.

To address this challenge, the space community could scale back requirements and rebuild or tweak proven designs. However, this would seriously hamper innovation. Alternatively, it could also fund high profile, very expensive, high-risk programs and hope that this will lead to higher S&T salaries, enticing more talent into the field and enabling future advances. The risk here is that the program will almost surely fail, siphoning dollars from more sensible projects. A prudent, middle-of-the road course would be to do some of both, based upon an objective understanding of the industry's strengths and weaknesses.

However, to do this, the Air Force would have to address its aforementioned dearth of technically qualified leaders—personnel who understand what can be done technologically within reasonable budgets and schedules. This is a microcosm of a primary failing of the entire defense acquisition system: decision-makers who lack understanding of the practical capabilities and shortcomings of the technical community. For too long, the Air Force has relied on contractors and sub-contractors, Federally-Funded Research and Development Centers (FFRDCs), and consultants to determine and validate its needs. As a result, the Air Force no longer has the Bernie Schrieviers and Lew Allens—the tough, competent mid-level officers who do the necessary gritty, detailed project management work. This situation must be reversed, and as there are no short-cuts, starting sooner rather than later seems wise.

Improve Long-Haul, High-Bandwidth Protected Space Communications

Today, the Air Force's non-stealthy airborne ISR systems like the Global Hawk UAV rely on regulated, constrained space communications links that a sophisticated adversary will likely interrupt or jam during a conflict. The lack of reliable, high-bandwidth communications and data support to forces on the move remains a critical joint force deficiency. The solution to both of these problems is found in Extra-High Frequency (EHF) and laser satellite communications, which provide high throughput capacity (e.g., bandwidth) and are extremely difficult to jam. Systems with these characteristics are generically called "protected SATCOM."

The Air Force had a two-step program to provide high-bandwidth protected SATCOM. The first interim step came in the form of Advanced Extra-High Frequency (AEHF) satellites. The second step was the (recently cancelled) \$20 billion transformational satellite (TSAT) program, a constellation of five large GEO satellites that would provide high bandwidth protected EHF and laser satellite communications. Using TSAT, future non-stealthy and stealthy airborne surveillance-strike platforms and mobile joint forces would enjoy *fifty times* the bandwidth in an unregulated

The Air Force no longer has the Bernie Schrieviers and Lew Allens—the tough, competent mid-level officers who do the necessary gritty, detailed project management work.

Contractor assurances that technology readiness levels have improved should not provide sufficient grounds for production go-ahead.

spectrum using a small, stealthy 1.5 inch antenna arrays.¹⁸⁴ Recently, however, Defense Secretary Gates decided not to proceed with the TSAT program in favor of launching additional, lower-cost AEHF satellites.

While the need for TSAT-type capabilities could not be more urgent in the posited future security environment, three primary arguments led to the program's cancellation. First, technology and design maturity were an issue. According to the Government Accountability Office (GAO), in 2004 the Air Force proceeded with satellite risk reduction and design development even though only one of seven key TSAT technologies had achieved the required technology readiness level.¹⁸⁵ Competing contractors say they addressed the remaining six critical technologies, but this leads to the second point: it is not clear whether the available government or contractor acquisition infrastructure can support TSAT along with other critical space programs. In a 2007 report, the GAO noted specific space acquisition personnel shortfalls in cost estimation and program management as hampering TSAT development schedules.¹⁸⁶ Those same shortfalls apply to the scientists and engineers tasked with designing and building TSAT. According to long-time space system engineer and NRO veteran Terry Dunlavey, there are "not enough experts left in the business — seriously, the industrial base just isn't there."¹⁸⁷ In a recent report about the lack of technically qualified officers to oversee space projects, US Strategic Command chief and former astronaut General Kevin Chilton commented: "We recognize that as a challenge, unfortunately, we can't grow these people overnight."¹⁸⁸ Thus, contractor assurances that technology readiness levels have improved should not provide sufficient grounds for production go-ahead.¹⁸⁹

¹⁸⁴ See Don M. Boroson, "Laser Communications in Space," MIT Lincoln Laboratory briefing, September 6, 2007 at <http://www.osa.org/news/policyprograms/specialevents/don%20boroson%20-%20laser-com.pdf>, accessed on 5 October 2008. As with many Air Force capabilities, all the Services and other users want TSAT laser links for their forces, leaving significant doubt as to whether Air Force assets would gain any benefit from a program funded by the Air Force budget.

¹⁸⁵ United States General Accounting Office (GAO), "Transformational Satellite Program," report GAO-04-71R, December 4, 2003, pages 5–7, accessed at <http://www.gao.gov/new.items/d0471r.pdf> on 8 September 2008.

¹⁸⁶ United States Government Accountability Office, "Space Acquisition: Actions Needed to Expand and Sustain Use of Best Practices," report GAO-07-73OT, April 20, 2007, accessed at <http://www.gao.gov/new.items/d0773ot.pdf> on 7 October 2008.

¹⁸⁷ Terry Dunlavey, interview, October 3, 2008. For a very concise outline of the problem, see: Patricia Maloney and Michael Leon, "The State of the National Security Space Workforce," *Aerospace*, Spring 2007, accessed at <http://www.aero.org/publications/crosslink/spring2007/01.html> on 23 March 2009.

¹⁸⁸ Gayle Putrich, "USAF work force cuts may pose next problems for space programs: GAO," *Defense News*, April 20, 2007, accessed at <http://www.vnfawing.com/forum/viewtopic.php?t=1908&start=210&sid=ad831a136e9e5eb60c73fco8f657aef5> on October 10, 2008.

¹⁸⁹ "Boeing and TEAM TSAT Confirm Readiness of Advanced Satellite Electronics," Boeing news release, April 8, 2008, accessed at http://www.boeing.com/news/releases/2008/q2/080408a_nr.html on 10 October 2008. "Lockheed Martin Team Successfully Demonstrates High Performance Radiator Technology for TSAT Program," Lockheed Martin news release, September 18, 2008, accessed at http://findarticles.com/p/articles/mi_m4PRN/is_2008_Sept_17/ai_n28568568 on 10 October 2008.

The final reason for cancelling the TSAT is that its capability will not be fully usable until the DoD funds a supporting fleet of airborne, high altitude “objective gateways” or relays that can fly above cloud cover, receive high bandwidth optical information, and transmit it to the right receivers. Over 50 percent of the earth is shrouded in clouds at any given moment, and lasers do not easily penetrate clouds or other atmospheric obscurants. The only way to ensure that information makes it to US forces is to build a fleet of airborne communications nodes as part of the “objective gateway,” an Internet-type network for high-bandwidth information.¹⁹⁰ None of these platforms are now in the DoD program.

Upgrade Satellite Defensive Measures, Including Geo Satellites

The PRC’s 2007 demonstration of a direct-ascent anti-satellite (ASAT) highlighted the growing vulnerability of US space systems. According to strategist Ashley Tellis, China’s destruction of an aging weather satellite at an altitude of over 530 miles demonstrated an operational capability to destroy low- and even medium-earth orbiting satellites.¹⁹¹ Unfortunately, it also diverted attention away from a much more compelling, near-term issue: GEO satellite vulnerability. GEO satellites such as TSAT, orbiting about 22,000 miles above the earth, represent a huge investment and provide critical capabilities that cannot be readily reconstituted.

Indeed, even if government and industry could make TSAT work on time and on budget, putting a relatively vulnerable, concentrated, and yet critical capability on orbit in 2018 without adequate space situational awareness (SSA), good space indications and warning, and satellite defensive measures does not seem strategically sound. Indeed, appropriate defensive measures must be “go, no-go” criteria of any fully-funded TSAT deployment plan. A system like TSAT that is specifically designed to operate in an opposed terrestrial environment should not be launched until all plausible aspects of adversary opposition over its on-orbit lifespan (to include co-orbital ASATs) can be reasonably countered. TSAT should not move forward as a program until a comprehensive plan for simultaneously-deployed SSA and defensive measures are designed and funded. The current plan should be delayed until TSAT’s operational viability *and* survivability can be assured. The same goes for all high-end GEO satellites.

Accordingly, the Air Force should immediately embark on a broad-based GEO satellite defense effort. US GEO satellites sit in stable, predictable orbits, bringing

The Air Force should immediately embark on a broad-based GEO satellite defense effort.

¹⁹⁰ For information about the objective gateway program, see Michael Peterson, “Objective Gateway: Information to the Battlefield’s Edge,” RUSI Defence Systems, June 2007, accessed at http://www.rusi.org/downloads/assets/Peterson,_Objective_Gateway.pdf on 10 October 2008. See also, Bill Sweetman, “F-22 and F-35 Suffer from Network Gaps,” *Defense Technology International*, December 11, 2007.

¹⁹¹ Ashley Tellis, “Punching the US Military’s ‘Soft Ribs’: China’s Antisatellite Weapon Test in Perspective,” Carnegie Endowment for International Peace Policy Brief #51, June 2007, pages 1, 4. Accessed at: http://www.carnegieendowment.org/files/pb_51_tellis_final.pdf, on April 13, 2009.

The Air Force's space efforts must address system vulnerability and capability assurance. For far too long the space community has focused on capability maximization in an unopposed space environment.

to mind the battlewagons anchored in Battleship Row on December 7, 1941. GEO satellites designed for the long haul should be engineered with onboard threat detection and diagnostic sensors. They should contain extra maneuver propellant, and should move periodically to demonstrate their mobility. Passive defenses like lightweight inflatable decoys should be included in a GEO satellite's defensive suite. To enhance warning capabilities, the Air Force should design a constellation of GEO SSA protection microsats to provide high-fidelity, timely, continuous GEO satellite characterization and threat detection.

These efforts must be supplemented by a capability to disable threatening spacecraft. Advances in solid state lasers might make the design of an active protection escort system feasible, using short or ultra-short pulse lasers that would recharge using solar power and would pose a very effective deterrent to anyone contemplating holding American satellites at risk. Through augmented space situational awareness, coupled with passive and active defenses, the US future space fleet might adequately defend itself, thereby safeguarding America's ability to project decisive, global military power.

As this short discussion suggests, the Air Force's space efforts must address system vulnerability and capability assurance. For far too long the space community has focused on capability maximization in an unopposed space environment. As a result, space situational awareness and defensive measures exist mostly in briefings, not on orbit; and that must change.

Operationally Responsive Space (ORS) Reconstitution

Even with improved warning and active and passive defenses, some US satellites may not survive an attack. Consequently, the Air Force needs to develop new means to preserve and rapidly reconstitute space capabilities. Two programs stand out as prime candidates for further development. The first are Radiation Belt Remediation (RBR) technologies to eliminate or reduce the lethality of pumped radiation belts following a high altitude nuclear detonation that could diminish the life of unhardened LEO satellites.¹⁹² Second, recent design advances allow light-weight, low-cost, rapid-launch satellites to reconstitute or backfill gaps in the US satellite constellation. Air Force Space Command's Operationally Responsive Space (ORS) program explores cost-effective, rapid replenishment tactical satellites along with commercial backup options to provide quick turn-around satellite replacement during a major conflict. The cost of ORS would include about \$20 million per launch of refurbished Minotaur launch vehicles and about \$40 million per satellite, with a capacity for two satellites

¹⁹² Numerous studies highlighting the threat to LEO constellations by high-altitude nuclear detonation. See Barry Watts, *The Military Use of Space: A Diagnostic Assessment* (Washington, DC: Center for Strategic and Budgetary Assessments, 2001) page 21, accessed at http://www.csbaonline.org/4Publications/PubLibrary/R.20010201.The_Military_Use_o/R.20010201.The_Military_Use_o.pdf on 3 August 2008.

per launch or \$50 million per satellite.¹⁹³ At a fraction of the cost of today's giant satellite projects, ORS "tactical satellites" could provide on-call space augmentation, enable crisis reconstitution, and bolster crisis stability and deterrence.¹⁹⁴

Addressing Space Requirements Dysfunction

One of the most pressing bureaucratic issues impacting Air Force space acquisition involves escalating, unconstrained space requirements. Despite some complaints on the part of DoD officials that the Air Force's space programs are not sufficiently supported, a quick look at recent budgetary figures suggests a different story. Due to the increasing enthusiasm—and demand—for space-based services by non-Air Force agencies, the Air Force's investment in space *doubled* over the past ten years. This ballooning "space tax" comes at the expense of other Air Force programs, since OSD neither adequately screens these resource demands nor compensates the Air Force for them.

For example, if the Air Force needed to provide protected satellite communications to its own forces, the burden on the Air Force budget would be far less than the \$30 billion the Air Force is expecting to pay over the next twenty years. Most of that bandwidth is devoted to supporting requirements imposed by other Services and agencies for "free" Air Force services. Those requirements will likely continue to grow, as high- and low-end adversaries demonstrate their ability to jam unprotected communications, which represent the bulk of current space bandwidth. The lack of space requirements oversight incentivizes others to exaggerate their space requirements, and, lacking adequate OSD or Joint Staff arbitration, forces the Air Force to short-change their own space and air programs. Valuing and charging for joint services would return the requirements process to a more market-based incentive structure rather than the current system that treats extravagant joint programs as must-do's and Air Force core missions as leftovers. (Indeed, the same goes for other programs, such as aerial refueling and UAV combat air patrol requirements.)

A space working capital fund, similar to the transportation working capital fund outlined in Chapter 1, subject to OSD arbitration, could ameliorate many of the problems associated with unconstrained space requirements. It would either demand reciprocal services or charge other agencies for satellite bandwidth as is now done for strategic and tactical airlift. That, in turn, would moderate requirements and make space program management much more streamlined and efficient.

¹⁹³ A notional ORS rapid launch capacity of fifty tactical satellites would cost \$2.5 billion.

¹⁹⁴ Nations contemplating an attack on US LEO space assets would have to calculate the possibility that their attack might only marginally reduce US space capabilities, raising their cost-benefit assessment.

The Air Force should consider creating an aviation “train, advise, and assist” cadre to train foreign air forces to operate, maintain, sustain, and program their own forces.

IRREGULAR WARFARE (IW) FORCE STRUCTURE¹⁹⁵

Like the other Services, the Air Force has been slow to adapt to long-duration irregular warfare operations. It operates today with a fleet designed for 1980’s major combat operations, carrying out irregular warfare tasks effectively, but at an unsustainable cost in fuel and accelerated airframe wear. For example, the Air Force component of the US Central Command (the regional combatant command responsible for Iraq and Afghanistan) is flying armed reconnaissance and overwatch missions with aging jet fighters like the F-16 and F-15 at a cost of \$7,000 to \$17,000 per flight hour, and expends another \$8,000 per flight hour for aerial refueling tanker flights, not factoring in fuel costs.¹⁹⁶ By contrast, if Air Force pilots flew the same missions with a small, turboprop-driven, modified training aircraft, costs would decrease to around \$1,000–\$2,000 per flight hour with a more flexible aircraft able to fly from more airfields and provide more coverage in benign environments.¹⁹⁷ These low-end platforms could also provide the basis for a very important export force designed to bolster foreign counter-insurgency efforts, representing a “win-win” proposition. The Air Force benefits from employing the aircraft in the training base and also gets an irregular warfare platform; allies can buy useful platforms they can actually afford and maintain; and the Air Force stands to enhance its relationships with other militaries, with the prospect of potential increased foreign base access. Buying and fielding such an aircraft is not a trivial task, but even after five years of irregular warfare, no funded development plans for such inexpensive aircraft exist.

The Air Force should also develop an irregular warfare force structure that balances its operational competencies with fiscal realities. To be sure, while irregular warfare will be a persistent characteristic of the future security environment, it will not demand the kind of commitment posed by the PRC’s military expansion. Yet the Air Force clearly has an important role to play.

For example, the Air Force should consider creating an aviation “train, advise, and assist” cadre to train foreign air forces to operate, maintain, sustain, and program their own forces. The Air Force should also augment the 6th Special Operations Squadron (6th SOS), increasing its capacity to conduct persistent, multiple-nation foreign internal defense (FID) operations in support of special operations aviation. Air Force advisors and trainers should be assigned to regionally-specialized squadrons and receive language training. They should qualify in several types of FID aircraft,

¹⁹⁵ Air Force IW and special operations force structure is discussed at some length in the Long Haul report on Special Operations Forces. See Robert Martinage, “Special Operations Forces: Future Challenges and Opportunities,” Washington, DC: Center for Strategic and Budgetary Assessments, Strategy for the Long Haul Series, 2008.

¹⁹⁶ For DoD fixed wing aircraft “reimbursable rates” that show costs per flying hour for various aircraft, see “FY 2009 Reimbursable Rates: Fixed Wing,” accessed at http://www.defenselink.mil/comptroller/rates/fy2009/2009_f.pdf on 23 March 2009.

¹⁹⁷ Marcus Weisgerber, “ACC Officials Want Air Force Irregular Warfare Fleet of Aircraft,” *Inside the Air Force*, 7 November 2008.

to include airlift, ISR, and strike. Trainers and advisors should be supported by dedicated Air Education and Training Command (AETC) units.¹⁹⁸

FIGHTER FORCE STRUCTURE

Given the range of future operational challenges outlined in Chapter 2, emerging threats will likely force an evolution away from a warfighting paradigm centered on massed operations with short-range, multi-role fighter-bombers. Indeed, at some point over the next two decades, short-range, non-stealthy strike aircraft will likely have lost any meaningful deterrent and operational value against the PRC in the Western Pacific. They will also face major limitations in both irregular warfare and operations against a nuclear-armed regional adversary due to the increasing threat to forward air bases and the proliferation of modern air defenses that will render non-stealthy strike-fighters unusable on the high end, while they remain over-designed—and far too expensive—for low-end threats. In short, the so-called “tac-air shortfall” or “fighter gap” is only a problem if one believes that (1) legacy force structure replacement is affordable; and (2) its utility will endure in the future security environment relative to other investments.¹⁹⁹ Based on CSBA’s analysis, neither of these conditions is likely to hold for strike fighters over the next twenty years.

However, stealthy air superiority aircraft like the F-22 will likely retain significant utility over the next twenty years, with the urgency growing in the near term. The proliferation of sophisticated Russian air defense systems means the only US systems that can reliably penetrate and maintain a high survivability rate in the presence of integrated air defenses populated by SA-20B and SA-21 surface-to-air systems and modern Russian or Russian-derivative (e.g., Su-35BM) fighters will be the F-22 and the B-2. In order to conduct a modern air campaign, the United States must be able to conduct offensive fighter sweeps in contested airspace, maintain persistent defensive air patrols to guard against incoming supersonic or low-observable cruise missiles, defend tankers, AWACS, JSTARS, Rivet Joint, ISR and jammer aircraft, and suppress enemy air defenses (SEAD). Aging legacy fighters like the F-15C Eagle, the Air Force’s front-line air superiority aircraft since the early 1970s, can still conduct some of these missions in benign airspace (e.g., in CONUS). However, their useful operational life cannot be extended much beyond one decade without extensive, very expensive and complicated major airframe modifications.

Following this logic, the following recommendations are suggested as examples of types of actions the Air Force should take to shed some of its Cold War baggage and rationalize itself to the future security environment. They begin with discussion about one of the most controversial aircraft in the Air Force program: the F-22 Raptor.

¹⁹⁸ Robert Martinage, “Special Operations Forces: Future Challenges and Opportunities,” Washington, DC: Center for Strategic and Budgetary Assessments, Strategy for the Long Haul Series, pages 70–72.

¹⁹⁹ Graham Warwick, “Fighter Handoff,” *Aviation Week and Space Technology*, 29 September 2008: 36.

Unlike the F-35A, which remains in an extended development program and will not achieve full operational capability until 2017, the Raptor is a proven, fully operational platform in production.

F-22 OPTIONS. The F-22 Raptor will very likely prove to be an increasingly important platform due to its superior air-to-air capability, which resides in its all-aspect low observability, speed, and high-altitude performance. The ability to patrol at altitudes above fifty thousand feet allows it to provide a stealthy overwatch that greatly improves platform survivability and extends the performance of its long-range air intercept missiles. As an added benefit, its ability to conduct stealthy air-to-ground raids from those altitudes provides a credible strike threat even against advanced air defenses. Owing to its cutting-edge capabilities, deployment of the F-22 can serve as an effective diplomatic signal as well. Most importantly, advances in adversary capability indicate that we are likely entering a new phase of air-to-air competition that will require the F-22 to sustain the Air Force's long-held advantage.²⁰⁰

The F-22 has approximately the same organic endurance as the F-35A Lighting II Joint Strike Fighter. Both aircraft must be air-refueled to reach the long-range target and patrol areas. As a result, in a base-constrained environment like the Pacific, air refueling becomes an important factor in any air campaign. Limited air refueling puts a high priority on supporting the air superiority fighter force at range, making it essential that each fighter be as capable and heavily-armed as possible. Compared to the F-35, the F-22 enjoys greater all-aspect stealth, a higher operational ceiling, greater speed and maneuverability, and a greater missile carriage capacity. Also, unlike the F-35A, which remains in an extended development program and will not achieve full operational capability until 2017, the Raptor is a proven, fully operational platform in production.

Moreover, the F-22 excels in roles where there are no suitable substitutes. It is a much better offensive or defensive counter-air platform than the F-35, and most future strike missions can be carried out much more effectively by long-range bombers. As previously discussed, bombers are becoming critical to Air Force plans, both in the non-stealthy standoff and penetrating platform roles, and they require much less complicated and vulnerable tanker support due to their great inherent range.²⁰¹

However, despite the F-22's utility, previous Air Force leaders made three decisions that substantially diminished its long-term operational impact. First, they reduced the optimal squadron size from the proven combat standard of twenty-four aircraft. The larger twenty-four-plane squadrons can provide 24-hour combat air patrols (CAPs) with two "four-ships" per CAP at a reasonable range.²⁰² The smaller eighteen-

²⁰⁰ Unfortunately, just buying more F-22s may be necessary, but not sufficient to address the threat. Significant work must be done to advance an entirely fresh operational concept for air superiority that incorporates new tactics, weapons, and the re-invigoration of the moribund Department-wide electronic warfare establishment.

²⁰¹ Tanker tracks, or aerial operating locations, can be located farther from enemy fighters and operate from bases less threatened by ballistic and cruise missile attack when supporting long-range bombers. If the situation allows closer tanker operating locations, the bombers translate that range into endurance better than the much shorter-ranged F-35 when used in a bombing role.

²⁰² Air superiority tactics usually require at least four aircraft working in concert, with that group sometimes dividing into two four-ships in the case of visual fighter maneuvering.

jet squadron could provide 24-hour CAP coverage, but only at shorter range or with gaps in coverage. Those gaps would likely increase over time as strained maintenance personnel played a losing game to keep sortie rates up.²⁰³ Second, because the initial Raptor buy was limited to just 183 aircraft, to get the greatest number of operational squadrons Air Force leaders opted to sacrifice the attrition reserve (AR) portion of the acquisition program. Attrition reserve aircraft typically constitute about 14 percent of the combat-coded fleet, providing critical augmentation airframes as peacetime and combat operations attrite the force.²⁰⁴ Failing to buy the attrition reserve fleet, about eighteen aircraft, essentially sacrifices the long-term strategic viability of the F-22 fleet. Finally, under congressional pressure to minimize program costs, the Air Force delayed or failed to fund needed upgrades to the F-22 that will further limit its combat capability, leaving the fleet in various different configurations that cannot be efficiently operated or sustained, again limiting the number of available spare aircraft that could be used as replacements as attrition occurs over time. Retrofits are required to bring the fleet up to a standardized operational configuration.

The F-22 options suggested below hedge against F-35 program slippage and the potential for program redesigns, while addressing the force shortfalls noted above. The OSD-led, cross-service Cost Analysis Improvement Group (CAIG) recently reported that testing of the initial operational capability (IOC) F-35 Block 30 configuration will likely slip another three years at an additional cost of up to \$7.4 billion.²⁰⁵ If that happens, the Air Force will be forced to choose either to stay on its production schedule with insufficiently tested Block 30 versions that will likely need costly upgrades later, or to settle for a Block 20 derivative in the interim as it incurs additional development costs. A prudent alternative would be to conduct full developmental testing of the F-35A Block 30 configuration, and slip the planned 2013 IOC and procurement schedule by three years. Delaying the F-35 buy for reasons of program integrity, something the Air Force can ill afford to compromise, makes the procurement of additional F-22s in the interim much more attractive, as joint force commanders get a proven jet years earlier that addresses their most pressing air superiority needs until the F-35 can prove itself.

²⁰³ As with most military operations, extended conflicts become a logistical exercise. In this case, the logistics of an eighteen-jet air superiority squadron degrade dramatically in just days. Furthermore, whereas the F-22 is far more lethal than legacy jets one-on-one, current adversary saturation tactics put a premium on missile numbers, and the only way to compensate for that is with additional jets.

²⁰⁴ The formula for fighter aircraft inventory starts with Combat Coded (denoted as CC or primary aircraft inventory, PAI), then training forces (TF) are calculated by calculating 25% of CC, test aircraft (denoted as CB) constitute 5% of CC+TF, then backup aircraft inventory (BAI) equates to 10% of CC+TF+CB, then attrition reserve (AR) equals 10% of CC+TF+CB+BAI, and finally Total Aircraft Inventory (TAI), which represents the entire fleet.

²⁰⁵ Government Accountability Office, "Joint Strike Fighter: Accelerating Procurement before Completing Development Increases the Government's Financial Risk," GAO-09-303, March 2009, page 2, accessed at <http://www.gao.gov/new.items/do9303.pdf> on 27 March 2009.

The options below are listed in order of priority.

OPTION #1: UPGRADE THE CURRENT F-22 FLEET TO THE BLOCK 35 STANDARD. This option focuses on standardizing the current force to the most advanced Block 35 standard. Under congressional and Defense Department guidance to contain program costs, development of many essential F-22 capabilities lagged production, and some essential retrofits were not funded in the FY09 budget. F-22s in the current fleet are therefore in a variety of Block configurations. The highest-priority, high-payoff, near-term F-22 investment would be to bring the entire fleet up to the most capable Block 35 configuration.²⁰⁶ At a minimum, this would include modifying about sixty jets in the Block 30 configuration to the new standard, at an estimated total cost of \$2.5 billion for several key upgrades, including full small diameter bomb (SDB) capability, the ability to employ advanced AIM-9X and AIM-120D air-to-air missiles, updated electronic protection and adversary aircraft identification, and the baseline multi-aperture data link (MADL) for network connectivity.²⁰⁷ That would result in the operational fleet and its thin backup inventory achieving the same combat standard across the force.²⁰⁸

OPTION #2: BUY BACK F-22 ATTRITION RESERVE. The minimum F-22 expansion option that contributes to filling out the current operational force would be to buy the lost attrition reserve fleet. In every other fighter force, attrition reserve aircraft constitute about 14 percent of the operational fleet, providing critical augmentation airframes used to ensure squadron viability over the life-cycle of the program. Attrition reserve fleet size is based on plane attrition at a predictable peacetime rate. As discussed earlier, Air Force leaders chose not to buy attrition reserve F-22s in order to squeeze the maximum number of operational squadrons out of the limited buy. The current leadership must redress this problem for the existing seven squadrons, which would require buying an additional eighteen aircraft, costing the Air Force about \$3 billion in FY10 procurement.²⁰⁹ Buying back those eighteen aircraft will add critical years to the useful life of the F-22 fleet.

The first two options constitute a critical investment in the F-22's long-term operational viability.

²⁰⁶ Using the block upgrade concept, the F-22 is supposed to receive an ever-increasing set of capabilities through stepped increases designated by numerical increments of ten. Block 20 includes ground attack upgrades (joint direct attack munition [JDAM] and small diameter bomb [SDB]) and aircraft data links; Block 30 includes side-looking radar arrays and defense suppression capabilities.

²⁰⁷ Interview with F-22 program official.

²⁰⁸ About thirty-five aircraft will probably remain in Block 20 configuration, which is fine for the training group at Tyndall Air Force Base, Florida.

²⁰⁹ Assumes an average procurement cost of \$175 million per aircraft.

OPTION #3: EXPAND THE NUMBER OF JETS PER SQUADRON FROM EIGHTEEN TO TWENTY-FOUR. If the DoD leadership feels that expansion of the F-22 fleet to fill a gap caused by rationalizing the F-35 program would be prudent, it should be done based on an operational logic. This option would retain the number of Raptor squadrons (seven), but would fill them out to a much more combat-capable twenty-four-jet standard along with the requisite training, test, backup, and attrition reserve aircraft. This would require an additional forty-two combat-coded Raptors for a total of eighty additional jets at about \$13–\$14 billion in procurement costs, notionally bought over a four-year period at the current rate of twenty jets per year.²¹⁰ Through 2028 this option would also result in an additional operations and maintenance (O&M) bill of approximately \$9 billion, for a total Option 3 cost of \$22–\$24 billion over a twenty-year span. To rationalize the current AEF mismatch, the seven operational squadrons should be split into one squadron in each of five AEF pairs, with the additional two squadrons serving as a strategic reserve. Each squadron would constitute a much more formidable force, able to sustain 24/7 combat air patrols over a longer period of time than the current squadrons.

OPTION #4: REDUCE AND ACCELERATE F-35A PROCUREMENT. The F-35 Lightning II is the elephant in the room of the DoD procurement program. It was designed as a multirole complement to the Air Force F-22, replacing Air Force F-16s, A-10s, and F-15Es, Navy and Marine Corps F/A-18 A/C/Ds, and Marine Corps AV-8Bs. This ambitious goal is reflected by a projected program cost of over \$300 billion — a price that dwarfs other DoD acquisition programs. Moreover, it was specifically designed as a multinational aircraft program. As of today, the United Kingdom, Canada, Denmark, Norway, the Netherlands, Italy, Turkey, Israel, Singapore, and Australia are either cooperating participants in the program or intend to purchase some aircraft.²¹¹

Unfortunately, while the F-22 is a clear high-end system with specific capabilities critical to future US military operations, the F-35 represents a classic “middle-weight” capability — excessively sophisticated and expensive for persistent strike operations in the benign air environments of the developing world and most irregular warfare operations, yet not capable enough to contribute effectively to a stressing campaign against a nation employing modern anti-access/area-denial defenses. The era of massed strike fighters operating with impunity from close-in bases no longer defines operational utility in the most important planning scenarios. In the future, any US main operating base for short-range fighters will likely be vulnerable to both sustained short-range and long-range guided weapon attacks. This problem applies equally to the F-22 or the F-35, but with the proper investments in dispersed, hardened shelters,

²¹⁰ Assumes an average procurement cost of \$170 million per aircraft.

²¹¹ Stephen Trimble, “Foreign Service: F-35 tackles pricing issue for foreign buyers,” *Flightglobal*, March 7, 2008, accessed at: <http://www.flightglobal.com/articles/2008/07/03/225064/foreign-service-f-35-tackles-pricing-issue-for-foreign.html> on 13 April 2009.

The F-35A appears to be a solid design with future adaptive flexibility, and provides needed diversity in the future fighter force. Still, it represents an opportunity cost that poses the single greatest threat to the future Air Force's strategic viability, and risks bleeding the Air Force white over the next twenty years.

it should be possible to keep a moderate number of high-leverage performance aircraft in the fight — placing a high premium on their individual capability. Air superiority fighters can be based closer to the fight, while more effective bombers can operate from much longer range. In addition, against a sophisticated foe, highly constrained tanker resources will be taxed heavily in supporting the air superiority mission, where the F-35, lacking the performance and missile carriage of the F-22 Raptor, is clearly inferior.²¹² Most importantly, only bombers can provide the reach, payload, and persistence required for the strike mission in the most threatening and remote parts of the world. Thus, while the F-35 might be ideal for re-fighting Desert Storm or Kosovo, it is only marginally suited to the projected high/low threat environment, and thus the strategic and operational opportunity costs of pursuing the current program is very high.

Although the case for reducing the total F-35A procurement has strong strategic logic, because of the multiservice and multinational aspects of the F-35 program, cancelling the entire program is not a viable option. In any event, being a more modern design than the F-22, the Lightning II has great capacity for adaptation as the air combat environment evolves. Specifically, it has the space, power, and cooling for fast processors that run high-order-language system software, a full internal fiber-optic communications net, and a slew of low-observable sensor apertures and “low probability of intercept” (LPI) antennas. The F-35A appears to be a solid design with future adaptive flexibility, and provides needed diversity in the future fighter force. Still, it represents an opportunity cost that poses the single greatest threat to the future Air Force's strategic viability, and risks bleeding the Air Force white over the next twenty years.

Therefore, the Air Force could and should consider cutting its planned buy to free up resources for other pressing program requirements. A prudent compromise would be to reduce the current Air Force plan to buy of 1,763 F-35As through 2034 by just over half and increasing the purchase rate, resulting in a total of 858 F-35s, or 540 combat-coded F-35As on the ramp by 2020. This would yield thirty squadrons of eighteen combat-coded F-35As by 2021 instead of forty squadrons by 2028 under the current plan.²¹³

Reducing the buy would also allow the Air Force to buy three additional eighteen-plane F-22 squadrons (option 3 above). This would give each of the ten 2028 AEFs

²¹² F-35 can only carry four air-to-air missiles in its most stealthy configuration. In contrast, Russian-designed Su-27 Flankers and their more advanced derivatives such as the Su-30MKK, Su-33, and Su-35, carry ten or more air intercept missiles. See some comparative analysis by a group advocating F-22 over the F-35 at: “Joint Strike Fighter,” accessed at <http://www.ausairpower.net/jsf.html>, on 23 March 2009.

²¹³ The specifics of the cut were based on AEF force structure, with three eighteen-aircraft squadrons per AEF, or a total of 540 operational jets, or six F-35A squadrons (108) per AEF pair, the total amount available for steady-state, sustainable deployment at any given time. Note that because F-35A units will not have a primary air-to-air operational mission, they also do not require twenty-four-jet squadrons to conduct 24/7 operations, as would the F-22.

three squadrons of eighteen F-35As and one of eighteen F-22s. This represents a net reduction of 806 aircraft (905 fewer F-35s and 99 more F-22s) from the current program, resulting in procurement savings of \$62–\$77 billion over the life of the two programs.²¹⁴ Furthermore, by accelerating the F-35A build rate to 110 per year and concluding F-35 procurement earlier, significant additional savings could be achieved. However, O&M costs from this accelerated, constricted procurement schedule will actually rise by about \$12 billion by 2028 due to the accelerated buy if no other fighter force structure actions are taken, yielding a total savings of some \$50–\$65 billion over the twenty-year time span of the QDR.²¹⁵

OPTION #5: CUT LEGACY FIGHTER FORCE STRUCTURE. The Air Force continues to operate a substantial force of legacy fighter aircraft, including F-15C Eagle air superiority fighters, F-15E Strike Eagle and F-16 Fighting Falcon multi-role fighter-bombers, and A-10 Warthog close air support aircraft. Because of the 1990s “procurement holiday,” the average age of these aircraft is reaching unprecedented levels, making them increasingly difficult to keep in the air.

Accordingly, in addition to cutting back the procurement of F-35As, the Air Force should cut back its planned legacy fighter force structure some 35 percent by 2015, reaching about one thousand combat-coded fighters, and sustain this level through 2028.²¹⁶ This represents a more aggressive draw-down than the current Air Force plan, which calls for scaling back the F-15C force to fifty “Silver Eagle” (AESA-equipped) National Guard homeland defense interceptors, and reducing the A-10C fleet to five eighteen-plane squadrons (ninety operational jets) by 2015, and drawing down to zero by 2023. The plan would also retain the F-15E Strike Eagle force structure at 138 combat-coded jets throughout the next twenty years, and would modify the F-16 force to an all-Block 40/50 configuration, and replace all of them with F-35As by 2020.

Notionally, this plan would result in a 2028 operational fighter force of 908 aircraft, including 180 F-22 Raptors, 540 F-35A Lightning IIs, 50 Silver Eagles, and 138 F-15E Strike Eagles. This force represents a 30 percent reduction from the 1,300 total aircraft in the current plan. However, this smaller fighter fleet would be much newer, with the F-22 and F-35A models comprising about 80 percent of the force. This force structure would cost proportionately less to man, modify, and operate as a result. With this phased drawdown, projecting an average savings of \$3 million in

The Air Force should cut back its planned legacy fighter force structure some 35 percent by 2015, reaching about one thousand combat-coded fighters, and sustain this level through 2028.

²¹⁴ The low figure is based on no further real fly-away cost growth over current Joint Evaluation Team (JET) projections for decreasing production costs over time with a 10 percent increase due to the production cut, both very optimistic projections. The higher figure is based on a 10 percent fly-away cost growth, and an additional 10% growth due to procurement cut, a more mid-range projection. Based on historical performance of other major aircraft programs, an overall 30% increase (or more) is entirely likely and could raise the twenty-year offset projection to \$140 billion.

²¹⁵ Average O&M for F-35A was estimated to be \$3 million per jet per year, the same assumption used for the aggregate fighter force below.

²¹⁶ This total assumes selection of Option 3, or 99 additional F-22 Raptors.

O&M costs per jet per year (assuming no manpower savings), the Air Force should realize an aggregate O&M windfall of about \$20–\$25 billion through 2028.²¹⁷ To be sure, the proposed cut in F-35A numbers and the steeper reduction in legacy fighter aircraft represent a calculated risk. However, the strategic logic for the move is clear and compelling, as is the need to free up Air Force resources to address other more pressing priorities.

Continuing to fly congressionally-protected aircraft that the Service has marked for retirement costs the American taxpayer \$4.6 million per day. Yet Congress continues to deny the Air Force the ability to retire these aircraft.

OPTION #6: ADVOCATE A FORCE STRUCTURE REALIGNMENT COMMISSION. Despite its broad strategic and fiscal coherence, one drawback of the recommended plan would be its domestic political implications. Congress has been reluctant to approve Air Force plans to cut very old, even decrepit, KC-135E aerial refuelers, C-130E tactical airlifters, and C-5A strategic airlifters, all of which long ago passed their operationally useful lives. These aircraft continue to siphon money away from new programs as billions are spent on upgrades and skyrocketing O&M costs. The Air Force Chief of Staff recently testified that continuing to fly congressionally-protected aircraft that the Service has marked for retirement costs the American taxpayer \$4.6 million per day.²¹⁸ Yet Congress continues to deny the Air Force the ability to retire these aircraft.

This cannot continue without dangerously increasing national security risk. The future viability of America’s airpower advantage hinges on strong action on both sides of the budget squeeze — current force structure and new acquisitions. Consequently, some new method of breaking the political logjam must be explored. One solution to this “death by a thousand mods” problem — one that is also eating the Air Force’s S&T and R&D seed corn — might be to convene a BRAC-like process in which a congressionally-appointed commission assembles an omnibus force structure reduction package, and presents it to Congress for a single “up or down” vote. Such a package would give Congressional members political cover when old aircraft are removed from their districts.

OPTION #7: ADJUST FIGHTER FORCE MANPOWER. The Air Force should continue to pursue options for more fully mixing active, guard, and reserve manpower (called Total Force Integration) to gain both peacetime efficiency and rotational wartime capacity. The benefits of integration are evident in the way Guard and Reserve units currently deploy under the AEF construct using volunteerism rather than mobilization. Fighter unit combat capability stems not only from the number of platforms in

²¹⁷ The accelerated buy of F-35s actually increases O&M over the Air Force’s current plan, but only relative to F-35s. When you figure in legacy cuts, the aggregate O&M savings accumulate by the stated amount.

²¹⁸ Mackenzie Eaglen, “Airmen vs. Modernization: The Air Force Budget Dilemma,” The Heritage Foundation backgrounder #2037, May 18, 2007, accessed at <http://www.heritage.org/Research/NationalSecurity/bg2037.cfm> on 14 September 2008.

the squadron, but also from the mix of flight crew and maintenance manning and experience levels.

For a more optimized configuration, the Air Force should transition more units to a Total Force Integration model. Two different examples exist today, each providing different advantages.²¹⁹ The Classic Association features the active force owning the weapon system and acting as the host unit, with Air Reserve Component (ARC) personnel providing augmentation. Fighter units at Langley AFB, Virginia (F-22) and bomber units at Whiteman AFB, Missouri (B-2) use this model.²²⁰ The Active Association model, on the other hand, involves the ARC owning the weapon system and the host unit, with augmentation by active-duty personnel. The F-16 unit at McEntire Joint National Guard Base (JNGB), South Carolina, represents an example of the Active Association.²²¹ Experimenting with both models would likely yield lessons that could be applied more broadly to get more out of the smaller force structure recommended by this study.

Both the Classic and Active Association models benefit from the maturity of ARC personnel. ARC pilots and maintenance personnel are normally much more experienced than active-duty personnel, and can provide a more vigorous mentoring and training environment. As mentioned, the Air Force differs from the other Services in the enormous sums it expends on training its people to operate and maintain high-technology systems. The ARC provides an indispensable service by retaining very highly-trained people who would otherwise leave the Air Force, thereby saving the time and money required to grow new pilots or experienced aircraft maintenance technicians by maintaining them in the force at a fraction of the cost. The proportion of instructor pilots and weapons school graduates, the most highly-trained and capable Airmen, is typically higher at ANG fighter units, allowing associated units to conduct more and higher-quality upgrade training for their active-duty pilots. In the same way, RAND analysts found that ANG maintenance organizations produced more peacetime flying hours per person than active units due to their greater experience and training, in most cases double that of the active force.²²² Active-reserve component associations present few negative tradeoffs and many advantages.

The most efficient manpower model for Air Force squadrons based in the United States appears to be the Active Associate model where the ARC serves as the host

²¹⁹ A third type of associate unit is called the "ARC Associate" and combines ANG with Air Force Reserve manning, and does not present many efficiency or combat availability advantages.

²²⁰ Meaghan McNeil, "192nd Fighter Wing Activates at Langley," 192nd Fighter Wing Public Affairs, November 4, 2007, accessed on 4 November 2008 at <http://vko.va.ngb.army.mil/viriniaguard/news/nov2007/192ndLangley.htm>.

²²¹ McEntire JNGB has active-duty personnel who are administratively assigned to nearby Shaw AFB, SC. "Shaw, McEntire to sign MOU on active associate program," Shaw AFB press release, October 12, 2007, accessed at <http://www.shaw.af.mil/press/archive/story.asp?id=123071825> on November 9, 2008.

²²² See John G. Drew, et al., "Options for Meeting the Maintenance Demands of Active Associate Flying Units," RAND Corporation, 2008, accessed at http://www.rand.org/pubs/monographs/2008/RAND_MG611.pdf on 9 November 2008.

unit and the active component augments with flight and maintenance crews. It requires fewer full-time active-duty personnel to fill AEF requirements, resulting in lower personnel costs and greater utilization of each combat-coded aircraft. In the event of a major war, deployment requirements are the same regardless of component. Moreover, mixing experienced field-grade ARC officers with company-grade officers, and more senior ARC maintenance NCOs with junior enlisted Airmen from the active force leads to less friction and a better mentoring environment than the Classic Association, which risks combining higher-ranking officers and NCOs.²²³

Regardless of which Total Force manpower model is used, it seems clear that greater use of composite active-reserve unit approaches would result in closer relationships between the active and reserve components, maximize the combat capability of a shrinking force, and save substantial unit start-up and O&M costs over several decades.

OPTION #8: HOMELAND AIR DEFENSE AND SUPPORT FUNDING. In the future, the United States may not enjoy a clear delineation between major contingency operations, homeland air defense, and humanitarian support missions. Indeed, as a result of the priorities favoring overseas contingencies, the homeland air defense and humanitarian support missions have been accorded a relatively low priority by the Air Force. However, as seen on September 11 2001, it is possible for non-state adversaries to bring the war to the American homeland. Thus, every operational plan for major combat operations should develop a homeland defense annex that lays out forces and command and control relationships for potential homeland defense missions, with the goal of normalizing funding, equipping, and training for homeland defense and support requirements. The Air Force should incorporate the proper level of funding for those homeland defense requirements as well.

The next section provides recommendations affecting a key element of US airpower — air bases. As covered in Chapter 1, the Air Force suffers from a CONUS base excess, and an overseas base access shortfall. Righting that imbalance will relieve pressure on future Air Force budgets and provide access to critical overseas bases.

AIR FORCE CONUS AND OVERSEAS BASING

Restoring the Air Force's institutional confidence and relevance and reshaping its future force structure to better conform to existing and emerging security challenges will be critical to the Air Force's ability to perform as a key part of the joint force. This effort must also include rationalizing the Air Force's interior (inside the continental United States) and exterior (overseas) basing structure. The US basing network is the "launch platform" for US air operations, and this network has been neglected since

²²³ Classic Associations might be a more efficient model for OCONUS bases such as in Europe and Korea, where you could find skilled Air Force Reservists who would stay on to augment active-duty host units.

the end of the Cold War.²²⁴ The following two sections outline some important first steps that the Air Force should take to remedy this situation. However, unlike the previous recommendations found in this report, which depend largely on independent Air Force decisions, the following recommendations would require significant external cooperation.

Close Excess Interior (CONUS) Bases

The Air Force has excess CONUS base capacity for its planned force structure. Paying for excess base capacity weighs heavily on Air Force leaders, as it constitutes a tax on an already depleted Service budget. If the Air Force undertakes a 30 percent cut in legacy fighter force structure by 2015 as called for by this report, the excess base tax would be even more detrimental. Another Base Realignment and Closure round in the 2012 timeframe would allow the Air Force to get another step closer to attaining a force posture that maximizes its combat power and supports a move toward more capable high-end forces and more effective low-end capabilities.

Unfortunately, experience shows that savings from base closures are not realized for several years; nevertheless, base closures can free up significant resources over time. Analysis shows that the BRAC rounds in 1993 and 1995 decreased Department of Defense infrastructure by about 12 percent. The Department of Defense estimated that a similar 12 percent cut in the 2005 BRAC round would have resulted in savings of about \$3 billion by 2011, and in recurring yearly savings of \$5 billion thereafter (or \$85 billion through 2028). In the end, however, only a fraction of the proposed cuts in the 2005 BRAC were adopted, one reason why the Air Force suffers from a CONUS base excess problem.²²⁵ If the Air Force could realize a 20 percent reduction in basing infrastructure from a new 2012 CONUS BRAC process, the Air Force could generate a potential net savings of about \$23 billion from 2018 through 2028, or about \$2 billion per year.²²⁶ Savings could be re-invested in the programs recommended in this report, or other emergent needs such as funding overseas base expansion and hardening.

²²⁴ For through treatment of evolving US global defense posture since the end of the Cold War, see Andrew Krepinevich and Robert O. Work, "A New Global Defense Posture for the Second Transoceanic Era," Center for Strategic and Budgetary Assessments, 2007, accessed at: http://www.csbaonline.org/4Publications/PubLibrary/R.20070420.A_New_Global_Defen/R.20070420.A_New_Global_Defen.pdf on 23 March 2009.

²²⁵ 2004 BRAC Report, page 56.

²²⁶ This estimate uses Department of Defense projections for a 20 percent cut in "infrastructure plant replacement value" (PRV) in 2005, adds 20 percent for inflation from 2011 to 2018, and gives the Air Force its current budgetary share minus non-discretionary external add-ons such as NFIP (24 percent) of the savings from 2018 (six years after a 2012 BRAC) through 2028.

The Department of Defense, US Pacific Command, and Pacific Air Forces must begin a serious Pacific/Asian base assessment which takes into account the growing threat to all regional bases from long-range air and missile forces.

Expand Investment in Exterior (Overseas) Bases

The decline of the US Cold War overseas basing network was the natural result of the collapse of the Soviet Union. However, overseas base closures proceeded during the 1990s with little strategic rationale beyond “shrinking” the basing network in response to a world without a Soviet threat. In the wake of the 2001 QDR, OSD corrected that slide by initiating a comprehensive global posture review, shifting emphasis from overseas main operating bases to forward operating sites and cooperative security locations.²²⁷

While this posture realignment was, on balance, positive from a strategic perspective, it did not go far enough to expand or improve US base access in the region of growing importance to US interests: East Asia. The emergence of East Asia as the new center of geostrategic gravity suggests a draw-down of European bases and an expansion of Asian base access (not necessarily bases), particularly for land-based air forces. In the Pacific, China’s expansion of long-range strike and ISR capacity will likely place US forward bases at high risk, forcing a pullback from these bases during a potential crisis, and quickly overwhelming available capacity at the major US power projection bases in Alaska, Hawaii, and Guam. Accordingly, the Department of Defense, US Pacific Command, and Pacific Air Forces must begin a serious Pacific/Asian base assessment which takes into account the growing threat to all regional bases from long-range air and missile forces. Just as they did in the Cold War, US strategists must once again consider the four most important posture considerations of operating under threat of long-range surprise attack: (1) base dispersal (physically and operationally); (2) base hardening; (3) active defenses; and (4) survivable warning.

Of these four posture considerations, perhaps the most critical near-term action should be the hardening of Andersen Air Base in Guam, and the construction of aircraft dispersal bases in the Northern Marianas islands and Palau.²²⁸ The lack of hardened or local dispersal facilities on or near Guam combined with the increasing concentration of US military forces there presents a lucrative target that weakens the regional military balance, produces incentives for an adversary to launch preemptive attacks, and detracts from regional crisis stability.

Analyses of alternatives should include cost-benefit tradeoffs between passive and active defenses. Modern base hardening designs must address a different threat than old-style shelters, as was demonstrated in Desert Storm when US laser-guided penetrating bombs breeched Iraqi nuclear-hardened aircraft shelters with relative ease.

²²⁷ See testimony to the Senate Armed Services Committee about the global posture review on 23 September 2004 by Secretary of Defense Donald Rumsfeld and regional commanders at: <http://www.defenselink.mil/pubs/pdfs/qdr2001.pdf>, accessed on 27 March 2009.

²²⁸ Near-term candidates for dispersal basing in the Pacific include Palau, Tinian, Saipan, Wake, Johnston, Kwajalein, Bikini, and Eniwetok. Increases in access to dispersal basing with current regional allies should also be pursued as part of this effort.

Hardening should take the form of large aircraft shelters made of ultra-high performance concrete (UHPC) that would remove the incentive to attack the base with dispersed cluster munitions.²²⁹ Hardening measures also include hardened (thicker) runways and improved “rapid runway repair” (RRR) capacity that enables runways reconstitution quickly after being attacked. Although hardening offers the most cost-effective near-term measure of addressing the growing threat posed by A2/AD capabilities, it must always be supplemented with dispersal, active defenses, and attack warning to increase the survivability of US power projection forces.

While the recommendations in this chapter can and should be debated in detail, considered together, they would produce a more effective *aggregate* force posture over the next twenty years. The chapter that follows makes a few concluding observations about the importance of the Air Force’s strategic “forest” relative to its programmatic “trees.”

²²⁹ UHPC structures are about four times the strength of standard concrete (comparable to steel) in compression. It is also called Reactive Powder Concrete (RPC). See the “Ultra High Performance Concrete (UHPC),” Proceedings of the International Symposium of Ultra High Performance Concrete, 13–14 September, 2004 at <http://www.upress.uni-kassel.de/online/frei/978-3-89958-086-0.volltext.frei.pdf>, accessed on 5 September 2008.



CONCLUSIONS AND WAY AHEAD

The proposals contained in this report, while not exhaustive, differ in important ways from the current Air Force program. As the following short summary reveals, together they would result in an Air Force over the next twenty years that is better prepared to address today's threats and the unfolding challenges of the future security environment.

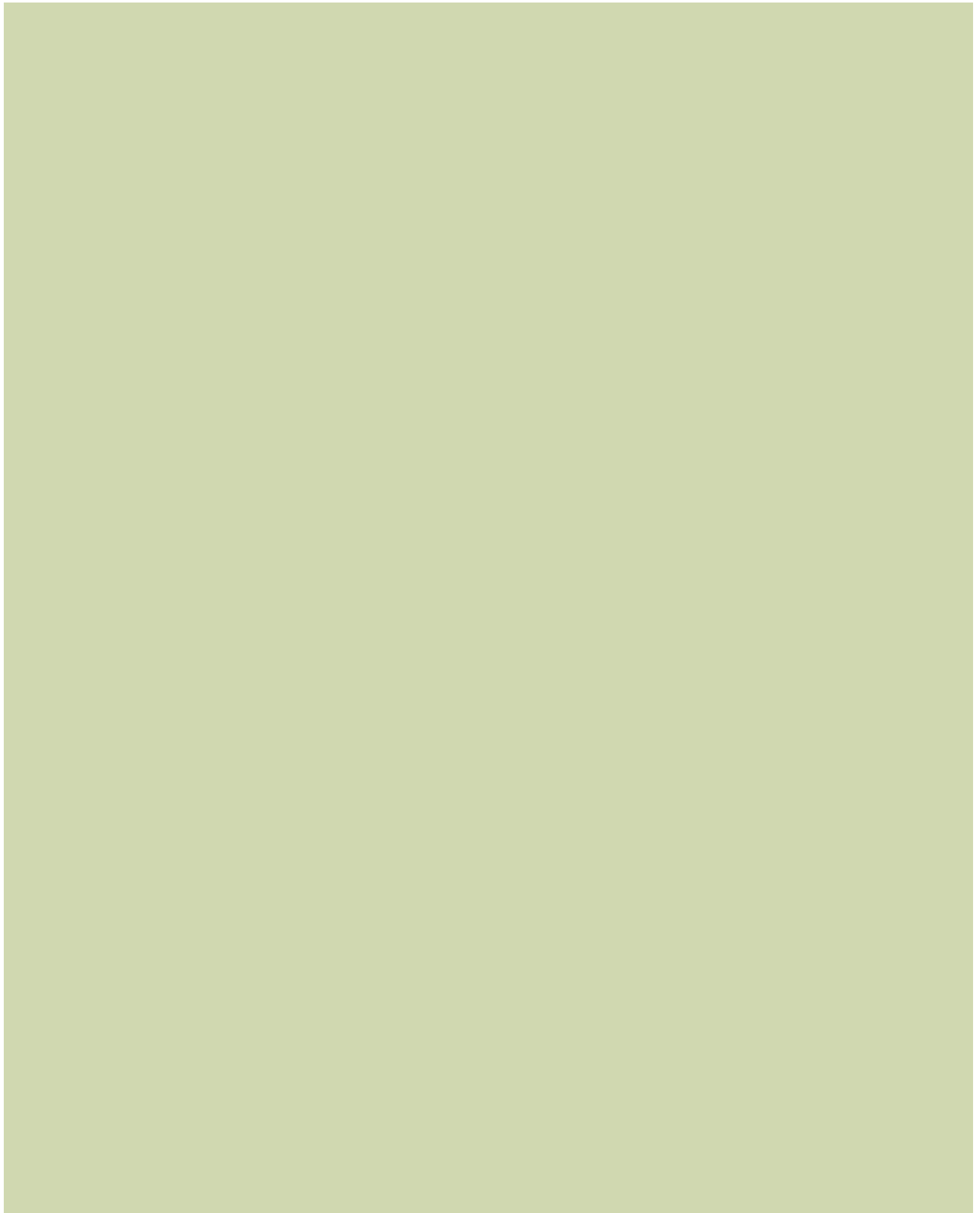
These recommendations would create an Air Force much more capable of flying and fighting from long range. Under current Air Force plans, only 6 percent of its 2028 Air Force air arm will consist of long-range bombers. The plan presented here would see that percentage almost triple, to 17 percent of the strike arm, with one hundred additional bombers and eighty additional long-range ISR platforms fielded, most of them low-observable designs. This plan also results in a much more stealthy and survivable force across its total range of capabilities. From a force that in 2009 has low-observable or stealthy platforms in only 5 percent of its fighter force, 20 percent of its bomber force, and none of its ISR force, this plan results in a 2028 Air Force with low-observable platforms in 80 percent of its fighter force, over 60 percent of its bomber force, and over 50 percent of its ISR force. The combination of range and stealth makes this plan far more capable of confronting both rising peers and nuclear-armed regional adversaries. Moreover, substantial force structure additions in the form of light aircraft and UAVs make this Air Force much more useful and sustainable in protracted, distributed irregular warfare environments.

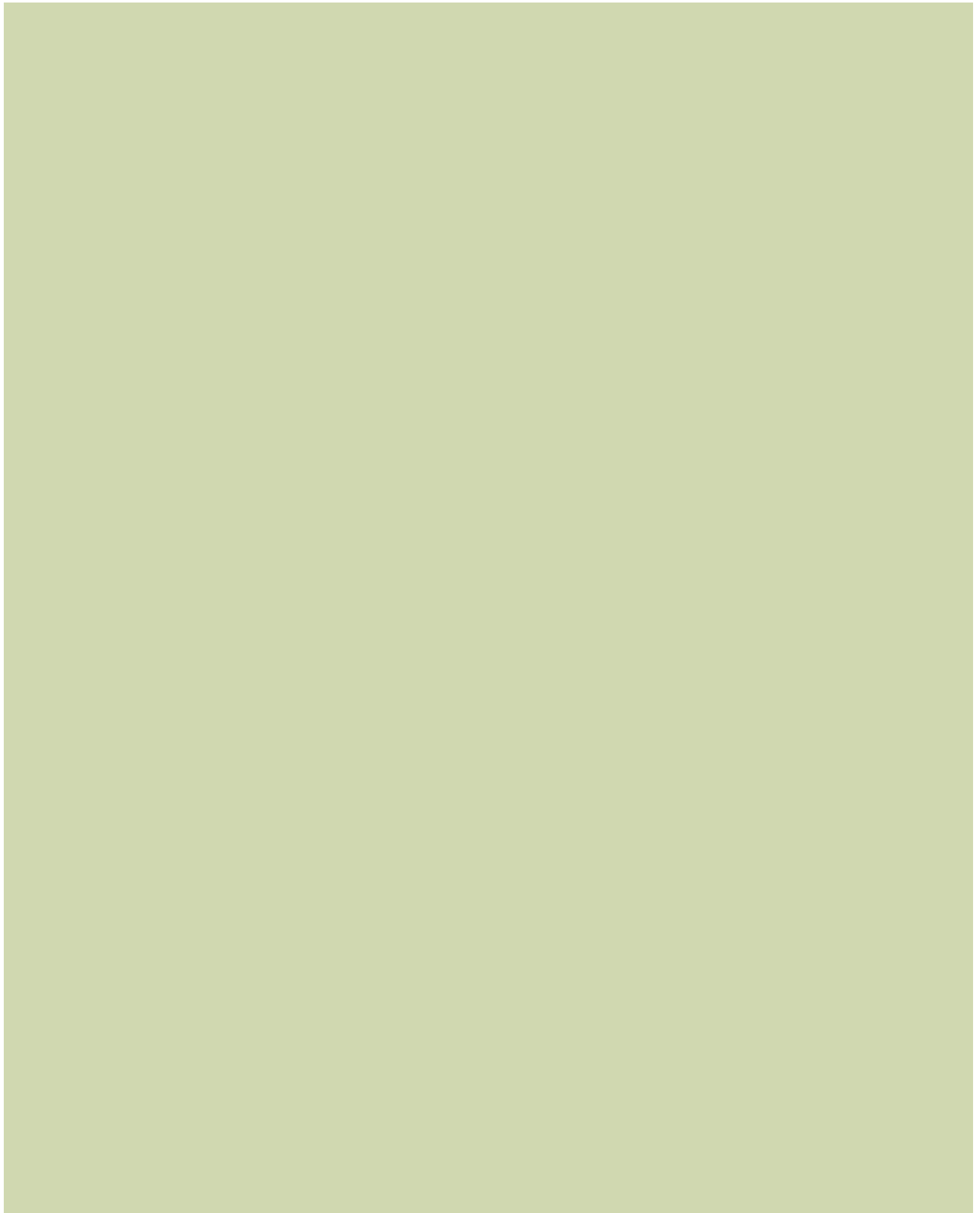
Similarly, this plan would transform the Service's space forces, which are coming under greater threat. The future space force, with better space situation awareness and satellite attack warning, improved passive and active defenses for satellites from low-Earth to geosynchronous orbits, and new operationally responsive tactical replacement satellites, would be far better suited to a future in which opposed space operations seem virtually guaranteed. Deferring the Transformational Satellite Program (TSAT) while building up the national space design and industrial base will

allow the Air Force to design and field a new generation of satellites that will enable the United States to retain its long-held advantage in space.

Under this plan, CONUS basing would be rationalized and reduced to support a smaller, more efficient force structure, which would free up the resources to harden and expand overseas bases, which are under steadily increasing threat of long-range guided missile attack. Not only would this plan bolster US power projection, but it would also contribute greatly to a more engaged, multilateral US foreign policy in which the Air Force assumes a more substantial role in day-to-day diplomatic interchange.

Perhaps most important, this report also suggests concrete ways for the Air Force to resolve its current institutional identity crisis. During the 1990s, the Air Force shouldered the principal burden of every major conflict and seemed ascendant. Now, only a decade later, it finds itself with its generals mostly shunned from regional combatant commands, confronting questions regarding its nuclear operations, forfeiting its ability to manage a major acquisition selection, and questioning its own relevance in the ongoing wars in Iraq and Afghanistan. Rising out of this institutional slump requires a focus on the fundamentals, one of which is recapturing a meaningful vision for air and space power and realigning its investments and force posture composition accordingly.





GLOSSARY

AAV	Amphibious Assault Vehicle
A2/AD	Anti-access/area-denial
ACC	Air Combat Command
ADVENT	Adaptive Versatile Engine Technology
AEF	Air and Space Expeditionary Force
AETC	Air Education and Training Command
AFB	Air Force Base
AFMC	Air Force Materiel Command
AFRC	Air Force Reserve Command
AFSOC	Air Force Special Operations Command
AFSPC	Air Force Space Command
ALCM	Air-launched cruise missile
AMC	Air Mobility Command
ANG	Air National Guard
ASAT	Anti-satellite
ASVAB	Armed Services Vocational and Aptitude Battery
AWACS	Airborne Warning and Control System
B-1B	Lancer (bomber)
B-2A	Spirit (bomber)
BRAC	Base Realignment and Closure
C-130E/J	Hercules (transport)
CENTCOM	Central Command
CMO	Chief Management Officer
CSAR	Combat Search and Rescue
DARPA	Defense Advanced Research Projects Agency
F-22	Raptor (fighter)
F-35A	Lightning II Joint Strike Fighter
FWE	Fighter wing equivalent

GEO	Geostationary orbit
G-RAMM	Guided rockets, artillery, mortars and missiles
IAD	Integrated Air Defense
ICBM	Intercontinental ballistic missile
IED	Improvised explosive device
IOC	Initial operational capability
ISR	Intelligence, surveillance, and reconnaissance
JASSM	Joint Air-to-Surface Standoff Missile
JDAM	Joint Direct Attack Munition
KC-10	Extender (aerial refueling tanker)
KC-135E/R	Stratotanker (aerial refueling tanker)
KC-X	Future aerial refueling tanker
LEO	Low earth orbit
MQ-1	Predator (unmanned aerial vehicle)
MQ-9	Reaper (unmanned aerial vehicle)
MVM	Mounted vertical maneuver
NGB	Next-generation bomber or B-3
OSD	Office of the Secretary of Defense
PACAF	Pacific Air Forces
PACOM	Pacific Command
PLA	People's Liberation Army (Chinese Army)
PLAAF	People's Liberation Army Air Force
PLAN	People's Liberation Army Navy
PRC	People's Republic of China
R&D	Research and development
RQ-4	Global Hawk (unmanned aerial vehicle)
RRR	Rapid runway repair
SAC	Strategic Air Command
SATCOM	Satellite communications
SIGINT	Signals Intelligence
SOCOM	Special Operations Command

S&T	Science and technology
TSAT	Transformational satellite communication system
UCAS	Unmanned combat aerial system
UAS	Unmanned aerial system
UAV	Unmanned aerial vehicle
UHPC	Ultra-high-performance concrete
USAFE	US Air Forces Europe
VTOL/STOL	Vertical takeoff and landing/short takeoff and landing

Acknowledgments

The author would like to thank the CSBA staff for their assistance with this report. Special thanks go to Charlotte Brock and Eric Lindsey for their editorial and production support and to Cutting Edge for their design. The analysis and findings presented here are solely the responsibility of the Center for Strategic and Budgetary Assessments and the author; the views expressed in this paper do not necessarily reflect those of the Department of the Air Force, the Department of Defense, or any other government organization.

Center for Strategic and Budgetary Assessments

1667 K Street, NW, Suite 900

Washington, DC 20006

Tel. 202-331-7990 · Fax 202-331-8019

www.CSBAonline.org