AIR FORCE STRATEGY STUDY
2020–2030

JOHN A. SHAUD, PhD
General, USAF, Retired

Director of Air Force Research Institute

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Contents

CONTENTS

Illustrations

DEPARTMENT OF THE AIR FORCE
OFFICE OF THE CHIEF OF STAFF
WASHINGTON DC

MEMORANDUM FOR THE AIR FORCE RESEARCH INSTITUTE

FROM: HQ USAF/CC
1670 Air Force Pentagon
Washington DC 20330-1670

SUBJECT: AFRI CSAF Priority for FY10

 The following topic is the FY10 CSAF research priority for the Air Force Research Institute. I want you to approach this subject with a fresh holistic, balanced perspective, and provide actionable recommendations. Avoid parochial or functional biases, and I encourage you to consider "third-rail" sensitive issues, as necessary. Ensure the study examines any implications for increased risk and where appropriate, provide risk mitigation strategies. A brief description of the topic follows:

 USAF Strategic Concept for 2020-2030: The purpose of this study is to provide a roadmap for the evolution of the United States Air Force to 2030. Specifically, the study should recommend options on how the USAF might adjust its forces, capabilities, organizations, operating concepts and doctrine to meet challenges across the spectrum of conflict. The study should not be constrained by current programmatic boundaries. Additionally, the study should address the effects caused by the emerging geo-political landscape, fiscal realities, and technological changes. Please present me with an interim report by 30 June 2010 and a completed report by 1 November 2010.

NORTON A. SCHWARTZ
General, USAF
Chief of Staff

Executive Summary

In November 2009, Gen Norton A. Schwartz, the Air Force chief of staff, tasked the Air Force Research Institute (AFRI) to answer the following question: What critical capabilities—implemented by the combatant commanders—will the nation require of the Air Force by 2030?

Preparing for the challenges of a geostrategic environment 20 years in the future required a multiphase research plan. First, the AFRI team identified the nation's vital interests: commerce; secure energy supplies; freedom of action at sea, in space, in cyberspace, and in the skies; nuclear deterrence; and regional stability. The team analyzed four future world scenarios—a peer competitor, resurgent power, failed state, and jihadist insurgency—in relation to the nation's vital interests and the 12 Air Force core functions. The resulting analysis led to a synthesis of the core functions into five critical capabilities designed to meet the Air Force's strategic challenges in 2030: power projection; freedom of action in air, space, and cyberspace; global situational awareness; air diplomacy; and military support to civil authorities (MSCA).

Power Projection

For several reasons, the service's ability to project power will be severely tested over the next generation. Because many current systems are reaching the end of their service lives, the Air Force must recapitalize these assets to maintain its ability to project power. Adversaries will compel the nation's forces to operate at greater distances so they can remain outside the threat ring, thus making systems with longer reach, greater speed, and/or low observability indispensable. Domestic and international pressures may dictate that American forces operate from fewer overseas locations—magnifying the importance of power projection. Further, technically advanced adversaries will challenge the United States in space and cyberspace, making power projection a necessity to protect national interests. Thus, improved range and speed will play a central role in a successful Air Force strategy.

To be effective in the increased threat environment of 2030, the Air Force must integrate air, space, and cyber capabilities—focusing on strategic effects. Integrating these capabilities across domains will become a key enabler and force multiplier over the coming decades. Extending range and loiter times for existing platforms will have a similar effect. The development of unmanned systems incorporating artificial intelligence, autonomous operations, and hypersonic propulsion will help overcome the adversary's antiaccess and area-denial tactics. These systems will support allies, deter adversaries, and provide valuable capabilities against a peer or near-peer competitor.

Freedom of Action: Air, Space, and Cyberspace

Domain superiority is not guaranteed in the future. As the technological gap between the United States and other actors narrows, adversaries will contest the Air Force's preeminence in air, space, and cyberspace. Although American airpower has not faced significant challenges for decades, the service cannot take freedom of action for granted; therefore, it must identify ways to ensure air superiority through integration of space and—more importantly—cyber capabilities.

Today's freedom of action in space and cyberspace will encounter direct threats. Therefore, to gain superiority in either domain, the Air Force must develop resiliency in both space and cyber systems and thereby create an effective deterrent. Reducing the incentive for attack by negating gain is imperative. Further, creating systems that can continue effective operations following attack will be essential in the increasingly complex battlespace of 2030.

Global Situational Awareness

To execute the global situational awareness mission effectively, the Air Force's intelligence community must realign its assets for global and regional coverage. Because surveillance will become increasingly important as a standoff requirement, the service must plan and execute overhead capabilities in lockstep with national-level assets. As part of this effort, the Air Force should assign intelligence personnel to the National Reconnaissance Office in sufficient numbers and with sufficient rank to influence design and implementation of programs and to provide an operational perspective from the end user. Data processes, such as the distributed common ground/surface system enterprise, should focus on processing and disseminating products at the strategic as well as tactical and operational levels. The Air Force must exploit emerging automation to improve data analysis, freeing human analysts for the highest-order tasks. Accelerated development of translation software, artificial intelligence, and electronic means to process raw data—signals and electronic intelligence—offers the most practical means of managing this glut of data and should become a funding priority for the Air Force.

Air Diplomacy

Air diplomacy—the employment of power through capabilities such as humanitarian assistance, deterrence, and power projection—takes advantage of airpower's inherent soft-power capabilities. Today the service often conducts these missions through ad hoc means. However, the Air Force must develop a deliberate and comprehensive air diplomacy strategy to improve the effectiveness of these efforts; moreover, it should address specific ends, ways, and means of supporting the combatant commander's theater plan. The service also must commit to organizing,

training, and equipping for the air diplomacy mission to meet combatant commanders' requirements. Because the challenges of 2030 will demand the full range of Air Force capabilities, it is imperative that the service instill the potential benef ts of air diplomacy into its culture.

Military Support for Civil Authorities

Generally focused on providing consequence management for natural or man-made disasters, MSCA is a key role for the Air Force as it presents forces to US Northern Command. Whether in response to an attack that used weapons of mass destruction or to a f ood, the Air Force must be poised to serve as the primary source of airlif , medical support, and situational awareness.

Conclusion

In coming years the nation will look to the Air Force to provide power projection; freedom of action in air, space, and cyber; global situational awareness; air diplomacy; and MSCA to meet the strategic challenges Americans will soon face. Maintaining these capabilities will require continuous attention and investment, or they will erode. T e United States is in danger of being overtaken by emerging adversaries in a number of areas the nation has long taken for granted. Focusing on these f ve capabilities will assure the Air Force contribution to national security as the nation moves toward 2030.

Chapter 1

Introduction

To reinvigorate strategic thought within the Air Force, this study addresses a single question: what critical capabilities—through the combatant commanders—will the nation require of the Air Force by 2030? After two decades of constant operations that began with Desert Shield/Desert Storm (1990–91) and continue to the present conflicts in Afghanistan and Iraq, Airmen have become extraordinarily experienced at applying air, space, and cyber power to achieve tactical and operational objectives. This focus, while useful in the current fight, has come at the cost of emphasizing a broader understanding of the Air Force's strategic role in national security. As the nation moves beyond the current irregular conflicts, Airmen must develop a more comprehensive and integrated view of air, space, and cyber and their broader role in preserving the nation's vital national interests. Because the Air Force inventory is—on average—older than it has been at any point in its history, near-term decisions will dictate equipment available in the future.

Answering this question requires an understanding of the geostrategic security environment two decades into the future. In keeping with the widely used approach of strategic planners, this study turned to defense scenarios as a means of assessing future capability requirements. It uses four scenarios because a review of existing literature suggests that the United States will face a strategic planning space that includes a peer competitor, rising or resurgent powers, failed state, and jihadist insurgency. Based on an analysis of major trends affecting the geostrategic environment and a reading of the most recent literature, the four scenarios were revised and updated to reflect current developments.

The research team applied a three-step analysis to each scenario. First, it employed the Delphi method to develop a likely US response to the challenge presented in the scenario. Second, it identified the Air Force role in defending national interests—conceivably threatened in the scenario. Third, it compared the Air Force response to its current core functions, making it possible to determine their relevance and priority in the scenarios. Based on the examination of individual scenarios, the researchers compared the need for each core function across not only the scenarios but also the broader geostrategic security environment of 2030. This led to a synthesis of the core functions into a set of five critical capabilities which should determine what the Air Force provides the nation over the coming years.

Discussed in chapter two, the five critical capabilities include (1) power projection, (2) freedom of action in air, space, and cyberspace, (3) global situational awareness, (4) air diplomacy, and (5) military support to civil authorities (MSCA). The discussion of each critical capability is divided into three sections that define and bound the capability, develop a strategic vision that illustrates what the capability must look like by 2030, and describe shocks (also known as "black swans"), having

the potential to radically alter the utility of the capability, as a way of highlighting the strengths and weaknesses of each capability.

Following this broad discussion of critical capabilities, chapter three provides a set of actionable recommendations that will assist the Air Force in achieving a strategic vision. The recommendations are strongly influenced by a future geostrategic environment where the focus of American attention has moved from Europe to Asia and the Middle East (dramatically increasing the physical distance between the United States and the region), developments in cyber technology have leveled the playing field between the United States and its adversaries, and defense spending faces continued downward pressure. In this challenging set of circumstances, the service will succeed by developing new ways to exploit cyberspace (offensively and defensively) and fusing this new domain into Air Force command and control more effectively than potential adversaries can with their militaries. Furthermore, because of the combination of lean budgets, an increase in CONUS basing, and a focus on Asia, long-range power projection—in all its forms—will prove increasingly important.

Chapter four summarizes the analysis, major themes, and principal recommendations. In the final analysis, the study concludes that the Air Force must maintain its focus on global vigilance, global reach, and global power but argues that it must emphasize global power as enabled by global vigilance and global reach.

Background

The inherent difficulty of anticipating the future does not negate the need to understand the trends that are shaping and influencing it. Failing to look forward may prove more detrimental than an inaccurate prediction. This is particularly true for the Air Force, with its strong ties to technological developments. From now until 2030, the technological advances reshaping the globe may cause the Air Force to evolve from an air, space, and cyber force to a cyber, space, and air force, with an emphasis very different from that of today. Given the rapid pace of technological change, the Air Force must be prepared for a future where, for example, Great Power conflicts are once again likely and are waged in cyber and space. Air, land, and naval forces may serve principally to deter peer and near-peer competitors from challenging one another's sovereignty, rather than finding themselves engaged with rogue regimes and nonstate actors. As in the past, today's conventional wisdom may be tomorrow's target of ridicule.

Discerning trends that are likely to shape the future security environment is an essential investment of time and effort. One trend is absolutely certain: competition from state and nonstate actors will continue to require that the United States maintain credible conventional and nuclear forces. As the nation continues to exercise its role as a leader among the world's Great Powers, the historic pattern of Great Power competition will persist and prove to be the greatest strategic challenge. Terrorism will remain a significant threat that may undergo a metamorphosis as the ability to

achieve effects through cyber develops. Progress in ballistic missile technology, directed energy, cyber attack, and nuclear proliferation all place American space assets at new risk. In short, Air Force leaders must begin deciding how best to organize, train, and equip the force to be effective across the full range of conflicts—a range of possibilities that is growing increasingly complex.

As early as the summer of 2011, when American troops are scheduled to begin a withdrawal from Afghanistan, Air Force leaders will have an opportunity to shape the nation's changing priorities. In particular, this new reality allows the service to influence the development of the nation's strategic options. If the Air Force is to play an effective role in defending national interests, it must focus on those capabilities required over the next two decades.

Although many individuals believe that irregular warfare (IW) is the "most likely" form of conflict the United States will face in coming years—a debatable proposition—Great Powers remain a real threat. To dismiss the continued threat of peer competitors risks turning a "low probability/high threat" peer conflict into one of much higher probability.

Supporting Research

Although this document frequently mentions national interests and the Air Force role in defending them, it does not discuss those matters in detail. Rather, the study identifies commercial interests, secure energy supplies, freedom of action at sea, freedom of action in space, freedom of action in cyber, nuclear deterrence, freedom of action in the air, and regional stability as the nation's enduring vital interests. Appendix A provides an extensive discussion of national interests and exogenous shocks (game changers or black swans) and how they may impact the geostrategic environment. This dialogue not only delineates a clear set of interests for the United States but also provides an understanding of the threats (shocks) that can undermine the preferred state of affairs.

Appendix B outlines the study's methodology for scenario development and then discusses its environmental scan, which identifies three trends that are most likely to affect and shape the Air Force between now and 2030: economic developments (global and national); technological evolution in miniaturization, nanotechnology, computer processing, cyber technology, and autonomous systems; and global demographic trends.

Appendix C includes four scenarios used to determine the five critical capabilities. Designed to cover the strategic planning space, each scenario offers a unique challenge for the United States and a distinctive response from the Air Force. Although some readers may question the details of the scenarios, it is important to remember that they were designed to posit a range of realistic challenges requiring Air Force action, not to perfectly describe a future that continues to evolve.

As the Air Force moves beyond the wars in Afghanistan and Iraq over the coming years, a variety of differing views on the service's future direction are certain to gain a voice. The product of a year of research and analysis, this study provides one perspective on the future of the Air Force, with the ultimate objective of assisting the service's leaders in their decision making.

Chapter 2

Air Force Capabilities

The following pages explain the study's principal findings: what critical capabilities, provided through the combatant commanders, will the nation require of the Air Force by 2030? A scenario-planning approach describes the strategic challenges that the United States will likely face during the years approaching 2030. Analysis of the current Air Force core functions across the selected scenarios derived five critical capabilities (power projection; freedom of action in air, space, and cyberspace; global situational awareness; air diplomacy; and military support to civil authorities). The following describes these critical capabilities, including a definition, strategic vision, and potential shocks that could have a negative impact.

Air Force Critical Capabilities, 2020–30

The geostrategic environment the United States will face in 2030 will pose significantly different challenges to the Air Force. The United States' focus will shift from the Atlantic to the Pacific, requiring an emphasis on long-range power projection by the Air Force. Defending the nation's interests in Asia, the center of commerce and power in the twenty-first century, will approximately double the physical distance the Air Force must fly to reach the region. Thus, innovative thinking and a new approach to power projection will enable the service to maintain American influence in a time of shrinking defense budgets. Long-range strike is critical to the future; space and cyberspace offer new opportunities to project power around the globe.

Power Projection

Since the United States likely will face humanitarian disasters, resource conflicts, terrorism, small-scale conventional conflicts, insurgencies, and the potential for a peer or near-peer conflict, flexible power projection will prove critical to American success. This will occur in a global context in which the United States will operate at greater distances from potential targets as weapons of mass destruction, advanced antiaircraft and area denial systems, and ballistic and guided missile technology proliferate. American forces—land, sea, and air—will find it increasingly difficult to deploy within striking distance of an adversary, which will increase the demand for a range of power-projection options provided by the Air Force.[1] Given this complex security environment, power projection is undoubtedly the most critical capability the service will provide combatant commanders and the nation.

Definition. Joint Publication (JP) 1-02, *Department of Defense [DOD] Dictionary of Military and Associated Terms*, defines *power projection* as "the ability of a nation to apply all or some of its elements of national power—political, economic, informational, or military—to rapidly and effectively deploy and sustain forces in and from

multiple dispersed locations to respond to crises, to contribute to deterrence, and to enhance regional stability."[2] For the US Air Force, power projection can take many forms—as either hard or soft power. For many Airmen, power projection is synonymous with global precision strike, airlift, and aerial refueling. This view will remain valid but with a greater emphasis on global precision strike and still-developing cyber capabilities.

Defined elsewhere in this chapter, air, space, and cyber superiority is a key element of power projection. Most important, though, will be the integration of the three. By enabling Airmen to employ air, space, and cyber capabilities simultaneously—perhaps through single platforms or systems—the Air Force will greatly enhance the probability of mission success.

Vision. As the Air Force moves toward the future, the force structure—and, consequently, force-development programs—must change to emphasize integration of manned, unmanned, space, and cyber (offensive and defensive) power-projection capabilities. In other words, when formulating options to defend the nation's interests, Airmen should present proposals that fully integrate air, space, and cyber capabilities into the solution.

This approach will position the service to capitalize on technological developments within and beyond the 2030 planning horizon. It also will require near-term changes in organizations, doctrine, training, education, and force management. For example, the current requirements that manage rated personnel according to flying service (six-, nine-, and 12-year flying gates) make it difficult to provide opportunities for rated personnel to acquire skills in space or cyber fields during their formative operational years. For space and cyber careers, limiting the exposure of individuals in those career fields to traditional Air Force operations similarly limits their understanding of airpower. By 2030, Airmen operating in a joint environment will be expected to present comprehensive options that integrate the full capabilities of the Air Force rather than present compartmentalized solutions that represent only air, space, or cyber aspects of the service's capability.

The key strategic problem from the perspective of potential adversaries is to deny the United States access to bases and targets. The proliferation of robust and redundant air defenses is a legacy of the Cold War, but this has taken on new importance for peer and nonpeer competitors. In the near term, most nations will be unable to compete with the United States' technological advantages in conventional combat—this will change as 2030 approaches. Consequently, future battlefields may look more like the recent Russo-Georgian conflict, which saw Russia launch a cyber offensive. Conflicts will be more specifically targeted in terms of time and space, and the first salvos of a conflict may not be detected until after the second- and third-order effects of initial strikes manifest themselves.

As adversaries invest in modern air, space, and cyber capabilities, they will continue to seek access to commercial or third-party space capabilities while employing indigenous or contract cyber capabilities to deny or complicate American intervention. Assumptions that air, space, and cyber domains are separate will come under

increasing scrutiny as adversaries seek to counter traditional Air Force advantages by employing asymmetric capabilities while also fielding more capable symmetrical systems.[3] This could take many forms; for example, an adversary may choose to focus on ways to "hack" the avionics software of American aircraft rather than build advanced aircraft of his own.

Rather than relying solely on traditional integrated air defenses, adversaries will compete for control of the air by 2030 by using integrated denial strategies informed by space- and cyber-based surveillance and reconnaissance, coupled with high-performance, stealthy radar and missile systems designed to complicate deployment and operations for American airpower. In the words of the recent *Quadrennial Defense Review Report*, "The future operational landscape could also portend significant long-duration air and maritime campaigns for which the US Armed Forces must be prepared."[4] In these increasingly dangerous scenarios, Air Force capabilities will experience increased stress. As one analysis noted, "The USAF's path remains that of betting that forward bases, which are falling increasingly within the reach of enemy ballistic missiles, cruise missiles, and other A2 [antiaccess] capabilities, can nonetheless be utilized by its expeditionary air units."[5] The Air Force must present strategic and operational options along with forces capable of operating and prevailing in environments designed to deny access to deploying or striking forces, using combinations of offensive and defensive systems that include space and cyber capabilities.[6] The systems fielded by the Air Force are likely to play a critical role in the success of any Air-Sea Battle strategy.

Shocks. If the Air Force were to adopt the vision described above, successful implementation would be vulnerable to future shocks—low probability / high impact—that are difficult to predict prior to their occurrence. Sometimes called "black swans," three potential shocks embody the greatest concern to the future of power projection.[7] First, long-range strike, aerial-refueling, and nuclear-deterrence platforms—among the Air Force's oldest systems—are in need of recapitalization. They are also highly susceptible to unpredictable and shifting economic and political circumstances. For example, should the American economy face prolonged stagnation or decline, the United States may find itself unable or unwilling to replace systems that are exceeding their life expectancy. By 2030 the service may find itself without a credible long-range power-projection capability.[8]

Second, changing political, economic, and security circumstances in allied nations that host American main operating bases may compel the United States to withdraw forces from those countries. This may occur because of increasing costs to the United States, a loss of host-nation support, or risks to American forces from advanced ballistic missiles.[9] With Air Force long-range systems at historic lows in numbers and at historic highs in age, the service may find it difficult to prosecute a major conflict—particularly from the continental United States.[10]

Third, a variety of sources suggests that energy producers will reach "peak oil" sometime between 2020 and 2040.[11] A dramatic increase in the cost of petroleum-based fuels or a decline in their availability will limit the ability and willingness of

the United States to project power. As the largest consumer of fuel in the federal government, the Air Force would be hit hardest by such an event.

Although these shocks have a relatively low probability of occurring, the consequence of any one of them would be detrimental. Thus, it is necessary to prepare for these and less anticipated influences in Air Force power-projection capabilities.

Freedom of Action: Air

Although the previous section called for the full integration of air, space, and cyber for the sake of improving power-projection capabilities, freedom of action in air, space, and cyber is not inherently a power-projection mission. However, in a particular military operation, air superiority *may* be a component of power projection. In short, the five capabilities are not necessarily mutually exclusive but can be complementary. This point is worth noting as the discussion turns to the continuing importance of air superiority.

Access to and stability within the global commons (air, space, cyber, and sea domains) are critical to national security.[12] The objective of air superiority focuses on a subset of the larger challenge of access to all the global commons and is limited to ensuring access to the air domain at places and times of America's choosing. At the same time, it seeks to deny an adversary access to the air domain in a way that would put the nation's interests at risk. Air superiority, which does not operate in a vacuum, depends (to various degrees) on the ability to operate in the global commons.

Definition. As defined in Air Force Doctrine Document (AFDD) 2-1, *Air Warfare*, *air superiority* is "that degree of dominance of the air medium which permits the conduct of operations by friendly land, sea, and air forces at a given time and place without prohibitive interference by the enemy, while denying that enemy the same freedom of action."[13] Air superiority has two important functions: providing access to the air domain for American forces and denying that access to adversaries. Air superiority encompasses the ability to use the air domain to observe potential adversaries through reconnaissance and surveillance and then hold important targets at risk to influence outcomes in a way that is favorable to the United States.

In the history of warfare, technological developments are quickly followed by their countermeasures, which in turn are followed by further developments, and so on. This is certainly true of the systems, strategy, and tactics used in gaining and denying access to the air domain. Some current global trends include proliferation of fifth-generation aircraft; more capable air-to-air, air-to-surface, surface-to-air, and surface-to-surface missiles and weapons; surface- and air-based directed energy weapons (DEW); maneuvering air-breathing hypersonic and space systems that operate in or through the air domain; offensive and defensive cyber capabilities that could influence the effectiveness of offensive counterair, defensive counterair, operational command and control, suppression of enemy air defenses, and other electronic warfare capabilities; and the increasing use of remotely piloted aircraft (RPA) in expanding mission areas.[14]

Vision. Significant advances in air superiority are possible in the areas of autonomous systems and augmentation of human performance.[15] Applications could include stealthy, high-performance, autonomous aircraft that would augment the numbers and capabilities of fifth-generation fighters and replace the lost contribution of legacy fighters that are relegated to supporting roles, "building the foundation provided by F-22s and F-35s" before they are phased out.[16] It may also be possible to develop small, stealthy, high-speed, autonomous tankers designed to operate with air superiority fighters, thus providing much greater range to these aircraft. This may prove particularly useful as the United States shifts its focus to Asia where distances increase dramatically.

Augmenting human performance can "achieve capability increases and cost savings via increased manpower efficiencies and reduced manpower needs."[17] This will prove useful as weapons systems grow increasingly complex and dependent on advanced man/machine interfaces. It is reasonable to expect RPAs to evolve into autonomous aircraft, increasing the number of air superiority missions and supporting tasks that such platforms perform.

Improvements in the man/machine interface will continue to progress in speed, range, aerodynamic performance, sensor capabilities, information processing, and decision making. Current examples include infrared sensors to see at night, radar to see through weather, and computer interpretation of Global Positioning System (GPS) signals for navigation. Between the present and 2030, the amount of information to be analyzed, the number of decisions to be made, and the rate at which they must be made will increase dramatically and further exceed human capabilities, requiring significantly more capable man/machine systems.[18]

Shocks. Two developments would pose a particular challenge for air superiority. First, the proliferation of surface-based or airborne DEWs could change the air superiority calculus. Surface-based DEWs could augment and/or replace traditional antiair artillery and surface-to-air missiles and have a near-instantaneous line-of-sight kill capability with potentially unlimited numbers of engagements. Airborne DEWs with a finite airborne energy source might be more constrained but potentially would have a tactical attack and self-defense capability.[19]

Second, holding targets at risk using hypersonic and/or maneuverable space delivery systems could also significantly change interdiction opportunities and required capabilities, trumping current and linearly evolving antiaccess systems. However, the subsequent fielding of high-powered, surface-based DEWs could become an effective point-defense countermeasure for such high-altitude, high-speed systems.

Freedom of Action: Space

As a pioneer and leader in the use of space, the United States is more reliant on that medium than any other nation. This reliance will only grow in coming years. The opening of space has provided significant benefits but has also created vulnerabilities.

Recognizing the significance of space, on 28 June 2010 the Obama administration issued a new space policy declaring that "the United States will employ a variety of measures to help assure the use of space for all responsible parties, and, consistent with the inherent right of self-defense, deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them."[20] To achieve this national priority, the Air Force must realize space superiority, a concept not unlike air or cyber superiority. Currently, however, the United States has a limited ability to exercise space superiority. Thus, the principal objective over the next 20 years must be to exert control over space in a way that turns the concept of space superiority into a reality.

Definition. *Space superiority*, as defined by AFDD 2-2.1, *Counterspace Operations*, is "the degree of control necessary to employ, maneuver, and engage space forces while denying the same capability to an adversary." Moreover, space superiority is not dramatically different from the concept of *space control*, or the ability to "ensure freedom of action in space for the United States and its allies and, when directed, deny an adversary freedom of action in space."[21] Essentially, these terms imply the ability to shape the battlespace while denying the adversary that same privilege.

A second concept of great importance is operationally responsive space (ORS). Peter B. Teets, former undersecretary of the Air Force, defined ORS as a means "to create a more responsive, reliable, and affordable lift family capable of fulfilling both current and future launch requirements, and the corresponding responsive and affordable satellites."[22]

Vision. During the next 20 years, space is unlikely to become a domain through which kinetic effects are delivered. However, toward the end of the next decade, challenges to the United States' preeminent position in space may lead to weaponization, which would dramatically alter the existing paradigm. Adversaries are well aware of American dependence on space. Denying this capability to the United States would significantly degrade its civil and military operations and has the potential to deter American action in other domains. Events such as an attack on a communication, navigation, or detection constellation could drive a demand for weaponization by the American public, which would require the DOD to respond aggressively.

A successful strategy to delay the weaponization of space and maintain freedom of action in the domain will require that the United States use the entire spectrum of diplomatic, information, military, and economic capabilities to develop a multilayered construct for space operations. This approach places an adversary in a defensive position by masking the United States' space center of gravity. However, space superiority does not begin with a military solution. It starts with the United States taking the lead in engaging the international community to create a system of protocols and relationships that encourages beneficial and benign behavior. Through economic and technical cooperation, nations become interdependent and much less likely to act against their own interests.[23]

Partnering also lays the foundation for international negotiation, regulation, and governance by the rule of law—powerful concepts appreciated by our allies. Currently, the United States is party to a series of international regulations across land, sea, air, and space. A new round of international agreements could call for a ban on space-based weapons, which many nations may well find attractive. Alone, this vision of cooperation and engagement is insufficient. American leaders must prepare for the failure of such a system.

Thus, space superiority over the coming decades will depend on the Air Force's making significant strides in four areas. First, the service should maintain an increasingly watchful eye over space with such systems as Space Based Space Surveillance (SBSS). Second, the Air Force must achieve lower production and operating costs for space operations, making the replacement of lost assets cost effective. Third, the service must expand its partnerships with industry as part of a drive to cost-effectiveness and technological development. Fourth, the Air Force must improve the resiliency of its space assets. Improvements in these areas will assist the service in developing the operationally responsive space that the nation requires.

Shocks. Space is highly susceptible to unpredictable shocks, which, in many instances, can have striking implications. For example, a significant reduction in weight-to-lift ratio could dramatically alter space as an operating environment over the next 20 years. It costs between $4,000 and $40,000 per kilogram to place an object in low Earth orbit.[24] If this were reduced to less than $1,000 per kilogram, for instance, space access potentially would become as routine as air travel. Successful development of a reusable single-stage-to-orbit vehicle might signal such a development. During the 1990s, Lockheed Martin spent heavily on an attempt at this kind of breakthrough with the X-33. The company abandoned the effort when it became clear that the dream of a single-stage-to-orbit vehicle was neither technologically nor economically feasible at the time.[25] Additionally, scientists have proposed a space elevator, a fixed transit device that could reduce costs to $220 per kilogram.[26] However, today a space elevator remains only a theoretical possibility whose deployment in the next 20 years is highly unlikely. More than any other domain, space will prove sensitive to costs, giving the advantage to any nation able to significantly reduce the expense of putting assets into orbit.

Freedom of Action: Cyber

Cyberspace has only recently been acknowledged as vital to military operations. However, academia, the private sector, and government have been making efforts to secure cyberspace for several decades. Since the late 1980s, attempts to control cyberspace have intensified and become a constant and increasingly intense worldwide struggle. This rise in cyber conflict has led to the acknowledgement that threats to American security in cyberspace are just as real and significant as physical threats and that a military service should be tasked with defending certain parts of the cyber domain. Accordingly, the recent publication of AFDD 3-12, *Cyberspace Operations*,

states that "controlling the portion of cyberspace integral to our mission is a fundamental prerequisite to effective operations across the range of military operations."[27]

Although the service has activated Twenty-Fourth Air Force, transformed the communications and information career fields into the cyberspace operations and support career fields, and initiated Undergraduate Cyberspace Training, the future security environment will require more of the service as adversaries develop their cyber capabilities.[28] The challenge for the Air Force lies in remaining on the leading edge of advances in cyber technology. Cyber superiority will become ever more difficult to achieve and maintain in the future; thus, the Air Force must prepare today for future cyber threats.[29] However, the number of American computer science and computer engineering graduates is shrinking, while the proportion of academic and foreign master's degree and PhD recipients is increasing.[30] Current cyber training falls short of providing experts capable of dealing with the threats that will come from highly trained, highly credentialed, and highly motivated attackers.

The challenges posed to the Air Force by the cyber domain arise from the latter's uniqueness. For example, the costs of widespread operations in this domain are very low. Further, unlike its experience in other domains, the United States does not have a commanding lead in cyber technology and lags significantly in some key technologies. This is a strategic concern because shortfalls in cyber capabilities undercut capabilities in other domains. The United States has rarely faced a situation in which military success depends on successful operations in a domain that it does not dominate.

Definition. According to AFDD 3-12, *cyberspace* is "a global domain within the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers. . . . [Furthermore, cyber superiority provides] the operational advantage in, through, and from cyberspace to conduct operations at a given time and in a given domain without prohibitive interference."[31] Attaining cyber superiority will be a crucial prerequisite for carrying out all Air Force missions because such superiority ensures the reliability of data used for command and control as well as decision making.[32]

Vision. The cyberspace of 2030 will differ dramatically from that of 2010. Increases in computing power, doctrinal development, and changes in the focus of cyber attacks will make cyberspace a much more challenging and hostile environment. Cyber attacks will continue, but they will become more militarily relevant. In the future, cyber will evolve into a weapon of preference, replacing many of the kinetic choices in today's arsenal. The reduction in aircraft numbers and the ranges required for power projection, particularly in the Pacific, will drive cyberspace to the forefront of Air Force operations. Suppression of enemy air defenses and the ability to corrupt the software of an adversary's aircraft will become a reality, not just science fiction.

United States Strategic Command (USSTRATCOM) is likely to find itself more deeply involved in cyberspace, expanding its operations into irregular warfare. The

Air Force, while "growing its own," also will find ways to partner with academia and industry. These partners may not fit the mold of a traditional Airman, but their expertise will prove invaluable to accomplishing the Air Force mission.

Shocks. Because of the expanding, global nature of cyber technology, it is inevitable that adversaries will make several major leaps forward. Potential shocks include development of a penetration-proof operating system, rapid decryption of encrypted data, implantation of malware into an aircraft via its radar system, and isolation of a country by blocking its access to the Internet. All of these shocks may occur rapidly and unexpectedly. Any one of them could give an adversary's air force a significant war-fighting advantage and put the United States at a distinct disadvantage not easily overcome.

Global Situational Awareness

The strategic environment of 2030 is likely to include the continuing drawdown of large numbers of American troops permanently stationed overseas. Accordingly, the Air Force is likely to operate primarily from CONUS locations.[33] Thus, situational awareness will become a longer-distance endeavor requiring extended transit and loiter times to perform surveillance and reconnaissance missions during operations that cover the entire strategic planning space. The distance will also place a premium on cyber and space assets, which are likely to play an increasingly important role in building a situational awareness of far-flung regions. For example, whereas a drone may prove effective in an uncontested air environment, space assets may be the only means of conducting surveillance and reconnaissance of a peer competitor. For the United States, understanding the circumstances it faces is increasingly critical as decision makers operate in a more complex geostrategic environment.

Definition. Although the term *global situational awareness* is mentioned in AFDD 2-9, *Intelligence, Surveillance, and Reconnaissance Operations*, it is not defined in doctrine.[34] Thus, this study develops a definition based on discussions of global situational awareness in a number of sources. Global situational awareness is the understanding of the strategic, operational, and tactical environments gained through the use of space, air, sea, land, and cyber information collection systems.[35]

The Air Force contributes to the nation's global situational awareness by conducting surveillance, reconnaissance, and analysis to acquire and make sense of information that is turned into intelligence products. While the terms *surveillance* and *reconnaissance* may seem similar, they have distinctly different missions. Surveillance is the persistent overwatch of an area to measure change over time, whereas the objective of reconnaissance is the observation of a specific target. Analysis, the final component in situational awareness, is the thoughtful and informed evaluation of information to provide intelligence to the consumer. Thus, it is the combination of surveillance, reconnaissance, and analysis that enables the Air Force to contribute to global situational awareness.

Vision. Since the Air Force currently has few surveillance and reconnaissance aircraft capable of covering the extended distances required, space and cyber surveillance will become increasingly important as the Air Force globalizes sensor systems. However, RPAs and autonomous platforms with longer ranges and correspondingly longer loiter times should be fielded before 2030. Until their development, which is likely a decade out, existing space assets must fill the void.[36]

Two characteristics of future space surveillance systems are critical: they must be persistent and inexpensive. The current inventory is expected to suffice well into the next decade, but the United States will require newer systems before 2030. Moreover, the concept of operationally responsive space (discussed elsewhere in this study) must continue to include the ability to launch surveillance and reconnaissance payloads virtually on demand. The technical difficulties of tracking mobile targets from space also must be resolved over the next two decades.[37]

The focus on space does not mean that air-breathing platforms will become unimportant to global situational awareness. These platforms will present a different set of problems. For example, building a survivable reconnaissance platform from scratch or adapting a current system, such as the F-22, solely for the reconnaissance mission, is not feasible in a fiscally constrained environment. The Air Force will have to make do with what is already in the inventory for the next decade or more. Given this circumstance, the mantra "every shooter is a sensor and every sensor is a shooter" has merit.[38]

The mission of analysis is equally important to surveillance and reconnaissance. The exploitation of reconnaissance products, particularly imagery analysis, has enjoyed a renaissance because of the creation of the distributed common ground system (DCGS) and its refinement into an agile intelligence analysis and dissemination system. Since it already operates with a reach-back approach of distributed operations, the DCGS enterprise can be readily adapted to the global situational awareness concept necessary in the future.

Increasing the speed of product dissemination is critical and is possible through the DCGS enterprise. However, absent the development of improved software, analysis will remain time consuming because of the sheer volume of data and the ever-present shortage of trained analysts.[39] Sustaining a *sufficient* cadre of analysts over the next 20 years and automating many analytical tasks will assist in overcoming current deficiencies in quality and speed.[40]

Shocks. Among the many threats individual surveillance and reconnaissance platforms (air and space) face, one stands out as a potential large-scale shock. Should an adversary employ a device, such as a nuclear weapon, that is capable of producing a powerful electromagnetic pulse in low Earth orbit or at lower altitude over a key country or region, it would cripple surveillance and reconnaissance efforts and degrade situational awareness for a sustained period of time. This would hamper Air Force power projection by greatly reducing the information that is critical to current and future military operations.

Air Diplomacy

Although the concept of *air diplomacy* is neither defined in doctrine nor specified as a mission of the US Air Force, it is a task Airmen have performed since the early days of manned flight. Air Force history has many examples of Airmen conducting diplomatic missions, such as the Berlin airlift (24 June 1948–12 May 1949), Operation Provide Comfort/Northern Watch (1991–2003), and the training of Latin American air forces at the Inter-American Air Forces Academy (IAAFA). These examples are a small portion of the Air Force's historical contributions to American diplomacy.[41] Air diplomacy is not about "hearts and minds," but rather about developing influence that can be leveraged in times of need.

Currently, the Air Force conducts an array of diplomatic missions established in the Air Force Security Cooperation Strategy and many additional irregular and ad hoc diplomatic missions. While the service currently employs airpower to achieve soft-power objectives, these efforts are not optimally leveraged to the full benefit of the Air Force or the nation.[42] Fusing the service's disparate soft-power missions into a unified air diplomacy strategy will allow the Air Force to more efficiently and effectively employ its assets in the nonkinetic pursuit of national interests. Some further clarification of the concept is necessary.

Definition. *Diplomacy,* broadly defined, is "the peaceful conduct of relations amongst political entities, their principals and accredited agents."[43] States conduct diplomacy to promote economic interests, protect citizens abroad, propagate culture and ideology, enhance national prestige, promote friendship, and isolate adversaries. Moreover, it is the least expensive way to exercise power in international affairs.[44] Diplomacy is one of foreign policy's two elements; the other, of course, is war. Both are means to an end rather than ends in themselves.

The various forms of diplomacy—and there are many—fall into one of two categories: incentive based or threat based. On the one hand, incentive-based diplomacy (traditional, commercial, conference, public, preventive, resource, humanitarian, and protective) does not rely on threats for success.[45] Rather, it succeeds when states engaged in negotiations reach a mutually beneficial agreement. On the other hand, threat-based diplomacy (totalitarian, military, coercive, deterrence, and transformational) relies on coercion, such as the threatened use of force.[46]

Air diplomacy may best be described as the nonkinetic employment of airpower in defense of national interests. While all forms of diplomacy are designed to further state interests, air diplomacy is distinguished by the means employed to promote those interests. This is also true of other forms of diplomacy. It is important to note that air diplomacy does not replace the traditional diplomacy conducted by the Department of State. It is a complementary capability provided by the US Air Force. Understood in these terms, air diplomacy incorporates a broad range of Air Force soft-power capabilities (traditional, commercial, public, preventive, resource, humanitarian, protective, military, deterrence, and coercive diplomacy) into a unifying concept that highlights the service's contributions and capabilities. Admit-

tedly, the Air Force is not alone in possessing aircraft. However, Army, Navy, and Marine Corps aviation is designed to support ground forces or defend the fleet. The Air Force is uniquely tasked, organized, trained, and equipped to provide strategic power projection through air, space, and cyber, which it can leverage for diplomacy as well as kinetic operations. Thus, air diplomacy is a critical capability that falls within the service's mandate.

Currently, building partnerships and security cooperation are the principal focuses of the Air Force's diplomatic efforts, but with a broader understanding of the ways in which airpower can contribute to the success of American diplomacy, a greater role for the service is possible.

Vision. Over the next two decades air diplomacy has the potential to become an increasingly important Air Force capability for three related reasons. First, entitlement spending (Medicare, Medicaid, and Social Security, for example) will consume an expanding percentage of the federal budget, which will force decision makers to reduce discretionary—principally defense—spending while remaining engaged in the international system.[47] Second, stagnant or declining defense budgets will make acquisition of new weapons systems difficult. People and machines capable of performing both hard- and soft-power missions will undoubtedly have the greatest appeal.[48] Third, airpower's range, speed, and flexibility will make it an increasingly attractive option for decision makers. Air diplomacy provides a range of soft-power options that, if employed before kinetic operations are necessary, may assist in resolving crises that span the strategic planning space.

As operations in Afghanistan and Iraq clearly illustrate, irregular conflicts require that the United States pay a high price in blood and treasure. Although they are less costly than major conflicts, decision makers will seek ways to avoid them in the future.[49] Simply stated, air diplomacy has the potential to be an effective approach to the defense of vital national interests, building partnerships, preventing conflict, and expanding American influence around the world. It is also a cost-effective approach that does not create the anti-American sentiment which accompanies permanent overseas bases or large troop deployments. Admittedly, it will not always succeed. But, the deliberate conduct of air diplomacy has the potential to more effectively leverage the Air Force's soft-power capabilities before the service is called on to exercise hard power. In a future where defense acquisition programs face considerable competition for limited resources, the ability of Airmen to conduct hard- and soft-power missions will prove increasingly attractive.

The United States Africa Command's (USAFRICOM) approach to that continent provides a good example of the types of missions combatant commanders may require in the future. By focusing efforts on partnerships, peace, and stability USAFRICOM is placing much of its emphasis on preventing conflict through soft power.[50] Africa's lack of transportation infrastructure provides the US Air Force an opportunity to conduct air diplomacy through a number of programs that may one day pay substantial dividends for the United States.

Demand will likely increase over the next two decades for missions like those of USAFRICOM and those described in the Air Force Security Cooperation Strategy. Thus, the Air Force should be prepared to conduct a wide range of soft-power operations around the world as both regional and functional combatant commanders call on airpower to expand their diplomatic efforts.

Shocks. The future of air diplomacy is far from certain. Not only does it still lack supporting doctrine, organizations, tactics, techniques, and procedures, but the nation's susceptibility to economic, political, and geostrategic shocks makes the viability of air diplomacy uncertain. Two specific shocks have the greatest potential impact on air diplomacy.

First, demand for soft-power capabilities may diminish if the United States overcomes its looming debt and entitlement crisis.[51] Air diplomacy is attractive because it is a cost-effective approach to remaining engaged in international affairs, but it is unlikely to survive the budget axe if the choice is weapons or diplomatic assets and missions. As the Congressional Budget Office notes, "A large amount of debt could also harm national security by constraining military spending in times of crisis or limiting the ability to prepare for a crisis."[52] Thus, air diplomacy is cost effective, yet in a tight budget it may be perceived as too expensive and unnecessary.

Second, should the United States find itself engaged in a major conflict, the emphasis would change rapidly from soft to hard power. The American people may well perceive diplomacy as an approach of the weak. Such a view would drive resources away from air diplomacy, making it difficult to maintain ongoing diplomatic efforts.

Military Support to Civil Authorities

The increasing importance of military support to civil authorities became evident during the analysis of this study's scenarios. While all four scenarios are based on strategic challenges overseas, the proliferation of nuclear weapons, advanced missile technology, and offensive cyber capabilities will soon present the United States with a wider array of threats to the homeland than ever before. Current capabilities for disaster response are insufficient, which makes MSCA a critical capability for the Air Force now and in the future. Admittedly, a natural disaster may be more likely than a second major terror attack, but in either case the Air Force and Air National Guard (ANG) can expect to play a major role in providing the United States Northern Command (USNORTHCOM) a range of capabilities to mitigate the effects of a catastrophic event.[53]

Definition. MSCA most often refers to consequence management after a disaster. Most disasters within the United States are mitigated by local and state resources. Except in the most extreme cases, the DOD is constrained from providing immediate disaster response.[54] However, most first responders—local and state— lack sufficient resources to respond adequately to a major disaster, whether natural

or man-made.[55] No other agency—federal, state, or local—can match the organization and resources of the military.

AFDD 2-10, *Homeland Operations*, cautions that USAF forces "are only made available when not required by other military operations."[56] More to the point, Air Force Instruction (AFI) 10-802, *Military Support to Civil Authorities*, states that ANG forces (on state orders, not in federal service) have the "primary responsibility for providing military assistance to state and local governments in civil emergencies."[57] In short, the ANG not only can respond well ahead of any federal military effort, but is expected to do so by Air Force instruction.[58] Thus, Air Force support will come almost entirely from the ANG. Short of a man-made catastrophe involving chemical, biological, radiological, or nuclear materials, it is unlikely that active duty resources will be called upon. Nevertheless, if a disaster rises to the level of a catastrophe, state and local resources may be overwhelmed rather quickly. Governors are likely to ask for federal assistance, which may or may not be readily available because of the organize, train, and equip decisions of the Air Force.[59]

Vision. The Air Force and ANG are likely to play an increasingly important role in providing a critical air component to USNORTHCOM's response capability over the coming decades as threats such as terrorism, nuclear weapons proliferation, and natural disasters have the potential to overwhelm local and state authorities. The challenging economic environment that is almost certain to persist well into the future amplifies the importance of Air Force and ANG military support to civil authorities. If the United States continues to withdraw as expected from its Cold War role as defender of the free world and its post–Cold War role as global policeman, the American public will expect the military to focus to a greater degree on such missions as homeland defense and disaster relief. Analysis of this study's scenarios also suggests that the homeland will face increasing threats that must be mitigated. Thus, the Air Force and ANG are likely to be called upon to provide MSCA capabilities in three areas: situational awareness, medical support, and airlift.[60]

The air component of a national response capability will principally come from the ANG, except in response to an attack on the nation. In such a case, federal forces will respond along with traditional first responders. Given the Air Force's role in shaping the ANG through its organize, train, and equip responsibilities, it is vital for the Air Force to elevate MSCA to a critical capability.[61] Dual designed operational capability statements, particularly for the ANG, will assist in establishing the role of individual units in MSCA and wartime. In other words, the Air Force's and ANG's roles in providing MSCA are intertwined and inseparable. Thus, any discussion of the ANG's role in MSCA is also a discussion of the Air Force's role. Given the interconnected nature of the MSCA mission, three recommendations will enable the Air Force and ANG to improve disaster response.

First, imagery analysts should provide situational awareness to the Federal Emergency Management Agency (FEMA) regional staffs, in part representing the service and USNORTHCOM. The imagery analysts' utility is largely due to their ability to interpret imagery products from a range of sources. Should the Federal Aviation

Administration relax restrictions on the domestic use of RPAs, these aircraft could be employed for damage assessment and search and rescue operations. Processing imagery via the distributed common ground system, for example, will provide situational awareness for the DOD, Department of Homeland Security (DHS), and state and local governments.

Second, with local hospitals likely to be overwhelmed in the event of a major disaster, the air component should be postured to conduct immediate medical support missions. Because significant legal requirements must be met before federal forces can participate in disaster response, the ANG, in its role as a state force, is in a unique legal position to act as a first responder for the Air Force and USNORTHCOM.

Third, since a large portion of its future inventory will be airlift assets, the Air National Guard is uniquely positioned to provide first-response airlift. Aerial port squadrons attached to ANG airlift units will be key to any sustained air bridge needed for long-term MSCA events, such as those triggered by a weapons of mass destruction attack or major natural disaster. Again, the ANG, because of its legal status, is most capable of not only responding rapidly but also coordinating with USNORTHCOM.

The Air Force and ANG can contribute to building a more resilient domestic response capability. However, there is significant reason for concern. Today's total force approach will prove inadequate in the event of a major disaster in the United States. Thus, a renewed focus on MSCA will better serve the nation.

Shocks. In the event of a large-scale disaster where ANG troops from affected states are deployed to a war zone as part of the total force, remaining state forces may be inadequate to provide the necessary MSCA. The time required to bring in ANG units from other states or meet the legal requirements for federal participation could undermine the very purpose of designating MSCA as a critical Air Force capability. Such a situation would not only exacerbate postdisaster circumstances but also undermine the confidence of the American people.

Conclusion

Reinvigorating strategic thought within the Air Force requires developing an understanding of the critical capabilities the Air Force must be prepared to provide to combatant commanders in the future. By examining four scenarios that cover the strategic planning space, overlaying national interests, and determining the Air Force role in an American response to each scenario, we determined which service core functions are likely to prove most critical in coming decades. The analysis went one step further in synthesizing the core functions into a set of five capabilities. The next chapter completes the analysis by providing a series of capability-specific recommendations designed to assist the Air Force in achieving the vision described above.

Notes

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32. Alberts et al., *Understanding Information Age Warfare*; Alberts and Papp, *Information Age Anthology*, vol. 1; Alberts, Garstka, and Stein, *Network Centric Warfare*; and Alberts, *Information Age Transformation*.

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34. AFDD 2-9, *Intelligence, Surveillance, and Reconnaissance Operations*, 17 July 2007, 24.

35. Jeffrey Horne, "Transforming National Space Security: Enabling DoD and Intelligence Community Defensive Space Control Collaboration," *High Frontiers* 4, no. 4 (August 2008): 15–16; DHS, "DoD, DHS and DOJ Co-Sponsor a Critical Incident Preparedness Conference for First Responders," *NIPP [National Infrastructure Protection Plan] Newsletter* 38 (November 2008), 3; and Maryann Lawlor, "Covering the Six for Homeland Joint Operations," *SIGNALonline*, May 2009.

36. Add airships to the list of long-loiter assets in development for surveillance missions. Development is expected to take years beyond the first prototypes. David Pearson, "Airships Receive Lift from New Technology," *Wall Street Journal*, 27 August 2010, B8. Moreover, those systems that are serving so well in the CENTCOM area of responsibility (AOR) can form the basis for a CONUS-based Homeland Defense/Homeland Security program along our borders in the out-years and for use in disaster response as well.

37. In an interview with staff members of the Air Combat Command (ACC) Directorates of Intelligence (A2), Air and Space Operations (A3), Plans and Programs (A5), and Requirements (A8), several individuals commented on the inability of satellite imagery to react to even the slightest modifications of targets, referring to how "a little aluminum foil" could change the shape of an object on the ground and "mess up" a satellite's ability to discriminate targets via its moving target indicator.

Interview by Col John Conway, USAF, retired (military defense analyst, Air Force Research Institute, Maxwell AFB, AL), at Langley AFB, VA, 22 June 2010. (All interviews were conducted in confidentiality, and the names of interviewees are withheld by mutual agreement.)

38. Although this expression has been used for a number of years, it most recently appeared in Department of the Air Force, *Leading Turning the Future: The Vision and Strategy for United States Air Force Intelligence, Surveillance and Reconnaissance* (Washington, DC: Headquarters USAF, 2010), 19.

39. At present, the entire DCGS enterprise is being criticized by the Army for not having a sense of the fight since it operates from afar. To that end, the DCGS community is preparing an expeditionary-like unit to process data in-theater to more quickly satisfy commanders' needs and to get a sense of the fight. Some interviewees amplified their remarks, stating that due to long lag time in stateside processing, Marine users in the AOR have said that if the data is over three days old, they don't want it. ACC staff members, interview.

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42. See Jennifer D. P. Moroney et al., *International Cooperation with Partner Air Forces* (Washington, DC: Rand Publishing, 2009), 9; Gordon England, *Building Partnership Capacity: QDR Execution Roadmap* (Washington, DC: Department of Defense, 2006); and Bruce Lemkin, *Global Partnership Strategy* (Washington, DC: Department of the Air Force, 2008).

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50. United States Africa Command, *2010 Posture Statement* (Stuttgart, GE: US Africa Command, 2010).

51. Nicolette Batini et. al., *United States: Selected Issues* (Washington, DC: International Monetary Fund, 2010).

52. J. Huntley, *Federal Debt and the Risk of a Fiscal Crisis: Economic and Budget Issue Brief*, technical report no. PB2010-114953 (Washington, DC: Congressional Budget Office, 27 July 2010), 4.

53. Stephen Flynn, "U.S. Not Prepared for the Next 'Big One,'" CNN.com, 20 February 2007, http://www.cnn.com/2007/US/02/20/flynn.commentary/index.html.

54. Commanders always have the prerogative to conduct immediate response operations near their installations to protect life and property and to mitigate human suffering.

55. On average, local and state authorities handle about 25 "disasters" per year, only about 15 of which result in 40 or more casualties. David Arday et al., "Medical Aspects of Disaster Preparedness and Response: A System Overview of Civil and Military Resources and New Potential," *Joint Center for Operational Analysis Journal* 9, no. 2 (June 2007): 13. Floods, mudslides, forest fires, and similar disasters are usually localized, do not cause calamitous loss of life or property, and do not disrupt interstate commerce or impact national security. It is in these situations where the National Guard is most likely to respond within its states or in concert with other Guard units under emergency military assistance compacts (EMAC). As the commander in chief within their several states, governors can recall National Guard personnel in either state active duty (SAD) status or under *United States Code* Title 32. In both cases, Guard personnel are under the command and control of the governor, as exercised through the states' adjutant general. Moreover, Guard forces in SAD or under Title 32 status can restore public order using police powers that federal forces do not have under the Posse Comitatus Act. If federal (Title 10) forces are needed, an elaborate process must take place in order to get them on the ground. According to the White House analysis of the military response to Hurricane Katrina, DOD assets were dispatched only after an approval process requiring *21* separate steps. Lag time between the request and federal "boots on the ground" was measured in days, not hours. Fran Townsend, homeland security advisor, *The Federal Response to Hurricane Katrina: Lessons Learned* (Washington, DC: White House, February 2006), ch. 5.

56. AFDD 2-10, *Homeland Operations*, 21 March, 2006, 5. This is discussed further in DOD Directive (DODD) 3025.1, *Military Support to Civil Authorities*, 15 January 1993.

57. AFI 10-802, *Military Support to Civil Authorities*, 19 April, 2002, para. 4.3.4.

58. This echoes similar wording in JP 3-26, *Homeland Security*, 2 August 2005, and in DODD 3025.1, *Military Support to Civil Authorities*.

59. Arday et al., "Medical Aspects of Disaster Preparedness and Response," 11. See also Justin Rood, "Medical Catastrophe," *Government Executive*, 1 November 2005, http://www.govexec.com/features/1105-01/1105-01s1.htm. For example, catastrophes could be earthquakes of a 6.0 magnitude or higher, tsunamis, and volcanic eruptions.

60. AFDD 2-10 lists eight examples of Air Force capabilities (along with a laundry list of "Potential Defense Support of Civil Authority Missions" in fig. 3.1) which are based on previous missions. AFDD 2-10, *Homeland Operations*, 27. An Army National Guard Homeland Defense white paper, *September 11th, 2001, Hurricane Katrina, and Beyond*, 11 October 2005, 11, lists "Top 10 Essential Homeland Defense Capabilities," seven of which have an obvious air component mission (http://www.arng.army.mil/News/publications/Publications/HLD%20White%20Paper_11OCT05_Final_Version.pdf). See also *The Federal Preparedness Report* (Washington, DC: DHS, January 2009), table 2, 100, for a listing of 13 DOD asset contributions, the majority of which are suitable for Air Force accomplishment, http://www.iaem.com/committees/governmentaffairs/documents/FPR-Jan2009.pdf; and *Joint Center for Operational Analysis Journal* 9, no. 2 (June 2007) table 4, 17. For a list of seven emergency measures that the federal government can unilaterally provide, see the American Bar Association (ABA) Standing Committee on Law and National Security, *Hurricane Katrina Task Force Subcommittee Report* (Washington, DC: ABA Committee on Law and National Security, February 2006), 5, http://www.abanet.org/adminlaw/KatrinaReport.pdf.

61. J. Emery Midyette Jr., "Resource and Structure of States' National Guard," *Joint Center for Operational Analysis Quarterly Bulletin* 8, no. 2 (June 2006): 33, 37, https://transnet.act.nato.int/WISE/test/LessonsLea/JCOALL/JCOABullet6/file/_WFS/JCOA%20Katrina.pdf.

Chapter 3

Recommendations

While the previous chapter explained the critical capabilities the Air Force should develop by 2030, this chapter provides a set of recommendations that will enable the service to achieve the strategic vision previously described. In keeping with the structure of chapter two, recommendations are grouped according to the five critical capabilities. While the recommendations vary in scale and scope, each supports the Air Force's ability to provide combatant commanders with the strategic capabilities they are likely to require of the service in coming decades. It is worth noting that the recommendations found here do not provide detailed guidance for their implementation. Such specificity would likely detract from the broader purpose of the study.

Power Projection

Conventional power projection against a peer or near-peer competitor will continue to shape Air Force requirements for the foreseeable future.[1] Thus, four recommendations are designed to assist the Air Force in meeting power-projection requirements across the strategic planning space over the next two decades.

First, the Air Force must begin the process of fusing air, space, and cyber capabilities into existing and future systems. For example, aircraft currently rely on the GPS—a space asset—and a range of cyber systems, but much more is possible at the individual platform level and in support of command and control. Integrating capabilities, both offensive and defensive, across the three domains will prove a key enabler and force multiplier over the coming decades. This does not imply a requirement for a single system to be all things. Instead, it suggests the need for systems, operators, and organizations that are capable of achieving effects in more than one domain. No longer is it sufficient for Airmen to know one system. They will soon need to understand the full range of capabilities that air, space, and cyber can provide to offer effective solutions to combatant commanders.

Second, the service must continue to refine a flexible power-projection capability that is adaptable to any situation. The United States will confront a variety of irregular threats below the threshold of Great Power war (nuclear or conventional). In a conflict with a peer competitor, where national sovereignty and vital interests are threatened, the calculus for determining an appropriate Air Force response is simple. However, in an irregular conflict where limited interests are at stake, determining the appropriate course of action is more difficult. In many instances a graduated response is most appropriate. With Air Force power-projection capabilities often serving as the single best tool available in these situations, power projection must be scalable. This presents a challenge that is proving difficult to overcome in present conflicts.

In an irregular conflict two potentially divergent missions are possible for the Air Force: fighting as a member of the joint or coalition force or enabling partners to fight on their own.[2] The former requires traditional airpower assets. In the latter, the Air Force can leverage key tools such as training, education, and assistance. It is the latter that is proving particularly difficult. At present, the service does not possess such capabilities outside Air Force Special Operations Command. Thus, there is a need to develop "general purpose" forces accustomed to operating with allies in ways not often considered part of the service's power-projection role.[3] Preserving combat capabilities for major contingencies in the future will require greater investments in irregular warfare capabilities today. As Afghanistan and Iraq demonstrated, the Air Force's most capable aircraft are not always necessary in an irregular conflict. By developing the appropriate capabilities for this mission, the service can achieve significant cost savings and preserve the life expectancy of the nation's choice aircraft.

Third, developing unmanned platforms that are enhanced by artificial intelligence and able to operate autonomously to target an adversary will support the Air Force (conventional) deterrence mission and the defense of allies. Such systems may prove critical psychological tools in peer or near-peer competition, where a peer may view the employment of such systems as a reason to cooperate with the United States. Extending the range and loiter time of existing and future platforms—to account for the projected capabilities of antiaccess and area denial threats—will have a similar effect. And in the case of distant adversaries, for example, improved range will be an integral aspect of a successful Air-Sea Battle strategy.

Improving the range of air-breathing platforms will also delay or prevent the compromise of one of airpower's greatest advantages: the ability to operate from secure locations outside an adversary's reach. As American forces withdraw from Iraq and eventually Afghanistan, there will be a greater focus on Asia. Thus, the likely continuing drawdown in overseas forces and the number of OCONUS main operating bases must be offset not only through a closer relationship between the Air Force and Navy (Air-Sea Battle), but with long-range power-projection systems capable of holding targets at risk without access to nearby bases.

Fourth, offensive and defensive cyber capabilities must be fused into air and space platforms. By 2030 cyber capabilities may become the greatest power-projection tools in the Air Force arsenal, serving as both force multipliers and Achilles heel. Several nations are clearly equal to or ahead of the United States in their ability to launch cyber attacks. Despite the Air Force's attempts to organize, train, and equip to meet cyber requirements, its ability to conduct robust cyber operations remains a potential but not assured capability.

The United States is likely to find itself heavily reliant on the Air Force's power-projection capabilities in the coming decades. Defending the nation's vital interests will require a mix of old and new approaches. When necessary, the Air Force will be called on to provide precise and rapid effects that represent the fusion of air, space, and cyber.

Freedom of Action: Air

Freedom of action in the air domain will remain a critical capability for the foreseeable future. Whether the United States faces a peer competitor or a nonstate actor, the ability to operate in the air will remain a key component of any American strategy. With the F-22 and F-35 destined to serve as the nation's principal air superiority platforms for at least a generation, critical acquisition decisions that will guide the Air Force approach to air superiority through 2030 have already been made. However, if current projections are correct and the end costs of F-35 development and procurement consume much of the DOD acquisition budget, relatively inexpensive force multipliers such as continued research and development of autonomous unmanned platforms, human-computer enhancements, and cyber attack capabilities may become more important as the acquisition of advanced fighters declines.

A reduction in the purchase of F-35s is likely because of significant cost overruns and competing requirements. Along with the increasing need for capital investment in long-range strike, there is a real need for recapitalization of the nation's strategic defense systems. Thus, inexpensive force multipliers should be a focus of development. One such option is an aircraft-mounted cyber attack system with the ability to penetrate and disrupt the software of an adversary's aircraft, radar, and other systems.

As they always have, adversaries of the United States are continuously developing new means of challenging American air superiority. Denying them success will require that the Air Force continually adapt to improving systems and changing tactics, techniques, and procedures. This will become increasingly difficult as competition for research and development dollars grows over the next two decades.

Freedom of Action: Space

Space superiority over the coming decades can be gained by developing and implementing a comprehensive strategy. As the scenarios (see app. C) demonstrate, the Air Force must take the lead in ensuring that the nation's current space vulnerabilities do not lead to a premature and economically prohibitive strategy, or worse, spark a weapons race in space. Thus, the Air Force must tread carefully as it protects the nation's vital space interests. Four recommendations will assist the service in developing sustainable space superiority.

First, the Air Force must continue to improve American surveillance of space. A first step in correcting this deficiency was the 25 September 2010 launch of *Pathfinder*, the first satellite in a planned constellation which also includes supporting ground infrastructure. Known as the Space Based Space Surveillance system, its mission is to improve the DOD's ability to detect and track objects in Earth's orbit. To maximize its capabilities the Air Force must fully deploy SBSS—or an SBSS-like constellation—and integrate it into a coherent architecture that will detect objects in both low and high Earth orbit.[4]

Second, the Air Force must guarantee access to the space domain while achieving lower production and operating costs. The Air Force has a rich spacefaring history. It does not, however, have a record of responsive launch. Special handling requirements for lift vehicles and satellites entail months or years of planning for an on-time launch. The primary space launch vehicles in use today are evolved expendable launch vehicles (EELV)—Boeing's Delta IV family and Lockheed Martin's Atlas V family. The EELV was designed to standardize and improve space launch operability, reduce the government's traditional involvement in launch processing, and save a projected 25 percent over legacy launch systems.[5]

In 2006 the congressionally mandated National Security Space Launch Requirements Panel concluded that "ample evidence suggests that these rockets can meet the launch needs of the United States through 2020 (the end of the [panel's] study period), barring the emergence of payload requirements that exceed their design lift capability." The report noted, however, that the two launch families are "largely uncompetitive in today's commercial market."[6]

Smaller, less expensive lifters and satellites must become commonplace. Further, responsiveness must be marked by days and weeks rather than months and years. Operationally responsive space, while not a cure-all, must become an element of national space policy. Thus, the nation needs a mix of larger and smaller, less expensive systems to increase capability and simultaneously reduce vulnerability.

Third, increased partnering with industry will also assist in reaching the goal of space superiority. The private sector has made great strides in space development over the past 20 years. SpaceX successfully launched light- and medium-lift vehicles in Falcon 1 and Falcon 9, reducing costs compared to its Boeing and Lockheed Martin rivals.[7] The Obama administration's most recent decisions on space operations, shifting spending from government projects to commercial endeavors, potentially point to a dramatic change in American space policy—a greater emphasis on private companies.[8]

Fourth, to further mitigate vulnerability in space, the United States must establish greater resiliency in its satellite constellations. Space systems must become more responsive *and* less vulnerable to meet the war fighter's needs as warfare continues to evolve. The DOD has long relied upon large, expensive satellite systems to meet its needs. The launch of the Defense Satellite Communications System (DSCS) follow-on, Wideband Global System (WGS), is an example of this good news, bad news story. While each WGS satellite is more capable than the entire nine-satellite DSCS constellation, the planned six-satellite WGS constellation increases US space vulnerabilities by placing greater reliance on a reduced number of satellites.[9]

Resiliency can be accomplished through a number of methods, such as networking smaller satellites together, having ready spares on orbit, and being able to replace lost assets rapidly from the ground. The strategy must be to eliminate any incentive for destroying American space-based assets. Furthermore, networking potentially less complex satellites together, as is done today with computers, may enhance operational capability.

As it stands, the United States is the leading space nation but does not have space superiority. Absent significant investments, the American position in space will decline and become increasingly vulnerable to a range of threats.

Freedom of Action: Cyber

Over the next 20 years, the cyber threat will compel the Air Force to play a leading role in defending the nation's interests. Preparing for this future will require an unprecedented shift in the service's approach to cyber. Simply defending the network is not enough. The Air Force should undertake a more aggressive approach to developing cyber as a critical operational capability. This will require the service to undertake two principal efforts.

First, the Air Force must assume the mantle of responsibility for cyber activities as they relate to accomplishing Title 10 responsibilities. With the greatest dependence on cyber of any service, the Air Force must depend on itself for most of its cyber needs. Accomplishing this objective will require the service to operationalize cyberspace by preparing to conduct offensive as well as defensive cyber operations, develop a sound legal framework for operations, create broad interoperability, and aggressively work toward joint operations. For example, if the Air Force assumes responsibility for cyber functions directly related to its operations—functions currently performed by the National Security Agency (NSA)—the emphasis will shift from information security to operational effects.

Second, to operationalize cyberspace, the Air Force must develop a large cadre of degreed experts in computer science and computer engineering (CS/CE). Because of changes in the United States' CS/CE graduate base, the Air Force faces formidable obstacles that could grow by 2030. Simply stated, there are not enough CS/CE graduates for all purposes, and the best people will be able to command salaries far beyond what the Air Force and the DOD offer. Failure to overcome the manpower obstacle will undermine the Air Force's ability to maintain a cyber-proficient workforce and threaten the accomplishment of core Air Force missions.

One way for the service to acquire the needed cyber expertise is to develop it internally, a path it is currently taking. Incentives like career specialization pay, scholarships, or bonuses can help attract and retain the best and the brightest. The Air Force should also look to partner with academia and industry. Valuable expertise and experience in cyber reside outside the Air Force and can greatly enhance internal Air Force capabilities. Partnering with academia and industry may serve as a significant force multiplier.

Global Situational Awareness

Although globalization and technological advances are bringing people and nations closer together, they are making the world a more complex and expansive

place for the Air Force. Nowhere will the nation feel the impact more than in situational awareness. The Air Force will have to travel greater distances to accomplish its mission, and with the proliferation of geographically unconstrained threats, maintaining situational awareness is becoming increasingly difficult. Indeed, the opening of the High North, for example, where Arctic ice is receding, may create entirely new theaters of operation that must be monitored. Thus, not only are Air Force surveillance, reconnaissance, and analysis facing physical difficulties because of increasing distances between the United States and potential adversaries, but the variety of actors is making the strategic planning space more complex.

To execute the situational awareness mission effectively, the Air Force's intelligence community must globalize sensor systems through the integration of air, space, and cyber. This will enable the service to develop a comprehensive/integrated network of sensors and complete a metamorphosis of its assets into a tightly organized and dynamic force for global as well as regional coverage. While there are a number of ways to accomplish this broader objective, the implementation of the following recommendations is one approach to this transition.

First, space-based capabilities should be planned and executed in lockstep with the National Reconnaissance Office (NRO) because surveillance is increasingly becoming a standoff capability. As part of this effort, Air Force intelligence personnel should be assigned to the NRO in sufficient numbers and with sufficient rank to influence design and implementation of programs and to provide an operational perspective from the end user. Similarly, a growing dependence on second- and third-party surveillance—since these parties are often closer to targets—will call for exchange programs with allies and civilian partners as part of the larger effort to influence the product received by the end user.

Second, it is time to plan for a postwar (Afghanistan and Iraq) surveillance and reconnaissance capability that successfully develops a comprehensive/integrated network through use of the existing distributed common ground system. Serious doctrinal thought about DCGS roles in any future fight and the integration of long-range surveillance and reconnaissance assets into the DCGS is necessary. Currently configured and manned for tactical missions, the DCGS must shift its focus to processing and disseminating national and allied intelligence products, a mission that will require a change in philosophy and techniques. The increasing complexity, speed, and distances of future warfare demand such an evolution.

Third, the Air Force must exploit emerging automation as a means of improving data analysis so that human analysts are employed in the highest-order tasks. Currently, analysis is hampered by the sheer volume of data and the lack of means (human and mechanical) to process all of it. Accelerated development of translation software, artificial intelligence, and electronic means to process raw data—signals and electronic intelligence—is the most practical approach to managing this glut of data and should become an Air Force funding priority.

Air Diplomacy

The 2010 *Quadrennial Defense Review* (*QDR*) calls for the Department of Defense to balance resources and risks among four priority objectives: prevailing in today's wars, preventing and deterring conflict, preparing to defeat adversaries across a range of contingencies, and preserving and enhancing the all-volunteer force.[10] Air diplomacy is poised to assist combatant commanders achieve two of the four objectives: preventing and deterring conflict and preparing to defeat adversaries across a range of contingencies. While diplomacy is an obvious contributor to conflict prevention, the relationships built through diplomatic activities prior to a conflict's outbreak can play an important role in gaining necessary support from allies, who can be called on later when needed. By actively promoting air diplomacy as a soft-power tool available to decision makers, the Air Force can increase its role in defending the nation's interests and forge new and stronger relationships with friends and allies.

While the current Air Force Security Cooperation Strategy provides an excellent foundation upon which to build, an air diplomacy strategy that includes all of the Air Force's diplomatic capabilities is necessary.[11] This is particularly important when fiscal constraints force decision makers to choose among competing priorities. Conceptually, air diplomacy also provides a construct that supports the nation's soft-power options. Devising an air diplomacy strategy is best accomplished by implementing three broad recommendations.

First, an air diplomacy strategy should focus on three central goals. It must coordinate and enhance the disparate diplomatic missions conducted by the Air Force. The strategy must develop a proactive approach to engaging allies, neutrals, and adversaries. And it must accomplish strategic ends with existing means.

Currently, the Air Force lacks a unifying strategy capable of effectively leveraging *all* of the soft-power missions it performs. As noted previously, the Air Force Security Cooperation Strategy focuses many of the Air Force's train, advise, and assist missions into a unified strategy, but there are potential opportunities not included.[12] An air diplomacy strategy should incorporate additional soft-power missions that often have objectives beyond the scope of existing strategic guidance.

The second recommendation is for the Air Force to build on the foundation of existing strategic guidance, programs, plans, and approaches related to diplomatic action. This will simplify the process of creating a service strategy. With national, departmental, and service guidance found in a number of documents, it is not necessary to start from scratch when developing an air diplomacy strategy.[13]

As part of this process, it is important to establish where air diplomacy begins and ends. Clear boundaries are important because many of the platforms and personnel critical to air diplomacy's success are equally central to performing combat missions. Thus, creating a set of guidelines for measuring the success or failure of air diplomacy is a necessary component of any strategy.[14]

It is also important for an air diplomacy strategy to give clear direction to the Air Force and enable the chief of staff to present forces to combatant commanders that are prepared to conduct a range of diplomatic missions. Modularity and flexibility will prove critical to success. The Air Force must never sacrifice its primary mission—strategic power projection—for the sake of air diplomacy, but it must be able and willing to tailor forces to meet soft power's requirements.

The third recommendation is to bring together the necessary contributors to develop a strategy that is accepted at the interdepartmental level, within the DOD, and inside the Air Force. Participants should include the Department of State, the Office of the Secretary of Defense, combatant commanders, the Office of the Secretary of the Air Force for International Affairs, Air Staff components, and the major commands. If excluded from the development process, those affected by air diplomacy may not support its implementation.

Military Support to Civil Authorities

With its focus on homeland defense and disaster mitigation, MSCA presents a set of legal, political, and command and control challenges that vary significantly from those of the other capabilities. Three specific areas call for special attention if the Air Force is to improve its support of NORTHCOM domestic contingency requirements: airlift, medical support, and situational awareness.

First, developing the air component of a national response capability will require the Air Force to focus on airlift. One way to address airlift is to equip the bulk of ANG units with airlift aircraft. First-response airlift is a key enabler and will likely come from the ANG. A focus on airlift will enable the ANG not only to provide military support to civil authorities but to perform a valuable wartime mission as well. Embedded within each ANG airlift unit must be aerial port capabilities to provide staging expertise for follow-on airlift and deployable medical support.

Second, Air Force capabilities should be dispersed across Federal Emergency Management Agency regions. This could be effectively accomplished by distributing all future ANG airlift units among the 10 FEMA regions. ANG medical support units should also be included since medical evacuation and support are the most critical and long-lasting components of MSCA. These capabilities are required before anything else and must continue long after any disaster. As the Air Force's "first responder," the ANG must be postured to fill this quick-response role. Aligning ANG airlift units among FEMA regions will allow these units to exercise with state and local first-responders in disaster scenarios and establish strong relationships before a disaster occurs.[15] Additionally, Air Force hospitals and clinics should be prepared to receive any overflow of patients from local disasters because many municipalities lack sufficient hospital beds to adequately respond to a large-scale disaster.

Third, ANG imagery analysts should become the primary source of support, advice, liaison, and imagery interpretation for state and local officials within each

FEMA region. They should be an integral part of future MSCA exercises and be on call for domestic disaster support. Gaining situational awareness of a disaster's dimensions is a crucial step in dealing with it. As part of this effort to improve situational awareness for first responders, the DCGS stations staffed by ANG analysts should be used to provide real-time imagery support in the event of a disaster, and their designed operational capability statements should be amended to add MSCA. Codifying this mission will allow ANG units to exercise with local and state disaster entities as well as to provide a framework for oversight, funding, and inspection.

Conclusion

As the Air Force looks toward a future that likely includes turbulence and rapid change, the service must make a number of difficult decisions well in advance of an eventual need. The purpose of this study is to assist current leaders as they weigh possible decisions in the midst of a security environment laden with uncertainty, stagnant defense budgets, and threats at the high and low ends of the conflict spectrum. The previous pages provide senior leaders with one perspective on the many challenges the Air Force faces. By suggesting the service focus on five critical capabilities (power projection; freedom of action in air, space, and cyber; global situational awareness; air diplomacy; and military support to civil authorities), this study seeks to clarify the choices current leaders must make. Every decision made today has ramifications that will last well into the future—long beyond the tenure of any current Air Force leader.

Notes

1. A 2005 report noted, "US military strength is built on a foundation of technological superiority that grew from a position of global leadership in relevant technologies and innovative capabilities. That leadership position is no longer assured. The synergistic forces of globalization and commercialization of science and technology are providing current and future adversaries with access to advanced technologies as well as the expertise needed to exploit those technologies." Committee on Defense Intelligence Agency Technology Forecasts and Reviews, Division on Engineering and Physical Sciences, *Avoiding Surprise in an Era of Global Technology Advances* (Washington, DC: The National Academies Press, 2005), 1. More recently another defense analyst observed, "It is important here to note that as the pace of innovation may be slowing for the United States, American competitors may be catching up. For example, in coming years China could gain the ability to use large numbers of precision sub-munitions launched from maneuverable ballistic missile reentry vehicles. These could, in theory, make it quite impractical to use airfields lacking hardened shelters; and even those with shelters could have their runways threatened." See Michael E. O'Hanlon, *The Science of War* (Princeton, NJ: Princeton University Press, 2009), 184.

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3. See, for example, Robyn Read, "Effects-Based Airpower for Small Wars: Iraq after Major Combat," *Air and Space Power Journal* 14, no. 1 (Spring 2005): 103–12, http://www.airpower.maxwell .af.mil/airchronicles/apj/apj05/spr05/read.html.

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11. United States Air Force, *Global Partnership Strategy: Building Partnerships for the 21st Century* (Washington, DC: Department of the Air Force, 2008).

12. Ibid., 2.

13. Robert Gates, *Department of Defense Report on Strategic Communication* (Washington, DC: Office of the Secretary of Defense, 2009).

14. Jennifer Moroney, *Building an Assessment Framework for U.S. Air Force Building Partnership Programs* (Washington, DC: RAND, 2010).

15. For a detailed review of how to base ANG airlift aircraft for domestic support, see John Conway, "Beddown Options for Air National Guard C-27J Aircraft: Supporting Domestic Response," *Air and Space Power Journal* 24, no. 2 (Summer 2010): 35–44, http://www.airpower.maxwell.af.mil/airchronicles/apj/apj10/sum10/06conway.html.

Chapter 4

Conclusion

This study addressed a single question—what capabilities must the Air Force provide combatant commanders by 2030? To arrive at the answer, the research team took a multimethod approach. The team conducted a qualitative analysis of the nation's vital interests, which include commercial interests, secure energy supplies, freedom of action at sea, freedom of action in space, freedom of action in cyberspace, nuclear deterrence, freedom of action in the skies, and regional stability. The team then developed four future scenarios in which a peer competitor, a resurgent power, a failed state, and a jihadist insurgency pose a strategic challenge to the United States. In each scenario a modified Delphi process is employed to develop a likely American response—focusing on the Air Force role. Examining which Air Force core functions are most critical in each scenario and then across the scenarios makes it possible to synthesize the core functions into a set of critical capabilities that the service will require within the next two decades. These capabilities include power projection; freedom of action in air, space, and cyber; global situational awareness; air diplomacy; and military support to civil authorities. Some final observations will help set the tone for a summary of the recommendations and conclusions that follow.

Range and speed are the two characteristics that set the Air Force apart from the other services. Whereas Army, Navy, and Marine Corps aviation is principally employed in support of ground forces or in defense of the fleet, Air Force air and space assets have long served as the nation's foremost power-projection tool. In a world where globalization has led to an unprecedented geographic diffusion of US interests, the shifting of security concerns eastward underscores the strategic role air, space, and cyber power will play in the future. In this ever-expanding world, range and speed will become increasingly important.

This study recognizes that the current fight is important. However, continuing to focus limited funding, manpower, and service capabilities on irregular conflict threatens to marginalize the Air Force's ability to provide unique strategic options. The Air Force must first and foremost focus on the capabilities required to defeat a peer or near-peer adversary—the most dangerous scenario. The increasing complexity of challenges present in the international environment will require Airmen to develop a comprehensive and integrated concept of air, space, and cyber capabilities to support the combatant commanders as they secure the nation's vital interests.

The Air Force, more than any other service, is tied to technological innovation. Thus, it must remain mindful of the key trends driving change in the international security environment. With the current rate of change, the service may evolve from an air, space, and cyber force today into a cyber, space, and air force by 2030. Rapid rates of technological change require that the Air Force be prepared for a future in which peer competitors once again find themselves at war, but in the cyber and space domains. By 2030 the United States will be unable to ignore the potential for

conflicts between Great Powers. Further, rogue regimes and nonstate actors will be among the many adversaries the nation must deter or defeat. Preparing for its role in the future will require the Air Force to focus on five capabilities.

Power Projection

Power projection is a foundational capability that the Air Force provides to combatant commanders. The service's ability to supply sustained power projection, particularly long-range strike, will be severely tested over the next generation for a number of reasons. Many current systems have already lasted well beyond their expected lifespans and must be recapitalized, or the nation may lose a credible power-projection capability. Adversaries are also certain to deploy increasingly sophisticated strategies to compel US forces to operate at greater distances. This will require systems with longer reach, greater speed, and low observability. Because of political or economic conditions, the United States may opt to operate from fewer overseas locations—magnifying the importance of power projection. Most troubling is the rise of technically savvy adversaries who will challenge the United States in space and cyber, making power projection potentially even more vital in protecting the nation's interests.

Thus, the Air Force must integrate air, space, and cyber capabilities to achieve strategic effects in any potential conflict. Integrating capabilities across the three domains—the fusion of air, space, and cyber power—will prove a key enabler over the coming decades. Overcoming antiaccess and area-denial tactics will be aided by the development of remotely piloted systems that leverage advances in artificial intelligence, autonomous operations, and propulsion technologies. Such systems will support allies, deter adversaries, and provide needed capabilities against peer or near-peer competitors. Extending the range and loiter time for existing platforms will have a similar effect.

Freedom of Action: Air, Space, and Cyber

Freedom of action in the global commons is vital. Superiority in all domains—permitting conduct of operations at a time of our choosing without prohibitive interference from an adversary, while denying an adversary the same—will prove increasingly difficult over the next two decades.

While the United States continues to develop manned and remotely piloted versions of its systems, other countries are making dramatic advances in these areas as well. Although American airpower has not been significantly challenged for decades, the service must seek ways to assure air superiority through force multipliers such as offensive cyber capabilities. Adversaries will continually develop new means of challenging this long-held American dominance. Thus, air superiority can never be taken for granted.

The Air Force must build a resilient space force capable of rapidly replacing space assets lost to attack. Indeed, resiliency could serve as the most effective deterrent to space challenges. The service must also improve space surveillance. To maximize this capability, the Air Force must fully deploy an SBSS system—or an SBSS-like constellation—and integrate it into a coherent architecture that will detect objects in both low and high Earth orbit, thereby increasing capability and simultaneously reducing vulnerability. Finally, lowering the cost of space operations is necessary. Lowering production and operating costs via a mix of larger and smaller, less expensive systems will assist in creating greater space resiliency.

Cyber superiority will ensure the reliability of data used for decision making in all domains. An increasing volume of information and improved transmission speeds are likely to overwhelm human comprehension and require a more capable man-machine interface. In addition, as cyber capability increases, the Air Force must make a concerted effort to maintain a technological edge and incorporate advances to support combatant commanders. To accomplish this, the Air Force must develop a formidable cyber force—with the requisite capabilities to achieve a level of cyber superiority currently absent. The service should also recognize cyber as a critical Air Force specialty with promotion potential and dedicated funding. Finally, the Air Force must take a more aggressive approach to developing cyber as a capability—understanding that the service's ability to fly, fight, and win depends on seamlessly integrating cyber with air and space power.

Global Situational Awareness

The Air Force must develop an understanding of surveillance, reconnaissance, and analysis that is effects- rather than platform-centric; develop global perspectives on situational awareness; and engage all platforms in data gathering. Information gathering and processing will also be hindered without additional tools to process the overwhelming amount of data. This will require accelerating development of translation software and electronic means, such as artificial intelligence, to process raw data and additional analysts.

Since surveillance will likely be an "away" game in the future, overhead capabilities must be planned and executed in lockstep with the National Reconnaissance Office. Thus, Air Force intelligence personnel should be assigned to the NRO in sufficient numbers and rank to influence design and implementation programs and provide an operational perspective from the end user.

Air Diplomacy

Air diplomacy is the nonkinetic employment of air, space, and cyber power through capabilities such as humanitarian assistance, deterrence, and power projection. The Air Force should devise an air diplomacy strategy and organize, train, and

equip for its implementation. In addition, the service must communicate the availability of air diplomacy capabilities to combatant commanders and within the service while creating an Air Force culture that recognizes the significance of those capabilities. An air diplomacy strategy should address specific ends, ways, and means applicable to the combatant commander's theater plan.

Military Support to Civil Authorities

Generally focused on providing consequence management for natural or manmade disasters, MSCA is a key role for the Air Force and Air National Guard as they prepare to provide forces to the US Northern Command. Whether in response to an attack with weapons of mass destruction or a flood, the Air Force and ANG are poised to serve as the primary sources of airlift, medical support, and situational awareness.

The ANG must be postured to fill this quick-response role. To better respond to disasters and other events, Air Force hospitals and clinics should be prepared to receive an overflow of patients. Furthermore, since airlift aircraft will form the bulk of the ANG's future unit structure, embedded aerial port and medevac units will provide staging expertise for follow-on airlift and deployable medical support. In the end, the Air Force must ensure that USNORTHCOM can provide effective MSCA when called upon during a natural disaster or other emergency.

In coming years the nation will look to the Air Force to provide power projection; freedom of action in air, space, and cyber; global situational awareness; air diplomacy; and MSCA to meet the strategic challenges Americans will soon face. Maintaining these capabilities will require continuous attention and investment, or they will erode. The United States is in danger of being overtaken by emerging adversaries in a number of areas the nation has long taken for granted. Focusing on these five capabilities will assure the Air Force contribution to national security as the nation moves toward 2030.

Appendix A

National Interests and Shocks

The National Interest

Seventy-five years ago the respected scholar Charles Beard wrote in *The Idea of National Interest*, "Although employed as if it were a fixed principle, somewhat like the law of gravitation, the idea of national interest is, relatively speaking, a newcomer among the formulas of diplomacy and international morality."[1] Today, the amorphous concept known as "the national interest" is employed by commentators, politicians, and scholars to support divergent positions on a host of public policy issues. As Beard noted, those who employ the national interest rarely offer a concrete explanation of the concept or its specific elements.[2] Because of the lack of a well-understood framework, the enduring nature of interests—particularly vital interests—is often misunderstood by both policy makers and the public. Contrary to Joseph Nye's view that the national interest is "simply what citizens, after proper deliberation, say it is," the broader national interest and the specific vital, major, and peripheral interests that form it develop over time and endure across presidential administrations of both political parties.[3] The national interest is not defined by any sitting president's political agenda. Although specific interests develop or decline over time—often slowly—the national interest transcends the whims of the present day.[4] To provide greater clarity as to the composition of the national interest, we begin with a definition of the concept and a set of vital, major, and peripheral interests.[5]

Understanding the National Interest

The Idea of National Interest, a seminal work on the subject, traces the development of national interest from the feudal period, when national honor was linked with the honor of the monarch, to the present. As *national honor* faded, *national interest* rose to take its place. According to the author, two "fundamental relevancies" are at the heart of national interest—territory and commerce. The first of these is territory or, as Hans Morgenthau later called it, "survival."[6] Some consider survival—often understood as state sovereignty—a national interest; this undervalues its importance. State sovereignty is more appropriately understood as a basic characteristic of the state that is necessary for its very existence. Although the state can exist in an international environment in which its commercial interests are violated, for example, the state ceases to exist if it loses its sovereignty. The second of Beard's relevancies dates to the earliest days of the republic—commercial interests.

When Pres. George Washington published his farewell address on 17 September 1796, he laid out a concept of America's foreign policy designed to preserve the national interest. Washington's recognition of interstate commerce's importance is

exemplified in his famous statement that "the great rule of conduct for us, in regard to foreign nations, is, in extending our commercial relations, to have with them as little political connection as possible. So far as we have already formed engagements, let them be fulfilled with perfect good faith. Here let us stop." He went on to add that the United States should be a "friend to all and enemy of none" as the nation sought to "avoid the entangling alliances of Europe."[7] The United States largely followed a policy of commercial internationalism and military isolationism until the onset of the Cold War.[8] While commercial internationalism continued, the containment and defeat of the Soviet Union permanently ended military isolationism as *the* approach in advancing America's national interests. In the half century of the Cold War, two generations of Americans grew to adulthood during a time in which the United States maintained an average of 535,000 troops overseas.[9]

Pres. Bill Clinton sought to redefine the national interest during the 1990s by combining commercial internationalism with the spread of democracy and international institutions. American troops returned to the United States, and the nation's reliance on decisive military action declined. Much like the approach to foreign policy and the national interest prior to the Cold War, President Clinton exploited the "peace dividend" and focused on expanding America's commercial ties and influence. With what Francis Fukuyama described as the "end of history," liberal internationalism attempted to unseat realism from its perch atop the foreign policy hierarchy. Like his predecessor, George W. Bush was from the liberal internationalist school. Whereas President Clinton sought to make the world safe for democracy through globalization, President Bush sought to do the same through the force of arms. Even as Pres. Barack Obama winds down the war in Iraq and expands the war in Afghanistan, few are attempting to frame the debate surrounding these conflicts within the context of a well-defined national interest—thus necessitating this discussion.

Vital Interests

Strategists Dennis Drew and Donald Snow suggest that the national interest has three components: vital, major, and peripheral interests. They suggest that vital interests are defined by two basic characteristics. First, compromise is not an option when a vital interest is at stake. Second, resorting to war is a legitimate action in the defense of a vital interest.[10] Samuel Huntington held a similar view, defining a vital interest as one worth the expending of "blood and treasure."[11] As James Thomson suggests, "vital interests arise from an enduring combination of the nation's geographic position, political culture, economy, and power."[12] A third characteristic of vital interests is continuity over time. Rarely does a vital interest develop overnight, nor is it common for the nature of a vital interest to fluctuate much, if at all. More commonly, interests are constant and enduring in their importance to the nation. This description of the concept does not speak to a policy maker's understanding of the nation's individual vital interests.

Historically, preservation of the nation's commercial interests was seen as the sine qua non of vital interests because they were and are the foundation for economic prosperity. However, state sovereignty, that most basic characteristic of the state, rose to prominence during the Cold War as the fear of nuclear war captured the national conscience. In the generation since the collapse of the Soviet Union, the United States has found no peer competitor capable of challenging its enduring vital interests. Neither Afghanistan nor Iraq poses an existential threat to the United States, just as al-Qaeda and its affiliates are limited in their ability to threaten the nation and its citizens. Thus, the debate over vital interests has strayed beyond its traditional bounds.

Major Interests

Major interests—while important—do not require a state to resort to war if threatened. Here an interest involves a situation where "a country's political, economic, or social well-being may be adversely affected but where the use of armed force is deemed excessive to avoid adverse outcomes."[13] Many interests fall into this category and can be addressed in a number of ways. The United States frequently employs diplomatic and economic tools to secure its major interests. While the nation may resort to the use of limited force, major interests are of insufficient value to warrant a large-scale military response. Neither does their defense call for placing a significant financial burden on the nation.

It is important to note that the distinction between a vital and a major interest is often unclear and subject to debate. There is no easy formula for determining vital, major, or peripheral interests. Clarity, in many instances, comes only when an adversary acts provocatively, forcing decision makers to weigh the costs and benefits of possible actions. The Korean War is one example of this very point. Prior to the invasion of South Korea, the United States did not consider Korea a significant national interest. But once North Korean forces began pushing south, Pres. Harry Truman made the decision to defend the South with limited force.

Peripheral Interests

Peripheral interests are of least significance to the nation.[14] In many instances, they are related to the cultural and moral preferences/norms of the nation and its citizenry but are not of sufficient national significance to solicit more than a negligible response to their violation. Responses to the violation of a peripheral interest can include the reproach of elected officials, influential individuals, or powerful organizations. They do not, however, solicit more than a negligible diplomatic, economic, or military response in most cases. They can, however, lead to symbolic acts or threats of greater action.

The American reaction to human rights atrocities in Darfur is a typical response to the violation of a peripheral interest. Although the United States has expressed strong disapproval of what is taking place, neither the president nor Congress has

suggested that strong economic sanctions or military action is needed. Such acts of inhumanity violate the cultural and moral norms of Americans, but they do not offend the nation enough to warrant a strong response.

The National Interest, 2010–30

After more than two centuries of independence, the United States continues to pursue a set of interests that has remained consistent over long periods of time. In many respects, two centuries of growth and change served only to clarify what is and is not "in the national interest." Because the nation reinforces the enduring nature of its interest, events such as World Wars I and II, the Cold War, and the attacks of 11 September 2001 have not fundamentally reshaped what matters most to the nation. Advancements in technology and the geostrategic environment have played their part in the development of the national interests discussed below, but change has not undermined the legacy of continuity that is particularly important when discussing vital interests.

In figure 1, the order of interests progresses from left to right, moving from vital to peripheral interests. It is important to note that within each of the three categories (vital, major, and peripheral), no two interests are of equal weight. Rather, each is ranked—based on relevance to the nation—and diminishes in significance as it moves to the right.[15] Admittedly, offering a rank-ordered list of American national interests is fraught with danger. Such an effort will inevitably draw criticism because
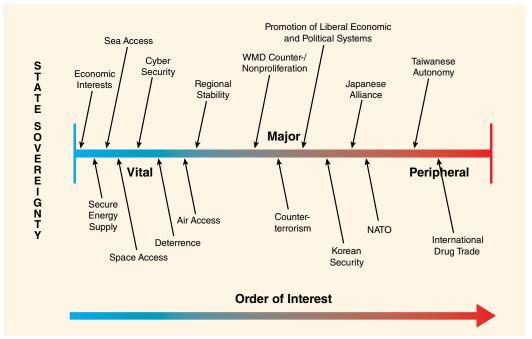

Figure 1. The national interest. (Developed by Adam Lowther, Air Force Research Institute, Maxwell AFB, AL.)

of the subjective nature of valuing interests. If the previous pages have offered nothing else, they should illustrate the complexity of deriving a cohesive understanding of the national interest.

Although the scientific method calls for the use of variables that are both exhaustive and mutually exclusive, the individual interests that compose the national interest are neither. Instead, there is significant overlap between interests. Thus, analysis of the national interest presents a picture absent clean lines of differentiation. With these limitations in mind, the following pages briefly describe current vital, major, and peripheral interests and the possibility for change over the next two decades.

Current and Future Vital Interests

Any discussion of the national interest must begin with vital interests. Although it is difficult to rank these interests with any empirical certainty, they are ordered based on a subjective evaluation of their significance.

Commercial or Economic Interests. Since the birth of the republic, commercial or economic interests have been the lifeblood of the nation. Originally built on the export of raw materials and the import of manufactured goods, the United States was successful because the nation focused almost exclusively on economic growth. Challenges to the nation's commercial interests came first from the Barbary pirates and then from the British navy.[16] In both instances the nation went to war. Soon after entering the industrial age, the United States would become the world's largest economy and a net exporter—well before World War II. During the twentieth century, the Soviet Union presented the clearest threat to American economic interests, as two great powers—one socialist and one capitalist—engaged in an epic struggle for economic supremacy.[17] With the Soviet Union's collapse, capitalism prevailed. America's "unipolar moment" did not, however, shift the focus from commercial interests.[18] Since 1991 every national security strategy has devoted significant discourse to the president's grand strategy for defense of the nation's economic interests.

The preeminence of America's commercial and economic interests is unlikely to change much over the coming generation. Neither American industry nor the government, dependent on industry-generated tax revenue, is likely to recast its symbiotic relationship. It should continue to endure in much the same way as it has throughout American history.

Secure Energy Supply. Some argue that the history of US foreign policy—since at least the Cold War—is the history of America's thirst for oil.[19] Although these arguments are meant as a condemnation of the American way of life, it is a reality that the world—advanced and developing—is dependent on hydrocarbons derived from such sources as coal, natural gas, and petroleum.[20] They drive the economy and the American way of life. Cutting the nation's energy supply would cause the economy to grind to a halt. No other natural resource is as pervasive in its impact on society.

While many Americans find the idea of waging war to secure the nation's energy supply unacceptable, no president—Democrat or Republican—is willing to place the

nation's energy supply at risk. Hydrocarbon-based fuels are a necessity of modern life, and their acquisition is the cause of regular conflict. Few would disagree that the first Gulf War sought to protect Middle East oil supplies from an aggressive despot.[21] Some also claim that the second Iraq war was a bolder attempt to secure America's oil supply, although others disagree.[22] The truth is likely somewhere in between. What most policy makers will agree on is the importance of fossil fuels to the continued success of the US economy and life as we know it.

By 2030 global energy demand is estimated to be 50 percent higher than it is today.[23] Absent a technological breakthrough in renewable energy, a dramatic increase in domestic drilling, and/or a turn to nuclear power, energy will play an increasingly important role in economic and security policy. The need for critical resources has a long history of generating conflicts. Oil has the greatest potential to be the resource over which much blood is spilled in the coming years.

Freedom of Action—Seas. When A. T. Mahan wrote *The Influence of Sea Power upon History* (1890), he was the first to develop a unified thesis linking supremacy of the seas to national greatness. His study of British and French maritime strategy convinced Mahan that Britain's control of the transoceanic lines of commerce and communication enabled an island nation (Britain) to become an empire. If America were to take its rightful place among the great powers, it too had to master the seas. As Mahan notes early in his work, "The profound influence of sea commerce upon the wealth and strength of countries was clearly seen long before the true principles which governed its growth and prosperity were detected."[24]

In previous centuries, "supremacy" enabled countries to restrict interstate commerce, but the United States saw the benefits of open trade enabled by secure trade routes. America has been the single largest economy in the world for nearly a century, and no other nation has derived greater benefit from the US Navy's maintenance of secure oceans. With more than 6.76 billion tons of goods moving by sea each year (90 percent of all interstate trade), a loss of such freedom would adversely affect the national interest in ways that are complex and difficult to calculate accurately.[25]

Freedom of action at sea also ensures that the lines of communication remain open. Currently, undersea cables carry more than seven trillion bytes per second of information across more than 150,000 kilometers of fiber-optic cable.[26] If they were cut, the United States' ability to communicate with the world would be greatly degraded.

Over the next generation, trade will continue to flow across oceans while undersea cables will continue to carry large quantities of data. While the United States' *relative* position in the international system is likely to decline as countries such as China, India, and Brazil grow, maintaining American freedom of action at sea will remain a vital interest. Defending the global commons will not diminish in its importance to the nation.[27]

Freedom of Action—Space. With the advent of new technologies over the last half century, space joined the ranks of America's vital interests. Now, space plays a

prominent role in communications (strategic and commercial), intelligence (imagery and electronic), navigation (commercial and military), and early warning.[28] One recent look at a hypothetical loss of commercial and military access to space from attack paints a plausible picture that demonstrates the United States' susceptibility to such an attack and the devastation it could wreak.[29] Such a loss is unacceptable.

The years and decades ahead will see space-related technology mature and spread, making space accessible to friend and foe alike, while also increasing American reliance on space assets. Absent some unforeseen shift in policy and technological development, the nation will increasingly rely on space in the decades ahead. If space is weaponized, as is frequently suggested, it will play an even greater role in national defense.[30] Thus, space is likely to increase rather than decrease in its importance to the national interest.

Freedom of Action—Cyber. In its opening paragraph, the *Cyberspace Policy Review* (2009) notes that "the globally interconnected digital information and communications infrastructure known as 'cyberspace' underpins almost every facet of modern society and provides critical support for the US economy, civil infrastructure, public safety, and national security."[31] As recently as a decade ago, suggesting that cyber security was a vital interest would have drawn harsh criticism. Technological development, however, has deepened the nation's reliance on cyberspace over that time. Currently, every economic sector and government agency is dependent on cyberspace for the transmission of data.[32] Disrupting that flow would have serious consequences for the United States.

As technology advances in the coming years, cyber dependence will grow. Thus, maintaining freedom of action in cyberspace is a vital interest that is likely to grow in importance. Should an adversary succeed in making data untrustworthy, for example, the fiscal and security consequences could prove far more costly than expected.

Nuclear Deterrence. Nuclear weapons remain the nation's most powerful guarantor of national security. The capability they provide also offers the single greatest incentive to avoid and mitigate conflict. Ensuring the credibility of extended deterrence is also a core component of the nation's deterrence strategy. Absent a nuclear arsenal that assures America's allies of the security they require, the United States will see nuclear proliferation from friend and foe alike. Thus, America's nonproliferation goals are aided by a strong nuclear arsenal.

While the probability of nuclear conflict is low, it may increase in the future as the United States significantly reduces its defense budget to offset growing debt and entitlement spending. Additionally, if projections are correct and the number of nuclear powers increases, the American nuclear arsenal may grow in importance rather than continue its current decline. Maintaining the most advanced nuclear deterrent in the world is an important aspect of preparing for such an eventuality.[33]

Freedom of Action—Skies. Maintaining access to the air commons is a vital interest because of its commercial and military utility. In 2008 American air carriers averaged 7.9 million passengers per month aboard international flights, making air travel the primary mode of international transportation.[34] Without continued

access to the air commons, commerce, diplomacy, and the legitimate movement of people would suffer greatly. Although it is true that most international trade is transported by sea (6.76 billion metric tons annually), US air carriers alone transported 18.1 million tons of cargo in 2008. This makes air transport the second most important mode of cargo delivery.[35] More important, however, is the human capital (people) that is transported via air. Strategic power projection through the air domain also plays a role in the success of the American military that cannot be replicated. Thus, a loss of air access would, without question, threaten the vital interests of the United States.

There is little reason to believe that the United States will become less reliant on the air domain over the next two decades. All indicators point to a growth in international air travel, trade, and the military's need for rapid power projection.

Regional Stability. Among the nation's vital interests, regional stability is the most amorphous and difficult to describe. Needless to say, the United States benefits greatly from stability in the international system.[36] In the aftermath of the Soviet Union's collapse, the United States became the "world's policeman," serving as the guarantor of global stability.[37] Promotion of regional stability ensures that vital interests such as commerce, energy security, and nuclear deterrence remain secure. Few would question the importance of stability, although many would disagree on how best to achieve it.[38] Instability has the potential to threaten American interests, but not every event calls for American intervention.

How long the nation can effectively promote stability is yet to be determined. Wisely choosing when and when not to intervene will continue to be among the president's most difficult tasks.[39] Predicting future instability will continue to prove difficult, but it is an effort worth undertaking.

Major Interests

Differentiating between vital and major interests is a difficult task. Here, interests do not rise to a level of significance requiring the use of large-scale military force. Diplomacy, sanctions, and the limited use of force are the primary means of protecting major interests. As with vital interests, decision makers are required to compare the value of a given interest against the cost of protecting it—often in the face of incomplete information and conflicting opinion.

Counterproliferation/Nonproliferation of Weapons of Mass Destruction. The potential spread of chemical, biological, radiological, or nuclear weapons to non-state actors and rogue regimes is a concern of the United States. With dual-use materials widespread and the consequences of an attack with weapons of mass destruction (WMD) against the United States understood, countering the spread of technology and material is a priority.[40] While nuclear weapons pose the greatest threat, biological weapons are also of great concern because of potential casualties.[41] To a lesser degree, the proliferation of chemical weapons threatens the United States.[42] There is little doubt that a WMD attack against the United States will lead

to a response with overwhelming force. However, recent experience suggests that counter-/nonproliferation efforts are not considered a vital interest requiring large-scale military action. This could change in the face of an elevated threat to the country.

Should WMDs present an imminent threat to state sovereignty, counter-/nonproliferation may dramatically increase in importance. The potential for such an event exists but is difficult to predict and will likely appear as a "black swan." This leaves the future of counter-/nonproliferation highly uncertain.

Counterterrorism. Terrorism presents a difficult case for the United States. Although the country is in the midst of a decade-long war against violent Islamic fundamentalists, terrorism—a tactic of the weak—became familiar to Americans long before 11 September 2001. The Department of State reports that more than two dozen terror attacks were carried out against the United States, Americans overseas, or American assets between 1961 and 2004. Only one of those cases drew a large-scale military response—Afghanistan.[43] In other instances the United States resorted to limited military strikes—Lebanon (1983), Libya (1986), and Afghanistan/Sudan (1998), for example. Most often, however, where a state sponsor was discovered, diplomacy and economic sanctions were common. When the perpetrator was a nonstate actor, terrorism was viewed as a criminal act—prior to 9/11. Since individual terrorist acts rarely generate large numbers of casualties, their probability of posing an existential threat to the country is low. Additionally, their economic impact is most often limited.

While counterterrorism is likely to remain a major interest over the long term, it is unlikely to become one of the nation's vital interests. As in previous periods of elevated terrorism, the failure of violent Islamic fundamentalists to achieve their objectives is likely to be followed by a lull in terrorism's use. Whether the violent Islamic fundamentalists will remain a threat to the United States in 2030 is unknown, but previous cycles of terrorism suggest it will lose momentum before then.[44]

Promotion of Liberal Economic and Political Systems. Often called "democratization," the promotion of liberal economic and political systems has been among the cultural, economic, and political interests of the United States since the founding of the nation. More recently, a wide acceptance among policy makers of the "democratic peace theory" and empirical evidence that democracies and countries with strong trade relations do not fight one another have fostered a renewed interest in the promotion of democracy, liberal economic regimes, and globalization.[45] Although the means by which the United States furthers its promotion of liberal economic and political systems will likely change in the decades ahead, it will remain a major interest of the nation.[46]

While the post–Cold War period has seen a significant move toward free markets and democratic political systems, there is some reason to believe that "autocratic capitalism" may become more prominent in the decades ahead. With political systems that are less free, these regimes will maintain stronger control over their populations while continuing to promote market-oriented policies. Not all scholars agree, how-

ever.[47] Some believe that democracy and free markets are triumphant. In either case, a major threat to American interests does not appear imminent in the coming years.

Korean Security. When Secretary of State Dean Acheson spoke to the National Press Club on 12 January 1950 and left South Korea out of the US "defense perimeter," the Soviet Union saw an opportunity to challenge the United States.[48] North Korean forces surged south on 25 June 1950, setting the stage for what has become a 60-year occupation of South Korea. Although the Cold War is over and the Soviet Union gone, North Korea and the People's Republic of China (PRC) remain. For some analysts, American interests in Korea remain largely unchanged.[49] In 2008 Secretary of Defense Robert Gates reaffirmed the US commitment to the Republic of Korea (ROK) but under the auspices of a reduced American presence.[50] Current rationale for the continued presence of American forces in Korea is based on the need to deter a rising China and its potential threat to the United States.[51]

History, however, demonstrates that alliances do not last forever. Changing cultural, economic, or political dynamics in the United States and South Korea are likely to force the two nations to reexamine American interests in Korea and the role of American forces on the peninsula. Absent the collapse of North Korea, tightening defense budgets may force a continued American withdrawal from Korea over the next two decades. Chinese-held American debt may also prove a useful lever in dislodging the United States from Korea.

The Japanese Alliance. After almost six decades since the signing of a Japanese-American mutual defense treaty (1952), the two states remain staunch allies. Japan's post–World War II pacifism and a strong US presence have allowed the Japanese to focus on economic development while the United States provided a credible security guarantee. The Soviet Union's collapse allowed for a significant drawdown in the number of American forces stationed in Japan. Recent developments in Japanese-American relations clearly suggest that Japan and the United States remain committed to the joint provision of security for Japan, even as the United States continues to realign its forces.[52]

The victory of Japan's Democratic Party, which has long promised to push for a smaller US presence, may serve as a catalyst for an eventual reshaping of the US-Japan security alliance.[53] While Japan is unlikely to rely on the United States for its security indefinitely, three variables may prevent it from taking an independent course. First, Japan's national debt exceeds the gross domestic product (GDP) by 200 percent, making large defense expenditures unlikely. Second, its elderly population will reach 40 percent of the total population by midcentury and demand an ever-increasing share of the national budget.[54] Third, US security guarantees are—by comparison—inexpensive, making continued cooperation attractive.

However, the degree to which the United States remains committed to Japan may also be negatively affected by its own domestic economic woes. A rapidly growing national debt and expected entitlement spending will also affect the United States. President Obama's commitment to a nuclear-free world is also giving the Japanese

cause for concern, as they see a reduced commitment to extended deterrence as a threat to their security and a rationale for developing an independent nuclear arsenal.[55]

North Atlantic Treaty Organization. A generation since the Soviet Union's collapse, NATO no longer faces a recognizable threat. Thus, all post–Cold War American presidents have reduced the US presence in Europe from its Cold War high of 325,000 troops.[56] The Department of Defense's Integrated Global Presence and Basing Strategy (2004) called for the reduction of US troops in Europe from approximately 105,000 to 65,000.[57] Without a clear threat, the interests of NATO members have diverged, making relations acrimonious at times.

Over the past two decades Asia surpassed Europe as the United States' principal trading partner.[58] Trade with Asia is expected to grow, while trade with Europe may stagnate, calling into further question the value to the United States of subsidizing European security. In failing to spend the minimum 2 percent of the GDP on defense, many NATO members are signaling the value they place on defense, which the United States is not in a position to subsidize.[59] Thus, the importance of NATO to the United States is likely to decline between the present and 2030.

Peripheral Interests

Determining peripheral interests is a volatile endeavor and likely to draw the greatest disagreement among policy makers. With the lowest hurdle to clear, individuals, groups, and organizations regularly appeal to the public and policy makers on behalf of a concern that has only limited impact on the economic or physical security of the United States. In most instances, peripheral interests are of cultural and moral significance. Thus, their violation generates a limited response from decision makers, which rarely includes the use of military force. They can, however, rapidly increase in importance as circumstances dictate. Although there are many peripheral interests, two are of particular importance.

Taiwanese Autonomy. Relations between the Republic of China (ROC) and the United States are governed by the Taiwan Relations Act (1979), which expresses support for Taiwan but does not require the United States to come to its defense if the island is attacked—presumably by the PRC. It does, however, suggest that the United States will assist the ROC in defending itself. Since the Kuomintang was forced from the mainland in 1949, the United States has been an ally, trading partner, and supplier of arms and technology to Taiwan. The US Navy has also patrolled the Taiwan Strait during times of elevated tension between the PRC and Taiwan.

With the United States serving as Taiwan's third-largest trading partner (behind China and Japan), strong economic ties remain. However, it is unlikely that an American president would wage war or take significant action against the PRC to prevent the reunification of China by force.[60] Economic ties between the United States and the PRC are far greater than those with Taiwan. Thus, future American/Taiwanese relations are likely to consist of public statements of support for an

autonomous Taiwan, sales of advanced weapons systems to Taiwan, and strong trade relations.

International Drug Trade. When Pres. Richard Nixon launched the "War on Drugs" in 1969, reducing illegal drug use was of limited importance to American foreign policy. Initially, Operation Intercept (1969) attempted to stop the illegal importation of marijuana from Mexico but was largely a domestic program.[61] As drugs continued to flow into the United States, and as the drug cartels of Colombia and Mexico began to threaten the stability of both states, the international drug trade became more than a domestic criminal issue.

Plan Colombia (1998–99) attempted to aid Pres. Andrés Pastrana in defeating the Revolutionary Armed Forces of Colombia (FARC) and other *narcotraficantes*.[62] More recently, Pres. George W. Bush launched the Mérida Initiative on 30 June 2008 with Mexico and several Central American states as a means of cracking down on drug trafficking and assisting Mexico with its chaotic and dangerous border states.[63] As recent drug-related violence has spilled into the United States from Mexico, the international drug trade has taken on elevated relevance.[64] Some analysts are concerned that drug cartels are powerful enough to pose a serious threat to the Mexican government.[65]

If the governments of Mexico and Colombia are unable to control the violence and crime in their nations, proximity to the United States may require a more active American response. Should Mexico, for example, continue to experience rampant violence and a further degradation in domestic security, the international drug trade may move ahead of other interests in importance to the United States.

Summary of National Interests

The description of American vital, major, and peripheral interests provided above will certainly generate criticism because there is no universally accepted set of national interests. Although the US *National Security Strategy* (the latest revision of which was released in May 2010) purports to describe the national interest, it is more accurately described as a partisan political document designed to describe the sitting president's foreign policy agenda. In attempting to give definition and form to the national interest—rank-ordering specific interests—the authors seek to briefly describe the nation's enduring interests and explain why they persist. Absent such a discussion, it is difficult to see where potential threats to American interests may originate. Only then can the Air Force develop a strategy designed to defend the nation's interests. In keeping with this approach, the study now turns to a discussion of the future security environment.

Exogenous Shocks in the Geostrategic Environment, 2010–30

Any attempt to describe the geostrategic environment over the next 20 years is prone to inaccuracy. Events have a way of shaping the international system at unexpected times in unforeseen ways. When one attempts to plan for a future in which the Air Force must operate, the proverbial black swan can lay waste even the best of plans. Thus, developing a strategic mind-set capable of rapidly adapting to unpredictable change may prove more useful than efforts to describe the future. With this in mind, the following discussion is offered.

In 1977 biologists Stephen Jay Gould and Niles Eldredge challenged the dominant theory of evolution, which suggests that biological evolution occurs gradually over long periods of time. Instead, they theorized that a biological system existed in a state of equilibrium until punctuated by a dramatic event.[66] An evolutionary leap occurs and is followed by a return to equilibrium—awaiting the next punctuation. Gould and Eldredge present a description of biological evolution that aptly describes change in the international system. Rather than occurring slowly over long periods of time, the geostrategic environment often changes rapidly due to unpredictable events of high impact.

For macroeconomists, "exogenous shocks" are analogous to the unforeseen punctuated equilibrium that Gould and Eldredge describe. The International Monetary Fund (IMF) describes them as "event[s] that [have] a significant negative impact on the economy and that [are] beyond the control of the government. That could include commodity price changes (including oil and food), natural disasters, and conflicts and crises in neighboring countries that disrupt trade."[67] Exogenous shocks encompass events ranging from a failed crop to world war. They are economic, military, natural, and political.

Political scientists also speak of dramatic and unexpected events playing a role in altering the structure of the international system.[68] As one scholar suggests, "Great power rivalries are more likely to terminate in periods of great system change and deconcentration and less likely to terminate when capabilities are concentrated in the hands of a system leader."[69] The "great systemic change" mentioned punctuates equilibrium in the form of an exogenous shock, forcing actors in the international system to adapt quickly to a changing geostrategic environment.

If the IMF definition of an exogenous shock is expanded to allow for positive shocks that are unpredictable and influential, the concept provides greater explanatory power. For example, technological breakthroughs can shape the international system in an unexpected and positive way. Also, including the effect of diplomatic, military, and political variables—as opposed to economic alone—allows for a broader understanding of the consequences brought about by dramatic and unpredictable events.

Efforts to minimize the negative impacts of exogenous shocks are widespread. The World Bank and IMF prevent and mitigate economic shocks by acting as lenders of last resort and economic development advisors. Treaties serve to stabilize

interstate relations. Militaries attempt to deter and mitigate the effects of conflict. But as the global economic recession and the war in Afghanistan illustrate, exogenous shocks are difficult to predict or prevent.

As one looks at the geostrategic environment in which the Air Force must operate over the coming decades, it may be useful to develop an understanding of exogenous shocks that may impact the United States' vital interests. This has the potential to offer a better understanding of the events that may shape future USAF requirements.

Commercial or Economic Interests

The "Great Recession" highlights the potential for two economic exogenous shocks to dramatically reduce the United States' ability to sustain its defense budget at 4 percent of the GDP ($14 trillion in 2010). First, the dollar may cease to serve as the preferred reserve currency and the currency of financial transactions.[70] Credible reports suggest that a rapidly expanding national debt is leading a significant number of nations to question the stability of the US economy over the long term and the wisdom of holding the dollar in reserve. States such as China and Japan, as well as Gulf Cooperation Council members, are reportedly planning a long-term strategy to replace the dollar for conducting economic transactions.[71] With the Federal Reserve operating a system based on fiat currency, the lack of specie to stabilize the dollar makes it highly susceptible to manipulation. Thus, a "de-dollarization" could lead to a plummeting in value and a sinking of the American economy.

The Great Recession—principally caused by inflation of the money supply—is viewed by much of the world as a long-term threat to American economic growth. Economic instability in the United States also presents an opportunity for rising powers to alter an international system dominated by a potential adversary. According to Frank Ahrens, "large emerging economies—such as China, Russia, Brazil and India—are tired of kow-towing to the American buck, and sense an opportunity to knock a weakened dollar off its imperial perch."[72] Replacing the dollar with a basket of currencies—as some states desire—would negatively impact the US economy in ways that are not fully understood.

A dollar shock would severely impact the Air Force. Rising fuel costs, increasing basing costs outside the continental United States, and costlier imported goods and services would consume a much greater percentage of the service's budget.[73] De-dollarization could also lead to cuts in defense spending as Congress is forced to choose between entitlement and defense spending.[74] If historical trends hold, Congress will fund transfer payments before defense spending—absent a clear threat.

Second, as the economies of China, Brazil, India, and other rising powers grow, American influence around the world will decline and could collapse when least expected. The United States may soon find itself increasingly at odds with longtime allies as China, for example, becomes the most influential trade partner. Just as the United States has used its economic ties to pursue political and military objectives,

so are rising powers likely to do the same. Research suggests that states with strong trade relations rarely go to war.[75] However, states with competing economic interests are shown to use available influence and resources to the detriment of rivals. How rapidly a challenge may develop is uncertain.

In contrast to the expectations of scholars who predict a gradual and peaceful American decline, some evidence suggests that the period in which a declining power and a rising power are relatively equal is prone to conflict.[76] Thus, the United States may find itself in a conflict it neither desires nor expects as a rising power (e.g., China) attempts to replace the American influence in Asia and elsewhere. If China's growth continues, a conflict is possible sometime in the future.[77] American victory in such a conflict is far from certain.[78] Long-range economic analysis does not suggest that the American economy can support the spending measures required to meet Air Force capability requirements. While testifying before the House Budget Committee, Prof. Kent Smetters said, "For 2005, the federal government currently faces a present value imbalance equal to about $65 trillion, of which Medicare alone contributes $63 trillion. The new prescription drug benefit alone costs about $17 trillion. This $65 trillion imbalance is about $20 trillion more than the value of all U.S. corporations, homes, and land in the United States." Since Smetters's testimony, the bursting of a $1 trillion asset bubble brought on a deep recession. Passage of the 2010 health care entitlement bill will likely cost at least $669 billion in new taxes over the first 10 years.[79] Between now and 2030, it is conceivable that the American economy will collapse under the weight of unprecedented debt, ever-expanding entitlement programs, and a skewed tax system that is heavily reliant on the wealthiest 3 to 5 percent of Americans.[80]

Many commentators argue that China is unlikely to engage in economic warfare against the United States because its economic interests would be harmed. This belies a fundamental misunderstanding of China's desire to reassert itself in Asia and the broader world. It also ignores China's growing influence as it seeks to meet expanding demand from its citizenry. While China may not have an inherent desire to wage a military conflict against the United States, the Chinese leadership may view the long-term benefits of sacrificing currency reserves as well worth the risk.[81] Thus, to suggest that China will not actively seek to devalue the dollar and change the composition of global reserves may prove to be a costly exogenous shock.

Secure Energy Supply

Iran's pursuit of nuclear weapons is a destabilizing influence in the Middle East and has the potential to threaten the oil flows through the Strait of Hormuz. Should Iran develop nuclear weapons this decade, a regional arms race is inevitable. In the short term, instability would leave the region unpredictable and highly susceptible to sudden oil shocks. With Iran's recent firing of short-range ballistic missiles, the Iranian Revolutionary Guard Corps (IRGC) is capable of closing the Strait of Hormuz with mines and a credible missile threat to commercial shipping. More than 20 percent of

global petroleum production is shipped through this area, providing Iran a strong point of leverage that it can use as a bargaining chip. By threatening to close the strait from behind a nuclear shield, Iran will be able to shock global oil prices from relative safety. As the single largest consumer of petroleum products in the US government, the Air Force is particularly vulnerable to fluctuations in petroleum prices.

A related issue arises. To minimize nuclear proliferation, the United States may expand extended deterrence to the Gulf States and the broader Middle East. This will draw it deeper into a region from which it is trying to extricate much of its military. Allies that pursue a nuclear weapons program may face economic sanctions, a suspension of arms transfers, or other consequences. Such action would also cause a spike in the price of petroleum, strongly influenced by stability in the Middle East.

No known technologies capable of providing equivalent alternatives to the internal combustion engine for all applications are readily available. Solar, wind, geothermal, and other renewable energy programs are proving expensive and unreliable. While "renewables" or the development of other domestic energy-producing technologies may prove to be a cost-effective and reliable source of energy late in the twenty-first century, they are unlikely to provide an alternative to JP-5 by 2030. Such a development would be a positive shock which could free the USAF from its dependence on hydrocarbon-based fuels.

Freedom of Action—Seas

Sea access is the area where the United States is least likely to experience a major exogenous shock. Josef Joffe, in a recent *Foreign Affairs* article, points out that the tonnage commanded by the US Navy exceeds the next 17 navies combined.[82] Brazil, Russia, India, and China are all expanding their blue-water navies, but they are unlikely to challenge the United States in size or capability before midcentury.[83] Absent the development of a black swan, commercial shipping is unlikely to face a serious threat over the coming decades. The US Navy will continue to be an effective deterrent until 2030.

China, Russia, and Iran are, however, developing sophisticated antiaccess/area denial (A2/AD) capabilities such as China's Dong Feng 21D antiship missiles, capable of penetrating carrier group defenses from a range of 1,000–2,000 nautical miles.[84] A2/AD systems are principally designed to increase the range from which the United States must operate, should a conflict with China, for example, become likely. Some evidence suggests that the lines of communication and commerce are under increased threat, given the improved capabilities of Chinese submarines—the Song class, for example.

Freedom of Action—Space

The United States' access to space is the nation's most susceptible vital interest. China's 2006 lasing of an American spy satellite and 2007 shootdown of its own weather satellite highlight the increasing ability of potential adversaries to hold

space assets at risk.[85] Advances in electromagnetic pulse (EMP), ballistic missiles, directed energy, and cyber technology pose a considerable risk to a largely unprotected constellation of satellites. Some experts suggest it is possible to disable commercial and military satellites through a nuclear detonation without ionizing the Van Allen belt. One scenario suggests that the United States may face a "space Pearl Harbor" without readily knowing the attack's point of origination.[86] A perpetrator can deliver such an attack in various ways and can be difficult to trace.

Attacking the constellation of Global Positioning System (GPS) satellites would cause a negative shock to the economy, military, and many other aspects of daily life. Not only are they used to determine the exact location of a driver, hunter, hiker, or soldier, but also the nation's computer networks are dependent on the timing signal they transmit. Loss of that signal would deal a crippling blow to power generation systems, automated teller machines (ATM), commercial aircraft, and virtually every computerized system.[87] The consequences of such a loss are equally grave for the military, with virtually every military system reliant on GPS targeting.

Targeting early warning satellites would leave the United States more vulnerable to a nuclear strike. A loss of intelligence satellites would partially blind the United States. If coordinated with additional hostile action, this deficit could cause irreparable harm to the nation's vital interests. Exactly when a threat will present itself is unknown. While Russia's capabilities are the most advanced, other nations (China, India, Brazil, Japan, and European Space Agency members) are developing advanced space programs capable of threatening American assets in the near future.[88]

Freedom of Action—Cyber

In many instances, past and present, threats to the nation's cyber infrastructure are classified. However, analysts have little doubt that the United States is vulnerable to cyber attack. President Obama's *Cyberspace Policy Review* issued dire warnings for commercial and government networks, suggesting that they are largely unprotected and jeopardized by penetration, theft, and destruction.[89] This is true of systems ranging from commercial e-mail to classified military networks.

Publicly disclosed cases of network penetration suggest that the United States is already engaged in a "net war" that will grow as cyber dependence and cyber knowledge increase.[90] In cases ranging from denial-of-service attacks in Estonia and Georgia to the hacking of government computers in the United States, incursions are often led by state-sponsored actors who are well trained, patient, and coordinated.[91] Adversaries penetrate military networks to monitor communications, steal information, plant false information, and, when necessary, disable communications, intelligence, and command and control networks.

An adversary is yet to launch a major disabling attack, but this may be the result of good relationships between the United States and those states with the most advanced cyber capabilities. Should those relations sour, a cyber attack is likely to be the opening volley in a conflict. States such as Iran, China, and Russia are integrating

increasingly advanced network warfare capabilities into military planning. Because the United States and the Air Force are becoming increasingly reliant on the transfer of information through cyberspace, vulnerabilities will exist.

Cyber attacks of the future are likely to be more sophisticated and damaging than the Russian cyber attack against Georgia, for example. There, Russian hackers focused attacks against websites and networks that had been used by the Georgians to inform the world about the Russian invasion. Command and control, telecommunications, and military networks were largely unaffected. Because of its ability to deliver kinetic effects, the American military is likely to be the focus of a combined campaign. As the service with the greatest power-projection capability, the Air Force will be a primary target.

The PRC could launch a major disabling cyber attack against the United States in expectation of achieving a knockout blow that would effectively prevent a timely American intervention in a China/Taiwan conflict. By slowing the American response, China may be able to carry out a fait accompli and retake the island.

Nuclear Deterrence

The US Strategic Command is currently attempting to recast nuclear deterrence as a concept applicable to nonstate actors, rogue regimes, and nuclear weapons states. This recasting will likely include dissuasion and denial along with threat-based deterrence policies, thus expanding the range of tools available to the United States. No longer is nuclear deterrence solely focused on a single adversary. While this makes deterrence more relevant to the current strategic environment, it is nuclear-armed adversaries with sufficient numbers of weapons—not terrorists or insurgents—who pose an existential threat to the United States.

Between 2010 and 2030, the international system is likely to see an increase in the number of nuclear weapons states.[92] Exactly which states will pursue nuclear weapons is unclear. Absent a major shift in policy, Iran will become the next nuclear weapons state.[93] Brazil and Venezuela have also expressed some interest in nuclear weapons, although the difference between interest and acquisition is substantial.[94] An unstable security environment may lead these and other states to pursue nuclear weapons.

While some scholars suggest a correlation between the number of states with nuclear weapons and the probability of their employment, empirical data does not support this conclusion.[95] This makes it difficult to project the impact of an expanding "nuclear club." Among nuclear weapons states, the relationship between India and Pakistan is the least stable. India's measured response to the Mumbai terrorist attacks demonstrates a significant level of restraint, illustrating the psychological effect of nuclear deterrence.[96] Because exogenous shocks can arise unexpectedly, maintaining a credible nuclear deterrent remains the best way to guarantee national sovereignty.

Freedom of Action—Skies

Air access falls into two categories: civil and military. The former is unlikely to face a serious challenge over the next two decades. Evidence suggesting that a state or nonstate actor has the capability or desire to disrupt the flow of people or goods through the air is conspicuously lacking. Nothing approaching a "line of death," as Muammar al-Gaddafi once proclaimed, is likely to imperil civil aviation.

However, the Air Force will face a serious challenge in gaining access to military targets. China and Russia are developing advanced A2/AD systems that may effectively deny the Air Force and Navy access to targets.[97] Secretary Gates observed that "when considering the military-modernization programs of countries like China, we should be concerned less with their potential to challenge the US symmetrically—fighter-to-fighter or ship-to-ship—and more with their ability to disrupt our freedom of movement and narrow our strategic options."[98] Developing denial capabilities *will* present a serious risk to American air and sea power in East Asia. China is on course to achieve a credible conventional deterrent against the United States.

Regional Stability

Many scenarios represent a threat to regional stability. Because such scenarios often develop rapidly and unexpectedly, the most difficult task is determining the appropriate American response based on the nation's interests. Not every failed state, domestic insurgency, or regional conflict is a threat to the United States' vital interests. While the full range of scenarios is expansive, a small number deserve mention.

Should Iran acquire nuclear weapons, an arms race in the Middle East is likely to follow.[99] Absent a successful Israeli strike against Iran's deep underground nuclear facilities, the Middle East may stabilize rapidly as the United States extends the nuclear umbrella across the region. Contrary to the fears of some analysts, a nuclear Iran is likely to create a regional dynamic similar to Cold War Europe, with Iran effectively playing the role of the former Soviet Union and the United States acting as it did for half a century. However, Iran may feel emboldened to use proxies across the region to accomplish its objectives, just as the USSR once did.[100] Given the significant Shi'a populations in Saudi Arabia, Iraq, and other Middle East states, an attempt to influence the affairs of Sunni-dominated states may have undesirable outcomes that are difficult to predict.[101]

A Chinese invasion of Taiwan is a second scenario that greatly concerns many strategists. While the effects of such an act would harm American economic interests, a cross-strait conflict is becoming less probable because of increasing commercial relations between China and Taiwan. The resultant harm to China's economic development would far outweigh any psychological benefit. Cultural, economic, and other integration is likely to continue, as is the political status quo. Where the greatest instability resides is in the vast disparity of opportunity and wealth on the mainland.[102] Real concern over growing fractionalization in Chinese society may pose the

greatest risk to China's ability to assert itself in the region. George Friedman suggests that China may dissolve as a unified state over the coming decades as strong regional governments focus on local economic interests.[103] If Friedman and others who question a prolonged meteoric rise of China are correct, much of US planning and war gaming may be in vain.

Nigeria is both a major supplier of oil (2,335,000 barrels per day) and rife with sectarian violence, corruption, poverty, and political instability.[104] Strong ties to the United States and Western petroleum companies make a collapse of the Nigerian government a significant concern.[105] An increase in crude oil prices, a large humanitarian disaster, and the destabilizing effect to the region are of great concern. Some voices in the African media do not believe that Nigeria will survive the scheduled 2011 election, underscoring the discord there.[106] A failed state of this size in the midst of sub-Saharan Africa would present a real challenge for an American president and an Air Force called upon to support US operations.

The failure of a nuclear Pakistan, civil war in Venezuela, and a Russian turn to autocracy also provide reason for concern. The effects of any one of these events would present a serious concern for the United States. Predicting any of these potential threats is difficult. Maintaining an unprecedented level of flexibility may be the Air Force's best approach.

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Appendix B

Futures Research Methods

Overview of Scenario Planning

Futures analysts and strategic planners use a variety of techniques to develop the program and budget requests necessary to ensure that their organizations are prepared to meet future challenges. One such technique—scenario planning—is used across industry, government, and the military. Futures analysts develop alternate futures—differing versions of possible future worlds or scenarios—to think about what the future might hold and how to prepare for it. According to Peter Schwartz, a scenario is "a tool for ordering one's perceptions about alternative future environments in which one's decisions might be played out."[1] While it is impossible to predict the future, scenario planning assists strategic thinkers in making systematic decisions today to prepare for a broad range of possible future events.

Using scenarios in defense planning originated with Herman Kahn's work in the 1960s for RAND and the US Air Force in envisioning future technologies and the "unthinkable" results of using nuclear weapons.[2] Corporations such as Royal Dutch/Shell and think tanks such as the Stanford Research Institute (now SRI International) began applying scenario-planning techniques to business and government programs.[3] Over the past 30 years, strategic planners have used scenarios to describe alternative futures in support of new product development, improved customer service, and initiatives to reduce energy consumption and, most notably, to anticipate the fall of the Berlin Wall and be prepared to launch new business opportunities, to name just a few examples.[4] More defense planners began to use scenario planning too, finding that the development of alternative scenarios fit well with the traditional military campaign planning practice of developing multiple courses of action.[5] Sam Tangredi, in his book *Futures of War*, includes a number of scenario-planning exercises in his meta-analysis of 40 futures studies on national security published between 1996 and 2007.[6]

Introduction to Scenario Planning in the USAF

In 1995 and 1996, the USAF chief of staff, Gen Ronald Fogleman, directed Air University to undertake a long-range strategic planning effort "to identify the concepts, capabilities, and technologies the United States will require to remain the dominant air and space force in the 21st century." The result was *Air Force 2025*, a large-scale scenario-planning exercise conducted by almost 300 students and faculty members from Air University and the US Air Force Academy, with feedback and guidance from dozens of subject-matter experts (SME) and retired military leaders from across the United States.[7] The students and faculty developed six plausible future worlds or scenarios posing different challenges to US national security. The

research team developed ideas for future military technologies (25 emerging technologies and 40 systems) and analyzed these ideas in the context of the six alternative future worlds. This analysis yielded 10 capabilities and six high-leverage technologies judged to be the most likely to ensure "continued air and space dominance in the future."[8] *Air Force 2025* "made enormous contributions toward directing Air Force research and procurement."[9]

Initiating Blue Horizons

The next major academic futures study for the USAF was launched in 2006 when Lt Gen Stephen G. Wood, then AF/A8, directed the Center for Strategy and Technology (CSAT) at Air University to initiate Blue Horizons. CSAT faculty and selected students from the Air War College and Air Command and Staff College conducted the first Blue Horizons study (*Blue Horizons 2007*) during the academic year 2006–7. The researchers analyzed emerging technologies and published a report designed to inform various long-range planning efforts, including the Strategic Planning Guidance, Quadrennial Defense Review, and Title X war games.[10] During the next academic year, a research team following similar guidelines produced *Blue Horizons II: Future Capabilities and Technologies for the Air Force in 2030*. The study's purpose was to determine the capabilities and technologies in which the Air Force would need to invest to maintain dominant air, space, and cyberspace capabilities in 2030. The team was expected to make specific recommendations, focusing scarce research dollars on future concept and critical technology areas.[11] To carry out this tasking, the Blue Horizons II research team built and analyzed four alternate future scenarios: a resurgent power, a peer competitor, a failed state, and a jihadist insurgency. With assistance from outside SMEs, the research team then created a roster of technologically feasible future systems the USAF could possess by 2030. Next the Blue Horizons II team developed an operations research model to score the utility of the proposed future systems across the four alternate scenarios.[12] This process allowed the researchers to identify the capabilities most needed by the USAF in the future, regardless of the proposed scenario: "*increased range, greater persistence, better defensive capabilities* for systems in all three domains, *a greater variety of unmanned systems*, *better offensive capabilities in cyberspace*, and the need for a *much faster command and control* set of processes" (emphasis in original).[13] *Blue Horizons II* concluded that the Air Force "must invest in a broad range of enabling technologies" to make these future systems a reality.[14]

Updating Scenarios from *Blue Horizons II*

Faced with the task of identifying critical USAF capabilities for the period 2020–30, an Air Force Research Institute (AFRI) research team reviewed a wide variety of reports and articles on strategic planning, current Department of Defense (DOD) and USAF policy, and futures studies. After studying the available material, the team decided to begin with the four alternative future-world scenarios developed by

CSAT for its *Blue Horizons II* study. The next step required the team to update the existing scenarios with relevant material newly available since the preparation of *Blue Horizons II* two years earlier. Experienced futures analysts have found that the first step in developing or updating a feasible and productive set of scenarios is the practice of environmental scanning.

Environmental Scanning

Environmental scanning, the "central input to futures research," is the practice of searching both the internal and external environments of an organization, looking for threats, opportunities, and early warning signs.[15] A ship captain assigns a lookout to identify as soon as possible any rocks, storms, or shipwrecks on the far horizon. A business executive gathers information on customers, competitors, suppliers, and overall business conditions to prepare forecasts and strategic plans.[16] A futures analyst performs 360-degree scans of the environment to assemble background data and to identify key trends to develop possible alternative views of the future, or scenarios.[17] The analyst selects and categorizes topics for environmental scanning based on the focus of the strategic planning and scenario-development exercises, tailored to the mission and vision of the organization: *What do we need to know today to spot emerging trends and make decisions to ensure a more successful future?*

Environmental scans examine three principal sources of information. The team of analysts must set criteria and assign responsibilities for tracking down relevant information in print media, electronic sources, and discussions with SMEs. Team members perform a standard literature review of both print and electronic media to establish a baseline of knowledge and to determine which publications and other sources should be scanned regularly. This baseline also helps team members set up a spreadsheet or database to track the output of the scanning process in a systematic fashion: category, indicator, source, date, consequences, actors, and so forth. Such templates allow computer-generated reports of the scanning process to be produced for more efficient analysis.[18] The scanning process itself involves three steps: scan, clip, and review. Just as military intelligence officers find clues about activities in hostile countries, so must analysts skim publications and electronic sources for relevant articles without reading every item.[19] After identifying the articles to be clipped or saved, the analyst must then review them to capture the most germane bits of information and file them in the proper database fields or categories.

Relevant print and electronic media must be scanned on a regular basis. Increasingly, traditional print media are available electronically, including everything from press releases, journals, books, literature reviews, and electronic newsletters to subscription databases such as ABI/INFORM. Tracking the latest trends electronically includes not only using traditional search engines on the World Wide Web, but also setting Google Alerts to receive updates on desired topics and using Twitter and other social networking sites.

Analysts can use the latest social networking tools to identify and track key SMEs. Subsequently, they clarify the level of involvement necessary with the SMEs. This can range from a one-time casual interview at a conference, to a series of regularly scheduled telephone or video discussions, to the establishment of an expert panel that meets on a regular basis to identify relevant trends.

To be most effective, analysts should perform environmental scanning on a recurring basis, receiving and incorporating feedback on the usefulness of the information gathered and updating projected trends and scenarios. This process creates an environmental scanning system, thus providing an established foundation for scenario development and implementation.[20] The environmental scanning system produces the raw data used to envision and develop the scenarios or scripts of possible alternative futures.

Three Key Trends

The AFRI research team performed an environmental scan, focusing on trends related to economics, technology, and demographics. An extensive literature review indicates that these trends were the most influential on future national security issues. They were considered interrelated and not mutually exclusive.

Using this information, the team updated and rewrote each of the scenarios from *Blue Horizons II*: a resurgent power, a peer competitor, a failed state, and a jihadist insurgency. Appendix D includes descriptions of each of the scenarios.

Economic Concerns and Trends

US Fiscal Stability. For at least a generation, the United States has enjoyed unquestioned economic and military dominance. In fact, the United States currently spends more on defense than the other top 25 military powers combined. However, it will not strengthen its hegemonic position over the next two decades because fiscal difficulties will almost certainly curtail real defense expenditures as potential adversaries become stronger. Since foreign governments and investors will not continue to bankroll massive deficits in perpetuity, the federal government faces difficult fiscal choices over the next generation. These budget choices will dictate whether the nation's unsustainable fiscal path will spiral out of control or whether credibility will be restored. America's continued leadership hangs in the balance.

To risk understatement, the country faces grave fiscal challenges. The International Monetary Fund estimates that an immediate and *permanent* 14 percent tax increase *and* a cut in all transfer payments would be necessary to restore fiscal balance.[21] Congressional Budget Office data suggests that the gap between projected spending and revenue in all future years could exceed $200 trillion.[22] Defense budgets are highly unlikely to escape unscathed because the military is the largest discretionary spending allocation in the federal budget by a wide margin. Although forecasting precise defense budgets 20 years in the future is beyond the scope of

this report, the budget's trajectory depends on numerous factors such as future US economic growth.

The United States relies on foreign capital to make up the considerable difference between its investment needs and domestic savings. Although intuition tells the average consumer that this situation is undesirable, the practical implications of this savings deficit are neither widely known nor easily understood. In a June 2007 congressional hearing, Dr. Robert D. Hormats, undersecretary of state for economic, energy, and agricultural affairs, outlined three scenarios that could describe the eventual outcome of the United States' dependence on foreign capital.[23] Since his testimony occurred before the recession, his concerns have faded in many people's minds but could become even more prescient considering the currently precarious global economic environment. Whether the US economy unravels because of its unhealthy level of reliance on foreign capital will dictate if more than meager economic growth is possible. Even under the most favorable economic scenarios, the defense budget will face increasing pressure. A disorderly resolution of the country's fiscal burden could hamper economic growth for many years and, as a result, threaten defense budgets more than any other environmental factor.

The United States' ability to borrow at low rates is dependent on an excess of global savings. That is, countries that run large trade surpluses are exporting their savings and forgoing domestic consumption. As capital markets develop in China and India, for example, consumers in these countries will devote a greater percentage of their income to domestic consumption and investment. The implications for the United States are quite clear: interest rates will rise, and the debt will become more expensive to service. In this most likely and relatively orderly scenario, the increase in interest rates will be gradual and not catastrophic.

In the second scenario, one or more of the countries holding vast quantities of dollar reserves decide to shift a large portion of their excess capital away from the dollar market. The value of these countries' own reserves would decrease, and the dollar would fall precipitously against their own currency, so there would be strong disincentives for dumping dollar assets. However, it is certainly foreseeable that political considerations could overpower short-term financial interests under certain circumstances. For example, hypothetical US trade sanctions against Russia for failing to follow through on promised Iranian economic sanctions could motivate Russia and Brazil, for instance, to dump dollars. To a greater extent than in the first scenario, this scenario would portend higher US interest rates and a lower dollar. A recession would be likely and become more probable if larger holders of US debt were involved.

The final scenario involves an important exogenous shock such as major terrorist attacks on US soil. For example, Hormats used strikes on critical infrastructure. Although the economic impact of the 11 September attacks was less profound than expected, several potentially aggravating stressors are more pronounced today and could combine to severely disrupt the US economy.[24] First, the US economy is in a much weaker state today than in 2001. Consumer confidence is at a very low level,

and a major terrorist attack could precipitate a snowballing effect. Second, foreign financing of US debt has become a more contentious issue. In fact, the ratings agencies have repeatedly signaled that the United States' AAA bond rating is no longer sacrosanct. Such an eventuality would have potentially devastating effects on the cost of financing the debt. In turn, this could increase creditors' fears and initiate a vicious circle. Third, future terrorist attacks could be more effective and targeted to vital infrastructure, which could dramatically increase the damage to the US economy through plummeting domestic consumer and international confidence. In short, a successful burst of terrorist activity could produce a general crisis of confidence that would be magnified by the weakness of the US economy and the perceived recklessness of its government in recent years. If confidence in the US economy or government is lost, economic growth could be jeopardized for an entire generation.

In the following sections, we develop future upper-bound defense budgets. Of course, the United States may not realize these spending levels for a wide variety of reasons, such as an altered political climate or the devastation involved with the more disruptive scenarios described above. The reader should remain mindful that the following analysis depends heavily on the orderly functioning of US debt markets and the avoidance of a major economic crisis.

Projections of Economic Growth. To evaluate both proposed and actual budgets, the Congressional Budget Office (CBO) routinely forecasts economic growth rates. The CBO recently published a statistical comparison of its forecasting record compared to that of other organizations that perform economic forecasting.[25] The CBO's performance in projecting the growth rate of the real gross domestic product (GDP) has been roughly comparable to the results of other major forecasters.[26] The CBO's forecasts are used in this study.

The CBO estimates that the United States will experience an average growth rate in real GDP of 2.36 percent between 2010 and 2030.[27] Although this growth rate is significantly lower than the 3.26 percent average growth rate the United States enjoyed between 1982 and 2007, economic theory and empirical results provide support for more sluggish growth in the coming decades.[28] Increasing real GDP means the US government will be able to increase real spending without increasing the share of GDP devoted to government expenditure. However, rapidly rising non-discretionary expenditures will completely offset this effect.

Growing Pressure on Discretionary Spending. The CBO has also recast government budgets for the next 75 years.[29] However, it presents two separate projections based on slightly different assumptions: the extended-baseline scenario and the alternative fiscal scenario. The first scenario follows current law and extends baseline assumptions for the entire projection period. The second scenario incorporates policy changes that Congress has made in the past and that lawmakers are widely expected to adopt in the future. The extended-baseline projection will be used as the maximum, while the alternative fiscal scenario estimate will serve as the midpoint

upper bound for this analysis. Since the alternative fiscal scenario avoids historically unusual political outcomes, it should be considered the more practical upper bound.

Although the CBO expects total US government expenditures to grow by 6.5 percent of GDP by 2035, discretionary spending as a percentage of GDP seems likely to fall during the same period. Under the alternative fiscal scenario, discretionary spending is expected to drop from 16 percent of GDP in 2009 to 10.4 percent of GDP in 2030. If we assume that defense spending remains a constant percentage of discretionary spending, real defense spending will grow at an average annual rate of less than 0.5 percent over the entire period of this study. Therefore, zero real growth in defense spending can be considered an upper bound for defense spending in 2025. Meanwhile, the extended-baseline scenario anticipates a 1.7 percent average yearly increase in defense spending and must be envisioned as the best-case scenario or the maximum upper-bound case.

China's Defense Budget in 2025. A glance at the estimated defense budgets of the world's leading military powers quickly reveals that China is the only nation with any prospects of becoming competitive with US military spending by 2030. A comparison of the two countries' maximum projected defense expenditures in 2025 should inform US strategic decisions over the coming decades. For the purposes of bounding future Chinese defense expenditures, the methodology devised by RAND researchers in a 2005 study will be adapted with 2009 data.[30] Two major caveats differentiate the methodology used in projecting Chinese expenditures from the US methodology outlined above. First, estimated Chinese economic growth rates were lowered from current officially reported growth rates to reflect the likelihood that growth is overstated and the near certainty that growth will inevitably slow. Second, Chinese defense spending was valued consistently with a renminbi exchange rate somewhere between the current market rate and purchasing power parity. The resulting upper bounds for both countries in 2025 are presented in table 1.

Table 1. Upper-bound defense expenditures for China and the United States in 2025 (in billions of 2009 dollars)

Scenario	United States	China
Maximum	688	595
Midpoint	534	274

Adapted from Congressional Budget Office, *The Long-Term Budget Outlook* (Washington, DC: CBO, 2009); Keith Crane et al., *Modernizing China's Military Opportunities and Constraints* (Santa Monica, CA: RAND, 2005); and author's calculations.

Implications. The DOD faces stagnant or slowly increasing real budgets over the next 20 years. However, US defense spending is almost certain to be the world's highest in 2025, so the tightening of budgets should be kept in proper perspective. The possibility that an economic catastrophe could strike the United States over the next 20 years should not be dismissed, and military leaders must be prepared to deal with the much leaner budgets that could result. Meanwhile, the CBO estimates that

real defense costs will exceed planned baseline projections by about $59 billion annually over the next 20 years.[31] Although this study's primary focus is on accomplishing the future USAF's missions, military leaders must be constantly cognizant of increasing pressure on budgets and the risk of a macroeconomic shock that could significantly curtail defense spending for a generation or more. Therefore, decision makers should aggressively seek avenues for savings while maintaining military capabilities.

Technological Concerns and Trends

While there are many emergent technologies, a few will have a significant impact on the military, commercial, and domestic sectors. How these technologies will impact each sector is unclear, especially as the time horizon extends further into the future, but over the next 20 years technological trends will begin to converge as the synergies from various technological advances spur development in other areas. Six trends are of greatest relevance: growth in miniaturization, proliferation in nanotechnology, improvement in computer processing, dependence on cyberspace, increases in speed, and evolution in autonomous systems.

Growth in Miniaturization. The growth in component miniaturization has aided the rise of technology. Miniaturization of components makes them weigh less, decreases their inefficiencies, and reduces the heat generated by the system, thus allowing more components to fit into a smaller space without a loss of functionality. Continuing miniaturization has also allowed greater speed in electronics and enormous processing and storage capabilities, while lowering the production and procurement costs. Miniaturization stretches across every domain—air, space, cyberspace, land, and sea—enabling more efficiencies, less energy loss, and greater power projection at a lower cost. Miniaturization applies to systems, platforms, components, and even the molecular level.[32]

Proliferation in Nanotechnology. Some of this miniaturization is enabled by nanotechnologies, which involve materials, devices, and structures that are less than one billionth of a meter in scale.[33] Placed in a more easily grasped context, human hair is 100,000 nanometers wide.[34] Nanotechnology has the potential to alter materials and manufacturing processes to enable further scientific breakthroughs. Potential outcomes include smaller, more powerful batteries; faster computer chips; smaller, lighter, and more powerful magnets and electric motors; more efficient binary switching; improved data storage; much more powerful body armor; higher performing sensors; more secure communications; advanced robotics; remotely guided, autonomous, and miniaturized weapons systems; and improved methods of absorbing medicines into the body.[35] Nanostrand technology, essentially nanofibers woven together, produces a variety of products which are significantly more conductive, more corrosion resistant, and lighter than products used currently. They are also less susceptible to microwave or other energy bursts, making them suitable for high-tech electronics.[36] Nanostrands are used to create high-performance,

electrically conductive adhesives, paints, resins, coatings, gaskets, and the like. Because of the combination of the unique geometry of nanostrands and the electromagnetic and physical properties, higher levels of performance are possible than with older technologies.

Improvement in Computer Processing. With miniaturization comes an increase in processing capabilities, speed, and storage. Studies estimate that computers will be over 1,000 times more powerful in 2015 and 1 million times by 2025 with the advent of quantum computer technology, which uses spinning electrons rather than silicon-based chips. Humans have benefited and will continue to benefit from this increased processing capability. It is estimated that human knowledge capabilities will also grow as the availability of data increases. As the data grows, so will the need to sort through all the data generated to make sense of it. Unfortunately, the number of decisions that must be made in a timely fashion is outpacing the capability of humans and is likely to increase significantly in the future.[37] By 2030, with their enhanced processing and storage capabilities, computers will outprocess the human brain to the point of becoming "thinking systems" capable of making reasoned decisions.

Dependence on Cyberspace. With the proliferation of technology and information, our dependence on technology is also growing, which is especially evident in the nation's dependence on cyberspace.[38] As these other trends continue, the need for greater cyber capabilities expands. From the mundane to the complex, from cell phone calls and bank transactions to placing ordnance on a target or launching a satellite, cyber technology plays a major role. Much of the growth in cyber technology is driven by the private, commercial sector to enhance profits, but it applies to the military sector as well. What the security needs are or will be in the future, no one is quite sure; we know only that cyberspace is a vulnerable and exploitable domain, especially with foreign firms controlling many systems, parts, and manufacturing. Whether a commercial venture or wartime operation, cyberspace information and systems need greater resiliency and an ability to detect tampering. In a similar manner, space assets are vulnerable, and since much of the data transferred through cyber systems transits space, nations can ill afford either a denied space or cyber environment. The nation needs options to operate without its cyber and communications networks and without access to space assets to mitigate its technological Achilles' heel.

Increases in Speed. Speed comes in many varieties—computer processing speed, for example. Improvements in two speed-related technologies will have a high impact over the next 20 years: directed energy (DE) and high-speed propulsion. DE applications at the speed of light will become more prevalent by 2030 and may be a game-changing technology.[39] With a tenfold increase in capability over the last year, DE applications will be part of the future communications systems and weapons arsenal.[40] Although DE has many military offensive uses, the ability to track and destroy in-flight missiles and other weapons with DE makes it ideal for defensive systems.[41] DE technologies, enabled by miniaturization and processing capabilities and

integrated on platforms or ground-based systems, will offer significant capability upgrades to today's weapons.[42] In a similar manner, high-speed propulsion such as ramjet-derived propulsion—supersonic air-to-air missiles as well as surface-to-air and cruise capabilities—may assist in meeting requirements for rapid transportation, space, and long-range military strike capabilities.

Evolution of Autonomous Systems. Another trend taking shape is a shift toward more autonomy in the commercial and military sectors. These sectors will benefit from the growth in autonomous systems, which will be used as a force multiplier to mitigate manpower shortages and to reduce risk to humans. Spurred in part by advances in miniaturization and nanotechnologies, increases in computer processing capacity and storage capability, and development of recognition software and reasoning algorithms, these autonomous systems allow decisions to be made by the machine. Autonomous capabilities will spread throughout industry and military circles with such applications as sensing/thinking components, robots, and military systems.

Common tools such as antivirus and malware-detecting software and applications that require more complex decisions reflect the reality that machines are pressing ever nearer to thinking. These autonomous systems are impacting the time domain via their ability to make decisions rapidly. With greater autonomy and enhanced decision-making speed comes advanced man-machine (or machine-man) interface. Improved man-machine interface, whether through nanotechnology software embedded in the human or in the machine, will enhance the ability to observe, orient, decide, and act in response to inputs. Further, once stronger verification and validation tools are in place, the use of autonomous systems and components is likely to grow. One military future-looking study noted that nine of the top 10 conceptual platforms identified in the report operate at Mach 1 or greater and that five of the top 10 concepts involve unmanned or potentially unmanned systems.[43] These autonomous systems, employing varied onboard technologies or combinations of technologies, will be adaptable, flexible, unmanned, and collaborative.[44] By 2030 airpower projection may be more about the weapon and the sensors on the platform than the platform itself.

These six technological trends will have significant impact on the military, commercial, and domestic sectors over the next 20 years. Each trend impacts the others. While the anticipated outcomes of these trends are uncertain, their convergence may well yield unanticipated second- or third-order effects.

Demographic Concerns and Trends

Developing countries are growing by over 80 million people each year, and by the mid 2020s, the global population is projected to total over 8 billion. In contrast, the developed world faces aging populations and declining or static birth rates.[45] From an international and domestic perspective, these trends will affect the national security of the United States.

International Trends. Developing nations across the globe whose populations continue to grow at a rapid rate pose significant challenges. By 2025 there will be 29 cities in the developing world with populations greater than 10 million.[46] The population explosion in poverty-stricken regions of sub-Saharan Africa and other developing areas promises keen competition for limited resources in the struggle to raise the standard of living. Large numbers of chronically unemployed and under-employed youth provide fertile ground for the growth of radical movements, terrorist organizations, and violence.[47] Alternatively, drafting the youth into military service could provide them employment and social cohesion, although creating larger standing armies might facilitate an increase of state-sponsored violence. Furthermore, increasing urbanization means that more conflicts could take place in an urban environment, necessitating changes in tactics, training, and rules of engagement for US forces likely to oppose radical movements.[48]

By 2030 developed nations will face a severe aging problem as the number of elderly people in those countries doubles.[49] While the proportion of the tax-paying, working-age population shrinks, retirees are living longer and consuming more health-care benefits.[50] Facing budget constraints and manpower shortages, the governments of many European countries and Japan will struggle to choose between "guns and wheelchairs." The military forces of these developed countries are likely to substitute capital for labor, emphasizing extensive training, high-tech weapons, and professional militaries.[51] Probable impacts of stagnant population growth include a slowing global economy and the expectation that the United States will assume a larger share of any activity requiring military resources.[52] Other likely outcomes include smaller standing armies and an emphasis on multinational military procurement and cooperation.[53]

China, as a result of its strict one-child policy, will experience an aging population as well as an imbalance of males and females. How an excess proportion of young men will influence China's behavior is difficult to anticipate, given the lack of historical precedents.[54]

Other possible demographic impacts on the international scene include widespread migrations or ethnic diasporas, as well as conflict over resources such as water.[55] These impacts will place the United States at greater risk from infectious diseases and increased violence.[56]

Domestic Trends. Given the international situation described above, in the future it is likely the United States will provide a larger proportion of humanitarian and military assistance in crisis situations.[57] While the United States will not suffer the same population deficits as Europe and Japan because of immigration, increased pension and health-care expenses will squeeze its defense spending. Total spending on Social Security and Medicare is projected to increase from 8.4 percent of the GDP in 2010 to 12.5 percent in 2030.[58] Slower economic growth in the developed world because of shrinking populations will threaten US export markets and revenues, thus reducing tax receipts available to support military expenditures.

The success of current US recruiting practices for military service remains in question for the period 2020–30. The size of the 16–21 age group (the cohort most likely to enlist in military service) has grown since 1996. Numbering 38.6 million in July 2009, it is projected to reach 40 million in 2020, with Hispanic youth representing the largest increase.[59] Current combined enlistment requirements for all active and reserve service components number about 300,000 recruits annually. Forty million thus appears to be an adequate recruitment pool. However, approximately 51 percent of youth now in the 16–21 age cohort are estimated to be ineligible for military service for a variety of reasons. The pool of possible recruits is further reduced by young people's increasing tendency to enroll in postsecondary education, the military leadership's desire to recruit only those who score in the top half of the military aptitude tests, and the declining veteran population—generally a positive tool for recruitment.[60] In the future, the US armed services will struggle to recruit and retain the best of the youth cohort, and the value of each service member will increase as long as youth cohorts remain limited.[61] The United States will probably have fewer standing military forces, require more personal protective gear for them, and be less likely to risk them in direct combat.

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Appendix C

2030 Scenarios

Scenario 1

Resurgent Power: 2030

At the dawn of the fourth decade of the new millennium, Russia is the preeminent regional power in Eastern Europe and holds sway over most of the former Soviet Union republics once again. This dominant role manifests itself in Russia's revitalized military, its focus on dominating the "near abroad," and its economic strength in raw materials.

Earlier, the reality of an uneven birthrate, poor medical care, and a declining male life expectancy forced Russian leaders to turn to technology to replace the enormous military manpower advantage it enjoyed during the Cold War, with impressive results. Using its huge oil and gas export profits, Russia bought technology and equipment for its military, trading size for technical efficiency.

Eschewing its global ambitions for the time being, Russia has used its near-abroad strategy to return many of the autonomous republics—save Ukraine—to the Russian sphere of influence and forced some to abandon NATO membership aspirations. These republics now form a buffer against NATO—and by extension, the United States—much as the old Warsaw Pact nations did during the Cold War.

The rest of Europe continues to be dependent on oil and gas imports from Russia, as it has for most of the century, which has given Russian politicians a strong political card to play. Beyond Western Europe, Russia's early and persistent exploitation of its massive oil and gas reserves in the High North has netted it strong commercial partnerships with Norway, Denmark, and Finland, again thwarting US efforts to establish a strong commercial and political presence there.

However, the economic largesse that has powered Russia's successes in the past two decades may be dwindling, and ethnic encroachments along its southern and eastern borders may pose additional problems in sustaining this resurgence into the midcentury. Strictly speaking, Russia has used its vast oil, gas, and timber export revenues to pay for technological advances it cannot replicate internally, forsaking improvements to a transportation infrastructure that is beginning to fail. Existing roads and its extensive network of 1980 vintage pipelines to the West are deteriorating at an accelerating rate, impeding the transfer of raw materials to Western Europe and slowing the resulting cash flow. What is more, overexploitation of its timberlands as well as its oil and gas fields is exhausting Russia's existing supply of natural resources. Only successful exploration/exploitation efforts in the oil and gas fields of the High North can stave off a severe economic slowdown.

Balancing Russia's successful near-abroad policy in the West is the troubling sight of ethnic migrations along Russia's other borders. Steady Muslim immigration along its southern borders in the past several decades changed the ethnic makeup of several southern republics, further reducing available manpower for the Russian army and creating a potentially hostile—or at least sullen—set of neighbors. To the east, Rus-

sian emigration from its Pacific provinces has led to the ever encroaching Chinese immigration across its nearly empty southeast borders. Both encroachments have increased Russia's already high xenophobia and may prompt some preemptive actions in the near future.

Militarily strong and financially sound for the moment, Russia has become a resurgent—albeit mostly regional—power on the world stage of 2030. Nevertheless, the ensuing decade may mark its zenith, followed by a long, slow decline toward century's end, marked by increasing economic woes and cross-border squabbles.

Russia in 2030

Demographics

Russia's demography in 2030 will be heavily influenced by several factors: an uneven birthrate, continuing poor medical care, declining male life expectancy, and immigration along its southern borders. The net result will be a country with an overall population decline of some 11.5 million people from 2010 levels.[1]

Migration of ethnic Russians from the Far East, caused by declining industry in Siberia, will create a vacuum along the Russian-Chinese border that may be filled by Chinese immigration. In the south, increasing Muslim migration will increase ethnic tensions in the coming years.

The birthrate of ethnic Russians continues to fall to a level below which the current population cannot be sustained.[2] The falling birthrate coupled with a high infant mortality rate means the cohort of male 15- to 25-year-olds will comprise only 11.9 percent of the population in 2030, down from 14.4 percent in 2010.[3] In contrast, 25 percent of Russia's population will be over 65 in 2030. Especially troubling is the current life expectancy of Russian males (60.3 years), ranked 148th in the world, placing it somewhere between Haiti (pre-earthquake) and East Timor. Female life expectancy is 73.1 years.[4]

Causes for Russia's low life-expectancy rate include poor medical care, alcoholism, and high suicide rates. Russia has a high rate of tuberculosis, among other infectious diseases—well above that of Western Europe and North America. The effects of AIDS on the Russian population is currently unknown, but it is expected to be a significant contributor to Russia's longevity woes.[5]

On the other hand, the birthrate among Russian Muslims continues to climb, and Muslim migration from the former Soviet states to the south is rising. Although a Muslim majority is not projected for Russia in 2030, a substantial minority will be clustered in the southern part of the country.[6] In the Far East, heavy industry is declining, forcing many Russians—as much as 6 percent of the region's population—to migrate west in search of work. As a result, many ethnic Chinese are crossing the border into Russian territory to find work and arable land.[7] Over time, this will become a flash point between the two countries, perhaps as early as 2030.

The outcome of this demographic turmoil is that by 2030 Russia will have a considerably smaller number of military-age males. Given that a significant part of the former Soviet Union's military was drawn from the now independent republics, this shrinking pool of males creates a serious personnel roadblock for a resurgent Russian military. As more of the Russian population is comprised of Russian Muslims, questions of state loyalty—heightened by the omnipresent Russian xenophobia—may keep these potential recruits from its armed service, further reducing the available cohort.

Economics

There will be no great economic surprises in Russia by 2030, but there are signs that its currently resurgent economy will be slowing by then. In part, this will be because Russia continues its 1,000-year "traditions" of government corruption and direct state involvement in the economy, neither of which has produced positive economic growth.[8] Also contributing to an economic slowdown will be Russia's crumbling transportation infrastructure and, perhaps, depletion of its oil and gas reserves.

The industrial sector will continue to be concentrated within a few large enterprises. Russia will continue exporting its oil and natural gas resources to Europe—oil and gas represent 60 percent of total exports and a third or more of state revenues—and will also exploit its vast timber reserves in the coming decades.[9] Russia presently enjoys the third largest currency reserves in the world, thanks in part to its favorable trade balance. All these factors, plus growing domestic consumption, have led to an economic boom within the country which most observers forecast to continue for at least the next 20 years.[10]

However, Russia has chosen to maximize its profits from its extractable resources to fund a military resurgence instead of reinvesting in its deteriorating infrastructure. Consequently, its transportation system—roads, bridges, rail lines, and especially the gas and oil pipelines to Europe—will not be able to sustain any increased capacity. Some parts of it, particularly its extensive network of 1980 vintage pipelines, will most likely fail in the coming decades.[11] This will undoubtedly impact the flow of natural resources to their prime markets and the resulting export revenue. Internally, rising demand for imported goods (fueled by a rising standard of living within this "boom") will shrink Russia's trade balance significantly by 2030.[12] Growing water shortages, particularly in the southern part of the country, may adversely impact the production of Russian grain, another major export commodity.

An area of increased interest in the next 20 years will be the potentially enormous gas and oil reserves in Russia's High North. A recent strategy document has called for the transformation of the Arctic into a Russian base for the exploitation of oil and gas by 2020.[13] Thinning of the Arctic ice pack and a large fleet of Russian heavy icebreakers have made transit of the region much easier, opening the Northeast Passage (also called the Northern Sea Route) for part of the year, and significant oil and

gas exploration/exploitation in the Arctic and on the Yamal Peninsula (adjacent to the Arctic Ocean) are highly probable by 2030. However, unresolved boundary disputes regarding 200-mile territorial limits in the High North may slow these efforts. Analysts believe these disputes will not lead to direct conflict, but resolving these issues—coupled with the enormous risk of extracting natural resources from such a hostile environment—could slow exploitation of the High North.[14] Given the current high rate of oil and gas extraction to meet European demands, Russia could run dangerously short of its reserves prior to full exploitation of any new fields.

Russia's economy will continue its boom in the near future, but its economic engine may start to slow significantly by 2030. Drastic infrastructure overhauls are needed soon, but they may not be accomplished in time. Two decades of high oil prices would continue to finance the military's resurgence, but a decline of oil futures below $70 per barrel, coupled with a failure to exploit oil and gas resources in the High North, could spell trouble for the entire nation's economy.[15]

Politics

The one constant in Russia's politics over the past several centuries has been its comfort with having a strong leader. Vladimir Putin is merely the 2010 extension of this long autocratic line, and there is no sign this practice will end anytime soon. Rather than moving toward a Western-style democracy after the fall of the Soviet Union, Russia's leadership has instituted a political system of "sovereign democracy." In short, power remains in the hands of a few wealthy individuals, and corruption in government remains a staple. We envision this trend to continue through 2030 and beyond.[16]

Beyond its leadership style, Russia's politics—both internal and external—is centered on the remarkable turnaround in its economy. An abundance of natural resources has created wealth for Russia, which it has chosen to invest in resurrecting its military—albeit a smaller and more technologically based one—in the image of the old Soviet Union. By 2030 a new Russian military will emerge from this investment, and Russia will manifest itself as a strong regional power, with its nuclear arsenal comprising its remaining vestige of international clout.

In the next 20 years this military strength will mesh nicely with Russia's political aspirations, engendering renewed influence over its former republics. Regional power projection will probably focus on freeing the minorities along Russia's borders as a pretext for increased political influence there, hearkening back to the pan-Slavism movement of the nineteenth century. Russia will also seek to renew a stronger relationship with Ukraine, perceived as the cradle of Russian civilization by most Russians. Russia claims a "special relationship" with Ukraine, but exerting influence over it will not be easy and may lead to military adventurism there. Both of these initiatives involving its former territories will involve risk, but Russia will be a strong conventional military power, with the technical prowess and organization to assert its will over its neighbors. Nevertheless, Russia will spend a great deal of time

and treasure in pursuit of this policy, perhaps limiting its ability to act on a larger stage in the next 20 years.[17]

Looking beyond the former republics of the old Soviet Union, Russia still sees the United States as its greatest competitor but will be increasingly unable to challenge it directly on the world stage except with its still formidable, albeit aging, nuclear arsenal. The United States and Russia hold 95 percent of the world's nuclear weapons; any future arms reduction would still leave them with the lion's share of global nuclear capability.

In the Russian Far East, border tensions between China and Russia will escalate because of Chinese migration into Russian territory in search of arable land. Nevertheless, the two countries won't come to blows over this area, except for the obligatory artillery exchange or two. China's northwest provinces are troublesome to it, and Russia's population is continuing its abandonment of the region in the wake of deteriorating industrial infrastructure. Neither has much to gain in a protracted conflict there.

Russia has also turned its eyes to the High North, primarily because of the oil and gas reserves there, and is seeking additional territorial rights as part of its coastal extension. If it is able to achieve a demarche with Norway, the economic largesse it enjoys today will fuel continued economic growth well past 2030.

Technology

Once upon a time, the Soviet Union produced scientists and engineers by the score. The launch of Sputnik in 1957 brought cries of a so-called missile gap in the United States, and comparisons of Soviet engineering prowess to American educational apathy launched a massive US effort to promote science and mathematics in its schools. In the decades after Sputnik, Soviet scientists outshone American efforts—particularly in the space arena. Soviet state-sponsored scientific institutes also churned out engineers and technical experts at an awesome pace.

Compared to the former Soviet Union's technological capability, Russia's—writ large—is a far cry from the Sputnik era. Current trends in Russian technical education indicate that by 2030, that gap will widen. There has been a shift in higher education within Russia, with a lack of emphasis on technical higher education and growing enrollments in newly created business schools instead. Recent observers of Russian technology have noted its inability to transfer technology from the theoretical into the practical.[18]

As a result, Russia is importing technology rather than creating it; examples of this shift abound. Its electronics industry is unable to make all the components that the Ministry of Defense (MOD) needs and must import them. Likewise, Russia has purchased remotely piloted aircraft (RPA) from the Israelis and has negotiated the purchase of an aircraft carrier from the French. While some observers posit that the Russians will lead the world in nanotechnology by 2030, others indicate that Russia must make heavy and continuing investments in science and technology as well as

in research and development to achieve only modest gains in any technology, much less nanotechnology, in the next two decades.[19]

Russia's huge oil and gas revenues are consumed by profit taking instead of reinvestment, but at least some of the largesse is slated for MOD modernization efforts. While newer and better weapons are procured, most of the revenues will continue to be used to improve existing systems.[20] Based on this evidence, any educational reinvestment will probably be too little—and certainly too late—to have an impact by 2030.

Russian technology is in a slow, gradual decline; immediate reinvestment in it on a massive scale is unlikely. However, Russia will continue to make improvements in its current weapons inventory from its nadir in the 1990s and will still be a formidable adversary in 2030, though it is unlikely to produce massive, game-changing technical breakthroughs.

Identity and Motivation

Simply put, Russia's identity is wrapped up in the idea of itself as a Great Power. From the founding of Moscow, the Russian people have exhibited a national inferiority complex which has resulted in territory grabs and saber rattling in order to be noticed as a world leader.[21] Combined with its national sense of xenophobia, Russia wants world-power status once again. More importantly, it wants the Great Power recognition that comes with it.[22]

Over the next 20 years Russia will continue its efforts to retain what is left of the old Soviet Union: the Russian Federation. To its credit, Russia has managed the transition from empire (Soviet Union) to nation-state (Russian Federation) without the attendant upheavals and violence that normally accompany such a change. Nevertheless, Russia is not content with the status quo.

As a sign of the paranoia characteristic of its national psyche, Russia will attempt to expand its territory in its "zone of privileged interests," in the guise of "freeing" the ethnic minorities in its former republics.[23] This effort has two aims: to regain hegemony over its former territories and to reestablish a series of buffer states between it and the West. If Russia cannot regain physical control of its former republics in the short run, it may settle for influence over them and bide its time until its military reorganization gives it the wherewithal to exert physical control.[24]

Russia also will continue its quest to constrain the United States in the coming decades. Continued nuclear parity with the United States makes international confrontation only a distant possibility, and Russia's dominance in responsive, readily available space launch vehicles will give it a distinct advantage in space in the foreseeable future.[25] By 2030 a more realistic scenario involves US support to Eastern Europe being countered by Russian influence and perhaps by Russian proxies. Russia's success in containing US influence in the former Soviet Union will go a long way in restoring the Russian Great Power mind-set, perhaps setting the stage for adventures farther afield by midcentury.

A possible detour on this expansionist/containment road could be the encroachment of ethnic Muslims to the south and Chinese immigration along the eastern borders in the coming years. Both situations could fuel Russia's xenophobia and cause it to act militarily to stem the tide of "foreigners" at its borders. This would be in keeping with its self-perception as a Great Power, requiring stability on its doorstep before launching into any other expansion. Given that its military will be capable of regional intervention in 2030, this scenario appears much more likely than any other.

Impact on US National Interests

In 2030 Russia will perhaps be at its zenith. It will be able to exert influence over its neighbors in the near abroad, maintain a strong nuclear delivery capability, and boast a military smaller than the old Soviet Union's but more technologically savvy than ever before. Overall, Russia will have the technical means to deny the United States and possibly some of our allies free space and cyber access.

Russia could impact US interests in several arenas, but the one with the greatest global impact is cyberspace. Since nearly everything we do as a nation is inextricably wedded to cyber networks, their interruption could be nation threatening. Moreover, current cyber warfare can be conducted from anywhere. Its perpetrators can hide in any nation, making it difficult to place blame and take retaliatory action. Thus, Russia could foster third-party cyber attacks via proxies and claim innocence on the world stage.

Space is another arena where Russia will clearly have the edge in 2030. Its operationally responsive space lift is a proven commodity for all types of operations. The United States lags in this area and shows little sign of closing the gap in the coming decades. As with cyberspace, Russia will have the means to deny us access in space by the sheer volume of launch vehicles and systems. We will thus have an even more difficult time overcoming space-related denial than we will cyber disruption. Given that space is an open frontier, weaponizing it to assure service there has never been an option in the international community. While China has demonstrated its ability to affect objects in orbit from the ground, true space-based weaponry has been conspicuously absent from any nation's arsenal. Russia has the means to change that today and will continue to possess that capability through the next 20 years and beyond.

Russia's wealth of natural resources and its willingness to exploit them for profit underpin all of its activities. Oil and gas exports, plus a booming internal economy, mean ready cash for research and development and for purchases of those weapons which Russia cannot produce internally. This largesse won't diminish in the next 20 years, but the oil bubble may burst in the coming decades without major reinvestment. Realizing this, Russia is committed to oil and gas exploration in the High North, an area where the United States has interests but has little ability to exploit or protect them. Our inability to operate effectively in the High North, alone or in con-

junction with our NATO allies, could deny us oil rights in an area with potentially 20 percent or more of the oil reserves in the world. Moreover, the single maritime choke point for access to the Northeast and Northwest Passages is the Bering Strait between the United States and Russia. Again, Russia has the capability to deny US operations in an area of increasing national interest.

In the coming decades Russia's aggressive overtures toward its former republics will test not only our resolve to support Eastern Europe's independent nations but also the strength of the NATO alliance and European Union. In addition, the United States may be hard-pressed to keep basing concessions in the region in the face of Russian military and economic pressure. These dynamics may set up a classic "proxy war" scenario between Russia and the United States. On the heels of our deep involvement in Iraq and Afghanistan, the United States may be forced to respond to Russian regional aggression with less than a total military commitment and ask for our European allies to step in. For this reason, building (as well as strengthening) partnerships rather than the overt commitment of forces to the region may be the strategy required to blunt Russian aggression in its near abroad.

There are other areas in which a resurgent Russia may affect US interests. Foreign military sales have always been a diplomatic tool for Russia and the former Soviet Union. Bargain-basement equipment prices are usually the precursor to Russian (Soviet) "advisors" being stationed to support these sales. While cash flow isn't currently a problem for Russia, influence beyond its borders always is. Russia continues to focus on improving existing military equipment rather than designing radically new hardware (with a few limited exceptions), and it will continue to export reliable, cheap, midgrade military equipment around the world. This poses the classic alternative to highly technical US foreign military equipment sales: quantity versus quality, with price perhaps the deciding factor. We may find ourselves in direct competition with Russia.

Tangential to all of this is the ever-precarious nature of future US overseas basing. If Russia succeeds in reestablishing influence over its former republics, US bases such as Manas Air Base in Kyrgyzstan would become a thing of the past. Once established, this Russian sphere of influence could be used to exert pressure on the new NATO countries to the west to also deny the United States basing there. As a result, the United States' military presence could be reduced by a minimal number of bases on the European continent, creating great difficulties in resupply and forward presence anywhere in that region, much akin to what we face in the Pacific Rim.

Finally, there is the popular notion that Russia has already emerged economically from the ruins of the Soviet Union, taking its place in the world's economies as part of the highly successful and economically powerful BRIC countries: Brazil, Russia, India, and China. Given that the old Soviet economic model—heavy industry, power in the hands of a few, and so forth—has endured the transition into a sovereign democracy and appears, on the surface, to be thriving, this may present a powerful intellectual challenge to the notion of democracy itself. Emerging nations may opt for the Russian model rather than try to make the painful transition to a classic

Western democratic state. Though one of America's prime exports has always been its version of democracy and free enterprise, we may find this notion a tough sell abroad in the coming decades.

A resurgent Russia will be a different kind of beast from the old Soviet Bear. Although it will be unable to assert its military primacy directly as it did during the Cold War (nuclear weapons notwithstanding), it will have the capability to deny the United States access to the High North, space, cyber gateways, and Eastern Europe if it so chooses. Denial of access to these areas would impinge on the United States' ability to conduct its external affairs as it wishes. It would also incline US military responses toward long-distance response rather than close-in influence.

The US Air Force's Role

Global Integrated Intelligence, Surveillance, and Reconnaissance

Gathering intelligence about Russia, a staple activity of the Cold War, will lose none of its importance in 2030; only the means to do so will change. While Russia is not the closed society of the old Soviet Union, it is a xenophobic rival that continues to keep its secrets.

Overall, the Air Force will continue to be the primary collector of intelligence regarding Russia. This is because it owns the vast majority of air-breathing and spaceborne collection platforms capable of operating near or over the Russian Federation. While processing and analysis of this information will, of necessity, be a joint endeavor, other services have focused on tactical collection in Iraq and Afghanistan and will not be able to refocus their missions to satisfy strategic collection requirements.

The one exception to this is in the realm of human intelligence (HUMINT). Since most service HUMINT assets were subsumed under the Defense HUMINT Service in the mid-1990s, Air Force HUMINT efforts have been relegated to the back burner. HUMINT functions "outside the wire" in Iraq and Afghanistan are being performed by agents of the Air Force Office of Special Investigations. Only the Army has retained an organic HUMINT capability.

Russia's new ability to project power in the High North, a locale where the United States is woefully short of military or civilian assets, is cause for concern and will require US intelligence-gathering assets to operate in this frigid environment. While this would appear to be a simple matter of repositioning a few intelligence satellites into a polar orbit, shortfalls in operationally responsive space assets and the waiting list to use what is available make this a long-term project. Air-breathing collection assets will be necessary gap fillers in the near term. The vagaries of Arctic weather and the overall harshness of the climate dictate that unmanned collection platforms would be the best choice, but the long distance involved makes current RPAs, with the exception of the Global Hawk, unworkable.

Two other factors must be considered in any efforts to collect, process, and disseminate intelligence on Russia in 2030. First, Russia's future is tied to its continued economic success. This will require some emphasis on acquiring and understanding economic intelligence about the Russian Federation, a domain that falls outside traditional military intelligence. Second, the end of the Cold War brought an end to emphasis on Russian language capabilities within all the services. The director of the University of Maryland's Center for the Advanced Study of Languages, Richard Brecht, has warned that this capability is in rapid decline and must be revived to collect real-time intelligence as well as to understand Russian intentions.[26]

Rapid Global Mobility

The linear distance between the military forces of the United States and Russia will grow significantly in the next 20 years. The United States will continue to withdraw from some of its Cold War traditional overseas bases either by design or by host-nation request, and Russia will be able to exert its influence only within its former republics. Rather than being "eyeball to eyeball," the United States and Russia will be continents apart. Given the past history of US-Soviet proxy wars, this will mean confrontations far from existing US bases or US-friendly nations.

As a result, our ability to rapidly transport people and cargo virtually anywhere in the world will be our most important core function in 2030. Complicating issues of distance may be a constrained operating environment. During the 1973 Arab-Israeli war, US airlift of ammunition and other supplies to Tel Aviv was critical to Israel's survival. Despite the presence of US logistical bases in NATO countries, airlift to Israel was conducted primarily from the continental United States because of almost universal European refusal to allow overflights of aircraft bound for the war zone. US airlift aircraft were allowed to stage through Lages Air Base in the Azores but still had to make a careful transit of the Mediterranean to reach Israel—reminiscent of the air corridors used for the Berlin airlift decades before. In any future conflict, we anticipate similar constraints on air operations.

Factoring distance and difficulty into any airlift operation leads to the conclusion that airlift operations will be our most difficult mission in the coming decades and will require the most emphasis. Strike operations can rely on stealth and speed to overcome distance and opposition. In stark contrast, airlift operations are usually visible reminders of US presence. While speed is important, the sheer weight and volume of airlift cargoes tend to make "speed" a relative term. We will require an Air Force in the coming decades that can operate anywhere in the world from bases in the United States. This will require more airlift aircraft, highly trained aircrews, and reliable aerial refueling capability. This will also require the ability to operate from austere facilities for unpredictable amounts of time and to defend those facilities without diverting other forces.

As an instrument of US "soft power," these same capabilities must be used to deliver humanitarian aid in virtually the same conditions as combat support. The key

similarity is the shared need to get whatever is needed to wherever it is needed with speed—the "rapid" in rapid global mobility. The sheer volume of airlift requirements, compounded by the current limitations on cargo size and weight, will make augmentation of global mobility assets necessary for any protracted US involvement. Revival of the Civil Reserve Air Fleet (CRAF) will be necessary to assure sufficient lift.

Nuclear Deterrence Operations

Russia in 2030 will have only one weapon system (if space is not weaponized by then) that could reach US soil: its nuclear weapons atop ballistic missiles. Russia and the United States possess 95 percent of the world's nuclear weapons; therefore, nuclear parity with Russia has always been and must always remain a constant. Since two-thirds of the nation's deterrence capability resides in the US Air Force, we are the preeminent deterrence force. Thus, nuclear deterrence remains a vital Air Force core function; its relative ranking in this study is a reflection of its endurance as an Air Force core mission.

By 2030 the rest of Russia's military will pose a regional threat with a modernized conventional force, but the days of planning for force-on-force in the Fulda Gap have disappeared. The US nuclear arsenal, however, must be maintained at sufficient levels to assure Russia that we have the capability and the will to counter any nuclear threat.

Nevertheless, aging inventories and the lack of any new launch vehicles make maintaining a credible nuclear deterrence more than a matter of improved oversight and aggressive compliance inspections. Investment in modernizing USAF nuclear weapons is required to assure that our capabilities remain at the highest standards. Additionally, oversight and understanding of Russian nuclear capabilities are necessary to correctly assess the threat and to forecast our future needs to meet that threat.

Partnership Building

In the coming decades, Russia intends to reassert its influence over its former territories in the near abroad and may strive to reclaim territories on its borders occupied by ethnic minorities. If Russia's incursion into Georgia is any benchmark, this may mark the beginning of a violent period of expansion.

The soft-power counter to this course is to establish—or in some cases continue—partnerships with these nations. While some aspects of US partnering are rooted within our current conflicts, partnership with the former Soviet republics must persist beyond termination of US war efforts to be effective. Current USAF partnering roles are focused on the use of air bases in these nations. In the future, this must extend to air advisory missions, officer exchanges, and joint exercises. In short, these former republics must be full partners with the USAF and not just viewed as "lily pads."

Currently, territorial issues in the High North are being decided under the Law of the Sea Convention. Because the United States is not a signatory, its legal influence

there is limited. However, one often overlooked aspect of NATO is that it has a southern boundary—the Tropic of Cancer—but no northern one; NATO extends to the North Pole.[27] Therefore, partnering with other NATO members with territorial claims in the High North (Denmark, Norway, and Canada) will allow the United States greater leverage in the area and a means to contain Russian expansion. The Air Force's ability to provide long-distance air support and persistent surveillance of the region provides the United States further entrée into the area—entrée that will prove a useful counter to Russian aims.

Space Superiority

Space is an area in which Russia has a clear lead, particularly in operationally responsive lift. More troubling is that the United States has no overarching plan to match this superiority. While a third of the US nuclear triad depends on land-based missiles and another third on sea-launched ballistic missiles, there is no concomitant US launch capability to place objects into orbit. With the end of the space shuttle program, we will become passengers into space and not drivers.

Space superiority is a core competency that today depends on our ability to track objects in space, monitor space launches, provide warning, and conduct surveillance and reconnaissance from space. While a limited ballistic missile defense system is in place, it is by no means complete. Our inability to quickly replace satellites that are degraded due to age or hostile action or to conduct any ad hoc space launches is significant. Our dependence on other nations' launch vehicles also places us in their debt—literally and figuratively.

The Air Force must continue to perform those space-related missions that allow it to monitor Russian space activity and to find resources to significantly improve its operationally responsive launch capability in the absence of any civilian initiatives. We must also deter the weaponization of space by maintaining a capability to counter any such initiative.

Cyberspace Superiority

It is unclear if cyber warfare is the warfare of the future. It is, however, one form of warfare in the present and demands the Air Force's attention.

Russia possesses the capability to conduct state-sponsored cyber war, but no more or less than any other industrialized nation. What Russia does possess, however, are the funds and the national will to conduct cyber attacks in the absence of any other form of global warfare short of a nuclear exchange. Its position as a resurgent power is framed by regionalism but motivated by the desire to be a Great Power. Cyber provides a way for it to do this at no great risk to Mother Russia.

To achieve cyber superiority, the Air Force must be able to operate in a degraded cyber environment (defensive net ops) while maintaining the ability to deny, degrade, or destroy other cyber networks (offensive net ops). However, the Air Force

should not be the lead agency for cyber superiority, but rather a prime partner in this enterprise.

No new core competencies are relevant to the study of a resurgent Russia. Of the six that are not listed above (air superiority, global precision attack, special operations, personnel recovery, command and control, and agile combat support), none lend themselves to the picture that has been painted of a resurgent Russia in 2030.

Both command and control and agile combat support are core competencies so ingrained in all that the Air Force does that they are almost transparent. Since it is postulated that there will be no force-on-force confrontation with Russia in the study period, both global precision attack and air superiority—core competencies in which the Air Force has no peer—are irrelevant to this study, but not to the Air Force writ large. The area of Air Force special operations is a core competency within a joint framework and does not play a singular part in the Air Force's 2030 world. Finally, personnel recovery as an Air Force core competency may not exist by the 2030 time frame and certainly plays no part in the Air Force operations listed above.

Summary

By the year 2030, Russia will have a smaller but smarter military that is more technologically capable. The country will remain an economic leader but will be showing signs of an economic slowdown. It is also likely to have retaken some, but not all (Ukraine), of its former republics and be the preeminent power in the High North. Russia will lead the world in the number of space launches, days in space, and the ability to deny space to others. Though it will be a world leader in cyber warfare, it will not be immune to cyber attacks.

Russia will face daunting challenges over the next 20 years. The effects of demographic decline will begin to manifest themselves. Serious climate change issues and significant minority immigration could wreak havoc on Russian society.

By 2030 the US military will operate fewer overseas bases but will certainly have a presence in the High North. Moreover, America is likely to partner with the former Soviet republics and to continue partnerships within NATO. The United States will still be grappling with operationally responsive space shortfalls.

To compensate for Russia's resurgence in 2030, the US Air Force must focus its efforts on several areas. It should reenergize its nuclear enterprise to assure its deterrence capability. The USAF must have the means to provide rapid mobility throughout the world, primarily from the CONUS. It should create an operationally responsive launch capability that does not detract from its nuclear launch capability. The Air Force should be able to surveil the High North, as well as all sectors of Russian military, economic, and scientific endeavors. It must supply effective joint cyber warfare capabilities. Finally, the USAF must provide air-specific partnering with NATO allies and former Soviet republics.

Notes

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Scenario 2

Peer Competitor: 2030

As the world's dominant power after World War II to the present, the United States has been the policeman, protector, and provider of goods, services, and currency to the world. Maintaining that role for over 60 years has been costly to the nation's economy and the Defense Department. Over the next 20 years, the United States will find that holding such a dominant position is difficult. On the horizon, one of the states presenting potential opposition to American preeminence is China. As the most populous nation, with significant natural resources and a rapidly growing economy, China presents challenges for America representative of those that any peer competitor would pose and therefore merits inclusion in this study.

After three decades of economic growth averaging nearly 9 percent, China has continued to prosper and has become a superpower, arguably replacing the United States as the dominant economic power in the world. Many of the world's major economies engage in more trade with China than with any other country. In part due to economic prosperity and investing in new military technologies, China's military might has also advanced—although it still falls short of the full capability of the United States. While Chinese political leaders make statements advocating "peace and harmony," China's capabilities cannot be ignored or taken lightly. Through advances and investments in equipment and technology, China poses a formidable military challenge. These challenges will be expressed through area and access denial, space systems, cyberspace defense of military and civilian networks and infrastructures, and emerging technologies such as nanotechnology. Furthermore, it is not merely the military aspect of a peer competitor that poses the challenge. Politically and economically, challenges to the United States will arise from Chinese clout in the marketplace, placing strains on America's overseas alliances and its military power projection.

China in 2030

Demographics

With a land mass approximately equal to the size of the United States, China (fig. 2) will be the second most populous nation—with nearly 1.4 billion people—by 2030.[1] Ninety percent of the Chinese identify themselves as ethnic Han.[2] The "one child" policy instituted in 1979 has abated; however, China's birthrate is estimated to be only 1.85 children per woman by 2025.[3]

China's one-child policy has resulted in a rapidly aging population with a diminishing labor force. Additionally, better diets, access to advanced medical services, and higher standards of living have increased life expectancies, creating additional demographic pressures on the country. The aging population, with fewer children

Figure 2. People's Republic of China. (*Reprinted from* "China Military Regions," NationMaster.com, http://images.nationmaster.com/images/motw/middle_east_and_asia/china_milreg.)

to support it, presents the usual fiscal challenges associated with large intergenerational transfer payments.

The population's shift to urban areas and a dearth of arable land will drive China to become a food importer before 2030.[4] Job opportunities in the major east coast urban centers have motivated mass migration. In 2010 approximately 47 percent of the population lived along the east coast, with 3 percent of the population moving from rural to urban areas each year. Moreover, nearly 75 percent of the population lives in the eastern one-third of the country. Only 15 percent of Chinese land is arable, and the urban shift leaves fewer people to produce food for the homeland.[5]

Segments of the growing middle class and non-Han population could generate social unrest. The 8 percent of the population that identifies itself as non-Han occupies approximately two-thirds of the land mass and speaks its own language. This

segment is somewhat removed from the mainstream of Chinese modern life and has a much lower standard of living than residents of more affluent regions. This inequality continues to motivate demonstrations by minorities.[6] In Tibet and the far western province of Xinjiang (home to the Uyghur minority), tensions between the government and the local populace have been worsening and result in multiple protests each year.[7] With Internet access and the availability of other media, the growing educated, consumer-driven middle class notices the disparity between the "haves" and the "have-nots" and speaks out for more freedoms and less corruption.[8] While the central government has attempted to shape and control Internet usage, it has not been completely successful.[9] Together, these dissatisfied population groups may challenge the ruling elite.

China's special administrative regions of Hong Kong and Macau, as well as Taiwan, pose unique challenges. These locales have considerably more autonomy than most in China. Hong Kong and Macau are not subject to China's socialist economic system. Their free-market economic impact on China from foreign direct investment and trade is significant. Taiwan may be assimilated into China by 2030, and its capitalistic economy and autonomous population will have additional effects on Chinese demographics. These societal issues pose a great risk to China. In fact, George Friedman predicts that China may split in the coming decades and see strong regional governments focusing on local economic interests.[10]

Economics

Despite growing unrest and troublesome social issues, China's rapid economic growth has helped keep the nation stable—politically, socially, and economically. In 2010 China stood as the second largest economy in the world. While continued economic growth of 9 percent will not last, some experts expect the Chinese economy to overtake the US economy before 2020 and become the world's largest economic power by 2030.[11] The post-Mao economic reforms which opened the once-closed, centrally planned system to unprecedented international trade have exceeded most experts' expectations. Deng Xiaoping and the leaders that followed him implemented a more market-oriented economy that resulted in a fourfold increase in output at the start of the twenty-first century, a rapidly growing private sector, and the creation of a middle class.

The World Trade Organization (WTO) notes that China recently became the largest exporter in the world.[12] China's main export partners are the United States, Hong Kong, Japan, South Korea, and Germany, while its main import partners are Japan, South Korea, Taiwan, the United States, and Germany. China holds a significant trade surplus.[13] Economic integration between Taiwan and China is noteworthy and leads experts to believe that the nations will eventually merge. Beyond Taiwan, there is ever-expanding trade with the Association of Southeast Asia Nations (ASEAN) countries.

Although China is rich in natural resources, it will require significant quantities of imported raw materials to further its economic development. China continues to reach out to nations around the world for those resources—especially oil and natural gas. Some of these nations include states along its strategic shipping lanes such as Myanmar, a significant number of the resource-rich nations in Africa, the Middle East oil nations, and even Latin America.[14] Energy drives the Chinese expansion and helps make it the center for world manufacturing. China is the world's second largest consumer of oil.[15] Some project that China will import twice as much oil by 2030 as in 2010 primarily due to an expected 500 percent increase in automobiles.[16] According to the *International Energy Outlook 2009* (*IEO2009*), China's energy use will double its 2006 consumption by 2030, and investment in infrastructure—railways, pipelines, and equipment—to support that growth will be substantial.[17]

As China becomes the leading trading partner of traditional American allies, tensions could arise. Just as the United States flexed its economic muscle to achieve political and military objectives, so has China used a similar approach. Research indicates that states with strong trade relations rarely go to war.[18] However, nations will use their economic advantage to promote their agendas and hinder that of their rivals. As China rises to become the largest global economy, American influence will decline. This will lead to indirect or possibly even direct challenges to American economic and military interests.[19]

Politics

The stability of Southeast Asia hinges on the Sino-American relationship. China's economic reach and physical proximity to the prosperous countries of Asia will exacerbate competitive tensions with the United States. Although competition inherently strains relations between nations, this will not necessarily lead to war or even a Cold War construct.

From a once centrally planned society, China has shifted to a form of market socialism. The government's source of legitimacy (the mandate from heaven) has been sustained by the country's economic performance.[20] Many experts believe that China is moving incrementally toward a measured democracy similar to that of Singapore. This one-party ruling elite authorizes democratic reforms while retaining control of freedoms associated with reform. The socialist ruling class will include an elite group of capitalists and traditional party members, and the government will maintain a strong presence in sectors important to national security.[21]

A series of agreements with India—the Five Principles of Peaceful Coexistence—describes China's approach to foreign relations. Broadly stated, those bedrock principles include (1) mutual respect for each other's territorial integrity and sovereignty, (2) mutual nonaggression, (3) mutual noninterference with each other's internal affairs, (4) equality and mutual benefit, and (5) peaceful coexistence.[22] Based on these five principles, the government wishes to develop relationships with other countries and to work toward a peaceful, harmonious world of common prosperity.[23]

Unlike many Western governments, China's leadership concentrates on economic issues at the expense of political considerations. China eschews foreign aid in favor of direct investment. Infrastructure investments are common so that countries can deliver the commodities that China desires.

As China's power rises and its national interests expand, China will seek to control threats to its sovereignty and preserve economic lines of communication (LOC). China's long-term military aims support its vision as a regional power. With a ring of influence in the Western Pacific, China's military will have sufficient power to prevent outside efforts to intervene in China's "internal" affairs. While Taiwan will remain the most likely near-term source of China-US conflict, the probability of conflict over Taiwan may well diminish in the long term with the potential for peaceful accommodation or even reconciliation. However, as China's interests expand globally, protecting lines of commerce and access to natural resources may also prompt China to flex its newly developed military powers.

From founding the Shanghai Cooperation Organization to more traditional friendships, China is actively seeking partnerships across the globe. China leverages its partnerships with African countries to acquire the resources a quickly growing economy requires to thrive. In contrast to Western democracies, China does not hector trading partners about human rights issues. Bilateral and multilateral partnerships will prove important to China and its security arrangements in the years ahead.

China not only views its major trading partner, the United States, as a potential adversary but also considers India a major competitor. By 2030 India's economy will be knocking at the door of the top economy in the world.[24] Since the countries share a border and because relations have not always been cordial, an economically and militarily rising India will pose challenges to China's vision of greatness. In particular, India's presence threatens China's main shipping lanes as well as its energy and commerce interests. To mitigate risks associated with India's growth, China is securing ports, facilities, and resource agreements along the trade routes and India's borders.[25] The presence of US forces will be a constant irritation, and the leverage of China's economic power may be sufficient to tip the balance in its favor, denying the United States access to bases along the Pacific/Indian rim. Long-term allies, such as Australia, may wish to keep open relations with the United States to hedge against the growing Sino presence.

Technology

China's impressive scientific achievements have been central to advancing its economic prosperity and military objectives.[26] This is remarkable in light of the 30-year gap in educational emphasis under Mao Tse-tung (1949–78). Since then, the Chinese have emphasized education and have achieved an adult literacy rate comparable to that of most advanced nations.[27]

The Chinese are pursuing asymmetric strategies to avoid an expensive arms race with the United States.[28] Although generally considered a defensive approach, Chi-

na's military buildup is a concern to its neighbors and America. For example, China's antiaccess technologies could offset the United States' superior power-projection capabilities and imperil its Asian bases. Chinese investment in sophisticated weapons and development of military-relevant technologies (such as nanotechnology, information technology, and biotechnology) will severely test America's ability to compete in scientific prowess.

China's significant defense modernization is propelled by double-digit increases in defense spending.[29] Numerous reports discuss China's growing antiaccess and area denial (A2/AD) programs.[30] These include both offensive—striking against the logistics infrastructure and platforms—and defensive measures, such as missile defense and influence operations with regional countries. China's investments in these measures, designed to preserve its sovereignty and prevent its adversaries from attacking Chinese interests, range from ballistic missile defense and antisatellite capability to the development of longer-range guided cruise missiles.[31] According to the 2009 congressional report, China has the most active land-based ballistic and cruise missile program in the world.[32] It is developing offensive missiles, to include a multiple warhead intercontinental ballistic missile (ICBM), and is expected to have ballistic missile defense systems sometime after 2020. Its current generation of guided missiles has an estimated range of 1,500 miles, and the next generation of cruise missiles will extend from a range of 2,500 to potentially 5,000 miles by 2020.[33] These assets will be used to deny penetration into China's mainland and keep adversaries at bay beyond the second island chain.

China is expanding its air defenses by exploring cruise platforms with stealth, hypersonic speed, and enhanced range potential. Experts believe that China will have a fifth-generation fighter before 2020 that will challenge the USAF's air superiority. No longer content with the former Soviet Union's imports, China appears to be expanding its industrial capacity to produce its own aircraft.

The Chinese have been investing in directed-energy systems for many years, and their use of "blinding" lasers on US reconnaissance satellites in 2006 indicates a high level of sophistication.[34] In addition, China is researching new space applications such as small launch vehicles for nanosatellites. These technologies would allow it to quickly place satellites in orbit and potentially equip those vehicles with laser armaments.[35] Recently, China's abilities in space have outpaced those of the United States. Indeed, security strategies discussed in Chinese writings—attacking weaknesses, surprise, and preemption—should cause concern for America's military and commercial space-based assets.[36] This is particularly true in the early stages of conflict, when loss of US electro-optical and intelligence low-Earth-orbit platforms would deal a severe blow to force projection.[37]

The Chinese have taken advantage of exponential improvements in computing power to develop considerable cyberspace abilities. Experts believe that China has the world's premier denial-of-service capability.[38] What is not known is how willing it will be to use these capabilities. Many cyber warfare tools (e.g., viruses, malware) are "one-shot" weapons. Once they have been used, an antivirus program can be

developed to render their future use ineffective. Thus, many of these tools will be saved for critical moments. In addition, depending on what types of systems are targeted, second- and third-order effects can be difficult to predict. For example, small effects in a power grid may have cascading consequences elsewhere. Nonetheless, despite these strong incentives against engaging in cyber warfare, the Chinese will be able to launch network attacks that could reasonably be expected to delay or reduce the efficiency with which the United States could deploy forces during hostilities.

Identity and Motivation

What are China's possible motives for conflict, and why should the United States prepare for a peer China? Experts believe there are many potential issues and shocks that could lead to armed conflict, and the potential exists for regional instability that could motivate US involvement. For instance, China's leadership could suffer from deepening social and political unrest. As mentioned earlier, protests generated by the urban population and rural minorities could grow if the Chinese economy falters. Furthermore, rising standards of living, improved diets, fewer agricultural workers, decreasing rainfall, and poor farming techniques will make it difficult for China to feed its people. If the government were unable to meet this need through imports, domestic instability would result. As China's appetite for energy expands and world demand outpaces supply, China's economy could slow, and inflation might spark domestic tension. Competition for resources between the world's two largest consumers will be keen and could lead to hostilities.[39] China's authoritarian government and transition to superpower status will continue to bring rapid change to the global power structure, thus dramatically increasing the possibility of conflict. Trade wars could bring about economic instability. A resurgent Russia and rapidly growing India pose threats to China's borders.[40] Regardless of the issue or event, a desperate ruling elite wishes to preserve its position at all costs. The United States must be ready to respond to protect its own national interests.

Impact on US National Interests

While an economic and military peer China will not necessarily threaten America's vital national interests, the United States must stand ready to defend its interests. Believing the "harmonious society" rhetoric without considering the possibility of hostilities with a peer China would be foolish. Experts have asserted that when peer competitors reach military parity, conflict becomes likely.[41] Further, it is common for economic rivals to compete to the other's detriment as one country attempts to assert itself and meet its increasing demand for scarce resources. Although China may not desire to engage a competitor such as the United States militarily, it may not consider financial warfare to be out of the question to significantly weaken its challengers.[42]

Protection of the oil reserves that drive China, feed its people, and fuel its commerce is vitally important to the Chinese economy and national security. Without energy independence, a secure energy source will remain a vital interest. Meanwhile, a secure energy supply for the United States in more competitive times may become problematic. China is making significant inroads into energy- and resource-rich countries around the world.

With the Air Force being the chief fossil fuel consumer in the US government, oil price fluctuations produce significant variation in the Air Force budget. For each dollar increase in the price of a barrel of oil, USAF operating costs increase by $60 million per year.[43] Price increases also affect the nation as a whole. In August 2009 petroleum accounted for 53.1 percent of America's trade deficit.[44]

Energy resources will fuel China's surge. The number-two oil consumer in the world, China is accelerating its quest for oil resources, to include investment in Middle Eastern, South American, and African oil fields. About three-quarters of China's imported oil comes from the Middle East or Africa.[45] To avoid shipping through the straits, China has aspirations for energy pipelines from the Arabian Sea, Bay of Bengal, and even the Central Asia republics into China.

Although the Middle East supplies less than 20 percent of America's oil, 40 percent of the world's supply comes from the Persian Gulf. Protecting those lines of transport often falls to America. For good reason, interruption of that supply is of great concern to many nations. Moreover, disruption of oil supplies paved the way for nine of the last 10 recessions.[46] Much of that oil passes through key sea lanes, such as the Strait of Malacca, Strait of Hormuz, Mediterranean Sea, and Arctic routes. These sea lines of communication (SLOC) could easily become choke points for commerce and energy.[47]

Freedom of action across all LOCs—sea, space, cyber, and air—has enabled the United States to maintain its commerce and protect the free world. Our reliance on space and cyber networks for commerce and defense is tremendous and will probably grow. Loss of air access, our second-most-important mode of transport for cargo, would hinder commercial interests and military activities.

The Chinese are seeking to secure their own LOCs, while possibly denying freedom of access across LOCs to others. For example, China is exploring options for producing or purchasing submarines and carrier aircraft. The question is whether China will use its capability to protect the SLOCs for oil. It has launched and destroyed spacecraft and is certainly one of the top cyberspace exploiters. Additionally, it plans to have fifth-generation aircraft before 2030. As USAF chief scientist Werner Dahm cautions, the technology gap that the service and the nation currently enjoy will shrink.[48] Defense Secretary Robert Gates warns that though it is sustainable for the next decade, America's uncontested access to the global commons is eroding.[49]

Extended nuclear deterrence on behalf of our allies remains a vital interest, particularly as the number of nuclear weapons states is projected to increase. China

does not disclose much about its arsenal, but the fact that it has nuclear weapons capable of reaching the United States must be factored into national defense planning.

Promotion of regional stability helps ensure that other vital interests remain secure. While instability potentially threatens American interests, every event does not require US military intervention. China has learned a similar lesson. The Chinese understand that successful growth results from peace and economic progress and should not be sacrificed to arm the nation.[50]

The current leadership of China has made it clear that it does not seek conflict with the West. Hu Jintao's repeated calls for a harmonious society appear to ring true. Indeed, China is now closely tied to the international economy. Continued economic growth seems to be a necessary (though not necessarily sufficient) condition for internal stability; thus, China has no interest in creating conditions that would slow its economic growth. In fact, its economic ties suggest that China has a strong vested interest in maintaining international stability. In contrast to the predictions of hegemonic transition theory, there does not seem to be a compelling reason to believe that China and the United States are destined to become mortal adversaries as China rises to peer status.

China's adoption of the Sun Tzu philosophy of achieving objectives through indirect means includes the use of defensive systems. These systems ensure that adversaries will suffer greatly should they decide to invade, but the same systems—short-range cruise missiles, fighters, and carriers—could be used on China's neighbors in an offensive fashion and destabilize Southeast Asia.[51]

The US Air Force's Role

The previous discussion reveals the United States' goals regarding a peer China: (1) maintaining regional security, (2) protecting LOCs and energy, and (3) ensuring commerce. The USAF core functions identified as central to success in this scenario are, in prioritized order: (1) space superiority, (2) cyberspace superiority, (3) nuclear deterrence, (4) global precision attack, (5) rapid global mobility, (6) global integrated intelligence, surveillance, and reconnaissance (ISR), and (7) partnership building. Although the other five core functions were evaluated as less important to this scenario and are not discussed, they are nonetheless important. For example, agile combat support and its subfunctions remain a foundation for all phases of military operations.

Space Superiority

Freedom of access in space is a vital national interest. By 2030 the United States will not have space superiority; however, it will need to be able to respond in kind (space deterrence) or be willing to conduct offensive operations from, as well as through, space. As noted earlier, China has a growing space program and has not

ruled out weaponization of space. It has demonstrated both the ability and willingness to attack space assets.

Cyber Superiority

Arguably, China has the world's most sophisticated network of cyber operatives and has significant cyberspace capability. As is the case with space, freedom of access in cyberspace is an equally vital national interest. Though the United States currently neither has nor is expected to have cyber superiority by 2030, it must have some freedom of access for mission assurance.

Nuclear Deterrence

China does not rattle the nuclear sword often. Unless the Chinese homeland is seriously threatened, use of nuclear weapons is an unlikely option because the repercussions are too great. In fact, this concept of deterrence may fit better under global precision attack since the delivery of the weapon is the deterrent.

Global Precision Attack

This capacity is contained in freedom of access to air, sea, and space (as well as land). Not only must America be able to "reach out and touch" adversaries at the time and place of its choosing, the United States must be able to do so selectively or en masse. In light of the increasing speeds of weapons, the nation must be able to react instantly. China has significant resources to reach the United States or hold its allies hostage with ICBMs, super cruise, and other weapons from all domains. It is certainly big enough to dominate East Asia and challenge the world's best by 2030.

Rapid Global Mobility

While the Chinese have few tankers and limited cargo capability, China could possess significant mobility assets by 2030. However, China is likely to set its sights on regional supremacy rather than on world domination and purchase assets accordingly. To get the USAF and "the boots on the ground" to the fight, the nation will require tankers for the near to midterm and *protected* strategic and tactical lift.

Global Integrated ISR

An argument can certainly be made for having another entity provide ISR. However, as an enabler for multiple missions, ISR is essential for global awareness and shaping the US response. Therefore, the USAF must stand ready to perform this function.

Partnership Building

To maintain regional stability, protect air and sea LOCs, secure energy resources, and have projection platforms from which to launch attacks, the United States needs

partnerships across the globe—particularly in zones of economic, energy, or nuclear interest or instability. Enabling partners to defend their own regions and countries without applying a host of requirements will provide allies in the future.

Summary

China is seen as a state that would prefer good relations with its neighbors and trading partners alike. However, the potential for internal instability, resource challenges, and the historic tendency for hegemonic transitions to be violent all suggest that there is at least some potential for the United States and China to find themselves at loggerheads in the decades to come.

What seems certain is that even in a proxy war setting, warfare against China would stress the military and the nation in ways not seen in recent times. Air, space, and cyberspace dominance would be called into question, and our ability to deploy fully into the region could be thwarted. We would have to fight our way into the area of responsibility in a way that the United States has not encountered since the island-hopping campaigns of World War II. Such a conflict would be expensive for both sides, which is why only an unusual set of circumstances—such as a desperate need for a vital resource or the last gasp of a dying regime—would be likely to precipitate it. Though unlikely, such circumstances are possible; for that reason, the United States must be prepared to respond.

Notes

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Scenario 3

Failed State: 2030

Failed states present challenges that often fall outside of traditional military concerns. These threats to US national interests can blur lines of responsibility between the Departments of Defense and State. Of the nation-states considered most likely to fail according to the Failed State Index, Nigeria is the most populous and boasts vast reserves of natural resources including oil and natural gas.[1] Therefore, a failed Nigeria presents challenges of sufficient scale and importance to demand inclusion in this study. Since the USAF would likely face similar difficulties with other failed states, the following scenario can be generalized to other potential failed states without a large number of caveats.[2]

By 2030 Nigeria's Islamic population will constitute a comfortable majority of the electorate.[3] This population is concentrated in northern Nigeria and has a higher poverty rate than is observed in southern and eastern Nigeria.[4] A new government, with increasing numbers of northern Muslims, will rule the country. The nascent government will decide to shift additional oil revenue payments to the northern regions. This shift need not be pronounced to provoke an incendiary reaction from southern Nigerians. In addition, extortion payments to the effective insurgent group Movement for the Emancipation of the Niger Delta (MEND) could slow, causing an increase in kidnapping of foreigners and disruption of oil flows from the Niger delta region. Eventually, mounting economic and ethnic tensions will cause MEND to attempt a takeover of the delta region. The future Nigerian government cannot defeat this large, well-armed insurgency, which has intimate knowledge of the Niger delta, and the majority of the delta region will fall under the control of MEND. Although it is unclear whether an increasingly Islamic government would be as corrupt as previous regimes, continuing high levels of corruption would increase southern Nigerians' frustrations and increase the probability of civil war.

Since Nigeria has a history of civil war and numerous ethnic groups (fig. 3) with competing interests, the possibility of complete state collapse cannot be dismissed. In a highly populated country with widespread existing poverty, the humanitarian implications of a collapse are likely to be staggering and perhaps even unprecedented in scope.

Nigeria in 2030

Demographics

Nigeria is the most populous country in Africa and the eighth most populous in the world.[5] In addition, Nigeria is the 39th-fastest-growing country, with an estimated annual growth rate of 2.29 percent.[6] Rapid growth will continue apace despite
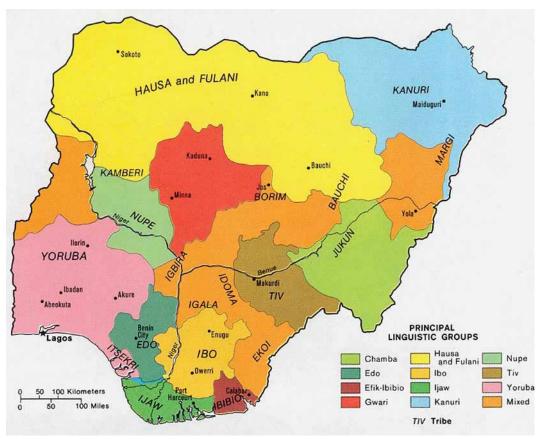
Figure 3. Nigerian ethnic groups by region. (*Reprinted from* Nigeria—Ethnolinguistic Groups from Map no. 504014, 1979, Perry-Castañeda Library Map Collection, University of Texas at Austin, http://www .lib.utexas.edu/maps/thematic.html.)

the 13th-lowest life expectancy in the world because of a staggering fertility rate of 5.01 births per woman.[7]

Two demographic phenomena could help push the country into civil war: (1) a continuing youth bulge due to a high fertility rate and low life expectancies, and (2) a shift in population to a predominantly Islamic northern Nigeria. Nigeria's median age was 19 in 2008 compared to 36.7 in the United States.[8] A younger population is more likely to exhibit higher rates of unemployment and violence, and this youth bulge is especially pronounced in northern Nigeria. Birthrates in the northern regions range between five and seven births per woman, compared to around four births in the southern regions.[9] Though mortality rates are also higher in northern Nigeria, that area is clearly growing faster than the southern part of the country. Considering its higher growth rate and current slim majority, the Muslim North should constitute a comfortable electoral majority by 2030. When this demographic fact is coupled with current oil-revenue distribution patterns favoring the oil-producing states, the country's national unity could be seriously threatened by 2030. The future of the Nigerian economy, fueled primarily by oil exports, will help illustrate this concern.

Economics

Nigeria was included in Goldman Sachs's follow-up report to its highly influential Global Economics Paper on Brazil, Russia, India, and China (BRIC).[10] This follow-up study dealt with the so-called Next Eleven (N-11) countries that "could potentially have a BRIC-like impact rivaling the G-7." The authors stated that Nigeria might overtake some of the G-7 by 2050, but the country was identified as having the least conducive environment for growth. More specifically, Nigeria was described as particularly weak in the areas of political stability, the rule of law, and corruption.[11] However, the authors then contradicted this bleak assessment when they projected real gross domestic product (GDP) growth rates for the 11 countries. With the exception of Vietnam, Nigeria's predicted growth rates exceed those of the other 10 countries. Growth is expected to proceed at impressive five-year average rates bounded by 5.8 and 6.6 percent between 2015 and 2030. Of course, such robust growth rates would lift millions out of poverty but are rather unlikely to come to fruition if Nigeria collapses and oil production stalls.

Nigerian oil is notably low in sulfur content, so-called sweet crude, and therefore requires less refinement when processed for gasoline production. In addition, Nigeria's location on the western coast of Africa allows for easy and relatively safe delivery to North America. For these reasons, the country has served as an important oil provider to the United States and plays an invaluable role in diversifying the US oil supply. Nigeria exports about 40 percent of its oil to the United States and presently accounts for almost 10 percent of US petroleum imports.[12]

In 2008 Nigeria produced over two million barrels of oil per day in the Niger River delta region along the country's south-central coast. This is the world's 12th-highest rate of production and accounts for about 2.5 percent of the total daily supply. Although MEND has successfully disrupted production in the past few years, oil production has followed a generally increasing trend over the past two decades (fig. 4).[13] Nigeria claims 36.22 billion barrels of proven reserves—2.72 percent of the world's total reserves.[14]

According to the US Department of State, oil and natural gas accounted for 37 percent of Nigeria's 2006 GDP, 97 percent of the 2007 export revenue, and about four-fifths of total government revenues.[15] Despite the relatively fast growth of its non-oil GDP in the past five years, it is clear that disruption of oil flows would devastate the Nigerian economy. Additionally, the central and local governments' distribution of oil proceeds will face intense scrutiny for evidence of corruption and for equity across regions.

Despite high GDP growth rates and generally increasing oil revenues, poverty rates across Nigeria remain high and are especially severe in the northern regions (table 2). Per capita income was only $2,199 in 2009, and over two-thirds of the northern population lived in poverty.[16] Educational differences between the two regions provide little hope that the poverty gap will close. It is estimated that 40 to 70 percent of the northern population is completely uneducated compared to about 20

percent in southern Nigeria.[17] The inequality of wealth between the regions and the increasing population dominance of northern Nigeria could cause increasing friction between the regions.
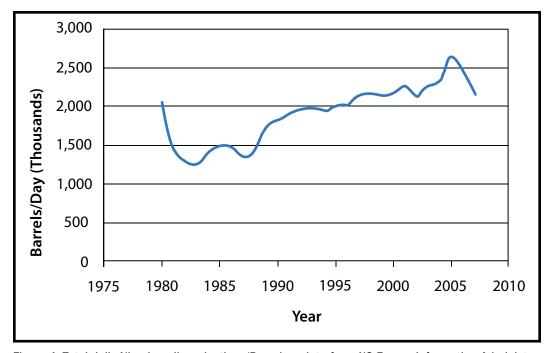

Figure 4. Total daily Nigerian oil production. (Based on data from US Energy Information Administration, "International Energy Statistics: Total Oil Supply," accessed 2 April 2010, http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=53&aid=1.)

Table 2. 2004 Nigerian poverty rates by region

Region in Nigeria	Poverty Rate (Percent)
South-Central	35.1
Southeast	26.7
Southwest	43.0
North-Central	67.0
Northeast	72.2
Northwest	71.1

Adapted from Prof. Chukwuma C. Soludo, Council on Foreign Relations (CFR), governor, Central Bank of Nigeria, "Nigerian Economy: Can We Achieve the Vision 20: 2020?" (presentation, 8 January 2007).

Politics

Nigeria was a British protectorate before gaining its independence in 1960. Since then, the country's record of political stability has been mixed. Of the numerous coup attempts, several have been successful in bringing down governments, although the government has not been overthrown by violent means in over 25 years.

Therefore, while there is reason for optimism that civil war will be avoided in the coming 20-year period, the possibility of a coup d'état should not be dismissed out of hand.

Nigeria's existing constitutional political system was designed with the same concept of separation of powers embraced by the US Constitution. There is a bicameral legislature and a unitary executive who is both chief of state and head of government. The Nigerian Supreme Court heads Nigeria's judiciary. The president is directly elected, and his cabinet, the Federal Executive Council, must include a member from each of Nigeria's 36 states. In late 2009 the president, Umaru Yar'Adua, became gravely ill. The Senate voted to replace him, on an interim basis, with his vice president, Goodluck Jonathan. Although this has been called a "coup without the word" by opponents, the country's relative stability in the face of this constitutional crisis is cause for optimism.[18] In May 2010 Yar'Adua passed away, and Goodluck Jonathan succeeded him as president.

Distribution of oil revenues is probably the most important and certainly the most controversial function of the Nigerian government. The derivation principle, which says that some percentage of oil revenues should be returned to the area from which the oil was derived, has generally been the cornerstone of the system. The percentage returned to the drilling locality has varied from 50 percent to the current 13 percent in effect since 2000.[19] Of the remainder, 48.5 percent flows to the federal government, 24 percent to states, 20 percent to local governments, and 3.5 percent to special funds. The remaining 4 percent is also distributed among the levels of government.[20] Although reduced payments to the Niger delta region should have decreased regional inequality and reduced northern poverty rates, precisely the opposite has occurred since 1992. Nigeria's Central Bank has asserted that poverty rates are highly correlated with "orientation to private-sector-led wealth creation as opposed to dependence on government assistance," among other factors.[21] Since oil-revenue-sharing formulas can always be altered with or without a change in government, the North's unhealthy dependence on these funds is deeply troubling. Furthermore, widespread corruption in oil revenue distribution could be the predominant or a contributing factor to igniting a civil war. A recent report quantifies the yearly oil revenue lost to corruption at $14 billion.[22] It should be noted that progress was made under president Yar'Adua; the most recent Corruption Perceptions Index (CPI) places Nigeria 130th out of 180 countries.[23] In previous reports, Nigeria has ranked in the bottom 20 countries.[24] Unfortunately, it is unclear whether this improvement will endure because of the recent change in leadership and Nigerian leaders' history of corruption.

Nigeria's political environment can be chaotic: five coups have taken place over the 40 years since independence. Much of the country's citizenry is dependent on oil revenue disbursements to avoid abject poverty, and these disbursements are attractive targets for corrupt officials. Political power will soon shift from the Christian South to the Islamic North. From a political point of view, it is not difficult to envision the collapse of Nigeria between today and 2030.

Technology

A recent RAND Corporation study names 16 technology applications that will be developed and become widely available by 2020.[25] A country's probability of successfully adopting a given technology depends on its level of scientific and technological capability. Although Nigeria is not named explicitly, countries with similar technological capabilities would be expected to acquire cheap solar energy, rural wireless communications, ubiquitous information access, genetically modified crops, and rapid bioassays. Although Nigeria is likely to acquire these technologies, RAND rates its ability to implement them by 2020 as low. However, by 2030 Nigeria could well possess capabilities in these areas.

Of the technologies likely to be available by 2030, ubiquitous information access and wireless communications are the most likely to play some role in state failure or preservation. It is unclear whether the introduction of these technologies makes state failure more or less likely to occur, but new technologies will certainly pose challenges for the government. Though the government and its powerful oligarchs will likely hold ownership control of most communications providers, well-funded opposition groups (such as MEND), the Sokoto Caliphate that rules much of northern Nigeria (if it is still in the minority), and criminal enterprises should be able to circumvent government restrictions and communicate rather freely across the spectrum to spread their message and recruit new followers.

Identity and Motivation

Two active participants in a potential Nigerian civil war can be named today: MEND and the Sokoto Caliphate. The contrasting values of these two groups could put them on a collision path. Undoubtedly, some of the 350 Nigerian ethnic groups will play a role, but identifying individual groups is beyond the scope of this study.

MEND seeks to localize control of Nigerian oil production and to secure government reparations for the oil industry's pollution. More specifically, its three major demands are (1) release of former insurgent group leader Alhaji Mujahid Dokubo-Asari, (2) receipt of 50 percent of revenues from oil pumped out of the delta, and (3) withdrawal of government troops from the delta.[26] Since these goals are at odds with the Nigerian government's policies, the insurgency group has turned to violent attacks against drilling sites and to the taking of hostages. Despite its penchant for violence, MEND enjoys widespread support among the delta region's 20 million people. MEND's size has been estimated from the low hundreds to the thousands.[27] Its members are armed with advanced weaponry possibly superior to that of the Nigerian government, and the insurgency employs sophisticated tactics that evince a strong knowledge of the Niger delta region. The International Crisis Group warns that the government may not be able to completely defeat MEND; even if the government is successful, oil production could be stopped for up to two years.[28]

Since the Sokoto Caliphate currently enjoys some autonomy in northern Nigeria, it is possible to make informed predictions concerning its governing style. First, the caliphate is likely to continue to strongly oppose any nascent jihadist extremism in

the country. Second, although a complete conversion to Shari'a law is improbable, the caliphate may take some steps in that direction. Finally, the caliphate is unlikely to be as corrupt as past regimes and will probably govern with a firmer hold on the country's educational and legal systems. The important unknown is how it will choose to alter oil revenue distribution and how any such actions will be perceived in the delta region. If the caliphate makes the wrong choices, MEND may pick up enough momentum in recruiting, funding, and popular approval to attempt a take-over of the delta.

Impact on US National Interests

Nigeria's failure and possible collapse would threaten some of America's national interests. Decreased or eliminated Nigerian oil exports would obviously threaten America's economic interests. Also, regional stability in all of western Africa could be compromised, and a limited civil war could result in a massive humanitarian crisis. We will consider the relative magnitudes of these threats to derive a well-reasoned ranking of necessary Air Force core functions for this scenario. The following analysis focuses entirely on the ramifications of a failed Nigerian state. For several reasons, we will not examine what steps might prevent Nigeria's failure.[29]

As mentioned above, a full-scale conflict between the Nigerian government and MEND could completely halt oil production for up to two years. To place this threat to US economic interests in perspective, we can quantify how this supply disruption likely would affect oil prices. Since temporary price spikes are unlikely to serve as the sole motivation for major US involvement in a Nigerian conflict, this analysis will focus entirely on long-term price effects.

Although Nigeria's sweet crude oil requires less refining than other grades and transport from Nigeria to the United States is particularly convenient, the most important factor in projecting Nigeria's share of future production is the country's share of current proven reserves. As of 2009, Nigeria's proven reserves constitute 2.72 percent of the world's total. In the absence of additional knowledge of specific production plans, this is a reasonable prediction of Nigeria's steady-state percentage of worldwide production. For ease of analysis, supply of and demand for oil are assumed to increase and decrease, respectively, linearly with price. Under a variety of assumptions concerning the long-run sensitivity of the supply of and demand for oil to price, loss of Nigerian oil exports would likely increase oil prices by 5 to 7 percent above the baseline price.[30] The price bump would cause the long-term real GDP to decline by close to 0.3 percent.[31] This translates to an overall effect of $45 billion per year in current dollars—probably insufficient to motivate unilateral US intervention.

The humanitarian crisis resulting from a full civil war is likely to be unprecedented in scope. As mentioned previously, Nigeria is the most populous country in Africa and one of the most populous in the world. Moreover, widespread poverty will make mitigation of the humanitarian toll quite challenging or impossible. Refugees could

number in the millions, and bordering countries do not possess resources to help. Such a large humanitarian crisis will motivate many countries to become involved.

Since Nigeria is universally acknowledged as providing the primary peacekeeping force in western Africa, the loss of regional stability is almost certain. However, all of the countries bordering Nigeria combined possess only a fraction of its population and wealth (table 3). If Nigeria's plight does not motivate the United States to intervene, it is highly unlikely that the failures of one or more neighboring countries would cause leaders to rethink this decision.

Table 3. Populations (in millions) and estimated GDPs (in billions of dollars) of western African countries

Country	Population	2009 GDP
Nigeria	154.7	353.2
Niger	15.3	10.8
Chad	10.3	15.9
Cameroon	18.9	42.6
Benin	8.8	13.4

Adapted from Central Intelligence Agency (CIA), *The World Factbook 2009* (Washington, DC: CIA, 2009).

Since it has been established that US economic interests would not be as seriously threatened by Nigeria's collapse as intuition might suggest, protecting these interests will likely be insufficient to justify unilateral intervention without the presence of other threatened interests. In addition, threats to western Africa's regional stability will not move the United States to intervene. However, Nigeria's failure or collapse is likely to cause a massive humanitarian crisis, which will cause countries around the world, including the United States, to become involved.

The US Air Force's Role

The discussion in the previous section reveals the United States' roles in a Nigerian failed state scenario: (1) humanitarian assistance to relieve human suffering, (2) peacekeeping duties to prevent full-scale civil war, contain the conflict, and protect aid workers, and (3) operations to secure Nigeria's natural resources. Since the overwhelming scale of the human tragedy will shock the world, the United States will assume a leadership role in an international effort. Moreover, humanitarian assistance is likely to be the international community's number one priority, but it is difficult to carry out this mission without protection by peacekeeping forces. Therefore, the reader should keep in mind that these relevant core functions do not usually operate independently. The USAF core functions identified as central to success in this scenario are, in prioritized order: (1) rapid global mobility, (2) special operations, (3) agile combat support, (4) partnership building, (5) global integrated intelligence, surveillance, and reconnaissance (ISR), and (6) personnel recovery.

Rapid Global Mobility

The USAF must be able to rapidly deploy forces, materiel, and humanitarian assistance supplies. The magnitude of the crisis will almost certainly require a response much greater than the largest humanitarian airlift operation of all time, the Berlin airlift. The Air Force could not accomplish this mission with existing airlift capabilities. In fact, a forthcoming Air Force Center for Strategy and Technology report asserts that "the Air Force's current lift capabilities are grossly inadequate for the scenario."[32] Important capabilities lacking in today's Air Force include (1) platforms with global range without refueling, (2) the ability to operate without airstrips, and (3) platforms with sufficient size for self-support.[33] If the mission is to be successful, the future USAF will require these capabilities and a larger, modernized fleet of manned and unmanned platforms.

Special Operations

Special operations forces will help secure Nigeria's energy resources, conduct precision air strikes, and contain the conflict within Nigeria's borders. Although some conventional forces will be necessary, special operations will shoulder the majority of responsibility for these missions. To meet the requirements, the USAF will need to invest in additional special operations airlift, air support, and the next generation of remotely piloted aircraft for persistent surveillance and precision strikes.

Agile Combat Support

Because of the massive scale of humanitarian efforts required, a failed Nigerian state scenario essentially reduces to one of the most taxing tests of defense logistics networks imaginable. Therefore, the adequacy of future USAF agile combat support capabilities must be investigated. Since Nigeria is inarguably an austere operating environment, the USAF should possess the capability to field and support significant numbers of personnel and tons of materiel within such an environment. The USAF will also assist in force protection efforts and in establishing and securing forward operating locations. Finally, a strong logistics network will be instrumental in strengthening the coalitions that will be crucial to mission success.

Partnership Building

Partnership-building efforts undertaken today could be the key to succeeding in Nigeria in 2030. Enhancing Nigerian military capabilities through various activities, such as training Nigerian pilots, could, in fact, help ensure that the worst-case scenario never takes place. Airstrips and other infrastructure constructed before 2030 will prove invaluable to logistical efforts. Ideally, the US military will substantially strengthen partnerships continentwide through the efforts of Africa Command (AFRICOM).

Global Integrated ISR

The requirements for ISR capabilities in this scenario will be similar to current needs in Afghanistan and Iraq. However, intelligence requirements may be even more extensive since the number of insurgencies may greatly exceed those in current contingencies. This is a core function in constant need of improvement and modernization.

Personnel Recovery

The need for civilian and limited combat search and rescue operations is self-evident. Because of the large scale of the Nigerian crisis, demands in this area are likely to be much greater than what is required of the USAF in Afghanistan and Iraq. In fact, the number of civilian personnel involved in this effort will undoubtedly cause personnel recovery efforts to reach historic levels.

Summary

It is not difficult to envision failure, collapse, or even civil war in the Nigerian state by 2030. Several scenarios could lead to this outcome, and the US military must be prepared to deal with this contingency. Although US economic interests alone will not justify intervention, the massive humanitarian crisis that would unfold and the threat to western African stability will make some sort of US involvement almost certain.

With its current capabilities, the US military would be unlikely to succeed in a failed Nigerian state scenario. Although many of the required capabilities are similar to those needed in Operations Enduring Freedom and Iraqi Freedom, the United States is unprepared to deal with a humanitarian crisis of an unprecedented scale. Partners will have to become involved, and the United States must invest significantly in lift capacity. Extensive logistical networks will be required, and special forces will play an integral role in securing natural resources and preventing the spread of the conflict. The USAF should begin laying the foundation for this effort today by building stronger partnerships and structuring itself for success in this mission.

Notes

1. The Fund for Peace, "Failed States Index Scores 2010," accessed 29 September 2010, http://www.fundforpeace.org/web/index.php?option=com_content&task=view&id=452&Itemid=900.

2. A failed Pakistan would likely be more threatening to US interests. However, the United States is much less likely to allow Pakistan to fail. "Can Pakistan Stay Afloat?" *Newsweek.com*, 10 October 2008.

3. The *World Factbook 2009* indicates that approximately 50 percent of the Nigerian population is Muslim. Since Nigerian Muslims have a much higher birthrate and are currently a slim minority, Muslims are likely to constitute a strong majority in 2030. Central Intelligence Agency (CIA), *The World Factbook 2009* (Washington, DC: CIA, 2009).

4. International Monetary Fund (IMF), *Nigeria: Poverty Reduction Strategy Paper—National Economic Empowerment and Development Strategy*, Report no. 05/433 (Washington, DC: IMF, December 2005).

5. United Nations (UN) Department of Economic and Social Affairs, Statistics Division, *Population and Vital Statistics Report*, Statistical Papers, series A, vol. 61, no. 2 (New York: UN, October 2009).

6. UN Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2006 Revision, Highlights* (New York: UN, 2007).

7. CIA, *World Factbook 2009*.

8. Ibid.

9. Pathfinder International, *Reproductive Health Knowledge and Practices in Northern Nigeria: Challenging Misconceptions* (Washington, DC: Pathfinder International, 2007).

10. Dominic Wilson and Anna Stupnytska, *The N-11: More Than an Acronym*, Global Economics Paper no. 153 (New York: Goldman Sachs, 28 March 2007).

11. Ibid., 1. The N-11 countries' prospects for growth were quantified using growth environment scores (GES). Nigeria's overall score was the lowest of the 11 (ibid., 4).

12. US Energy Information Administration, "US Imports by Country of Origin," accessed 21 October 2010, http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbl_m .htm.

13. US Energy Information Administration, "International Energy Statistics: Total Oil Supply," accessed 2 April 2010, http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3cfm?tid=5&pid=53 &aid=1.

14. CIA, *World Factbook 2009*.

15. US Department of State, Bureau of African Affairs, "Background Note: Nigeria," March 2010, accessed 2 April 2010, http://www.state.gov/r/pa/ei/bgn/2836.htm; and Lauren Ploch, *Nigeria: Current Issues*, Congressional Research Service (CRS) Report RL33964 (Washington, DC: CRS, 12 April 2007).

16. IMF, "World Economic and Financial Surveys: World Economic Outlook Database," October 2009, http://www.imf.org/external/pubs/ft/weo/2009/02/weodata/index.aspx.

17. United States Agency for International Development (USAID), "Socio-Economic Factors, 2007" (briefing, National Intelligence Council, September 2007), 2.

18. Ola Awoniyi, "Nigeria's VP Takes Over from Ailing President," Agence France Presse, 9 February 2010, accessed 2 April 2010, http://www.google.com/hostednews/afp/article/ALeqM5i8DQENtzQXmEb HeJQbS9ZAlpVg1g.

19. International Crisis Group, *Want in the Midst of Plenty* (Washington, DC: International Crisis Group), 19 July 2006.

20. University of California, Berkeley, Center for African Studies, "Understanding Sudan: A Teaching and Learning Resource—Fact Sheet Six: Nigeria," 2009, accessed 4 April 2010, http://under standingsudan.org/Oil/OilResources/FS6-Nigeria.pdf.

21. Prof. Chukwuma C. Soludo, CFR, governor, Central Bank of Nigeria, "Nigerian Economy: Can We Achieve the Vision 20: 2020?" (presentation, 8 January 2007).

22. Carmen Gentile, "Analysis: Nigeria to Mimic Saudi Arabia," United Press International, *TerraDaily*, 13 September 2007, accessed 4 April 2010, http://www.terradaily.com/reports/Analysis_ Nigeria_to_mimic_Saudi_Arabia_999.html.

23. Transparency International, "Corruption Perceptions Index 2009," accessed 4 April 2010, http://www.transparency.org/policy_research/surveys_indices/cpi/2009/cpi_2009_table.

24. To take one example, Nigeria ranked 152d out of 158 in 2005. Transparency International, "Corruption Perceptions Index 2005," accessed 5 April 2010, http://www.transparency.org/policy_research /surveys_indices/cpi/2005.

25. Richard Silberglitt et al., *The Global Technology Revolution 2020, In-Depth Analyses: Bio/Nano/Materials/Information Trends, Drivers, Barriers, and Social Implications*, technical report 303-NIC (Santa Monica, CA: RAND Corporation, 2006).

26. Stephanie Hanson, "MEND: The Niger Delta's Umbrella Militant Group," CFR, 22 March 2007, accessed 4 April 2010, http://www.cfr.org/publication/12920/mend.html.

27. Ibid., 2.

28. Ibid., 5.

29. Foremost among these reasons is the desire to focus on what will be needed from the USAF in the most stressful foreseeable case. In addition, preventing Nigerian failure is assumed to require the efforts of multiple countries and US government departments. While the USAF would not be one of the leading participants in failure prevention, it would undoubtedly play an important role once failure has occurred.

30. Price elasticities of demand were taken from John C. B. Cooper, "Price Elasticity of Demand for Crude Oil: Estimates for 23 Countries," *OPEC Review* 27, no. 1 (March 2003): 1–8; and Noured-dine Krichene, *A Simultaneous Equations Model for World Crude Oil and Natural Gas Markets*, IMF Working Paper 05/32 (Washington, DC: IMF, February 2005). Price elasticities of supply were taken from Krichene.

31. US Energy Information Administration, "Economic Effects of High Oil Prices," 2006, accessed 7 April 2010, http://www.eia.doe.gov/oiaf/aeo/otheranalysis/aeo_2006analysispapers/efhop.html.

32. Christopher Kinnan et al., "Failed State 2030: Nigeria—A Case Study" (Maxwell AFB, AL: USAF Center for Strategy and Technology [CSAT], August 2009). (To be published as CSAT Occasional Paper no. 67 in late 2010.)

33. Ibid., 139.

Scenario 4

Jihadist Insurgency: 2030

After watching al-Qaeda challenge the United States and the West in Somalia, Afghanistan, Iraq, and elsewhere, disaffected citizens of Zendia united under the banner of the Mahalwi—true Mahdi clergy—for the purpose of directly challenging the monarchy. By 2030 Zendia is effectively split between an insurgency in control of two of its five most important population centers—also the two most important religious centers—as well as the northern third of the country (see fig. 5). The Zendian government maintains control of the south, east, and some of the west. Now Zendia is the center of violent Islamic fundamentalism.

Over the previous three decades, declining profits from the Zendian oil industry reduced the monarch's ability to maintain a rentier economy. Sunni fundamentalists took advantage of growing dissatisfaction, painting the royal family as apostate and puppets of the United States. They also claimed that declining government benefits were an example of the monarch's lack of concern for the physical and spiritual well-being of the people. State-sponsored Mahhadist clergy were also targeted by the Mahalwi,

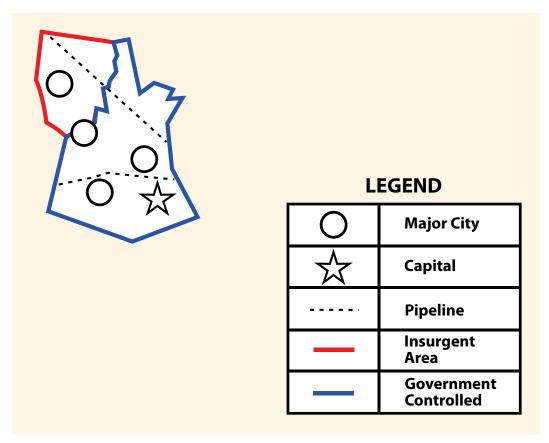| LEGEND	
◯	**Major City**
☆	**Capital**
- - - - -	**Pipeline**
—— (red)	**Insurgent Area**
—— (blue)	**Government Controlled**

Figure 5. Zendian political divisions, pipelines, and major cities.

who effectively drove a wedge between the people and the clergy—particularly in the most religious areas of the country.

Over the course of the insurgency, an alliance of convenience developed between disaffected tribal leaders, Zendian Shi'a, and the Mahalwi. This marriage of convenience unified government opposition. And with a nuclear-armed Iran funneling illicit weapons—some advanced—to Zendian insurgents, it became impossible for the royal family to suppress growing unrest in the major cities and elsewhere. By 2025 many mosques in more traditional areas were hotbeds of sedition under the control of the Mahalwi. Local police lost the ability to enforce the law as they and their families faced increasing personal violence.

The monarchy's gradual loss of control over the two major cities and the north was not due to conventional military force or a grand coup d'état, similar to the overthrow of Reza Pahlavi—Shah of Iran—in 1979. Instead, the current situation in 2030 Zendia resembles that of Colombia between 1999 and 2008 when the Revolutionary Armed Forces of Colombia (FARC) and the National Liberation Army controlled more than a third of the country.

While the Zendian royal family continues to govern a majority of the country—centered around the capital—as well as all oil production, there is disagreement within Zendian society and the monarchy as to whether the government should launch a full-scale military offensive to recover lost territory. In some instances, Zendians who support the development of a modern industrial state that is also moderate are willing to accept the de facto division of the country as a way to rid it of its most extreme elements. The government, however, recently turned to the United States for assistance in defeating the Mahalwi, Shi'a insurgents, and rebellious tribal leaders.

One important provision was imposed as a condition of any assistance from the United States. No large-scale American presence is allowed on Zendian soil. Thus, American forces—primarily air, naval, and special operations—must operate from bases elsewhere in the region or at sea. However, over the previous decade, a dramatic expansion of alternative energy and domestic oil and natural gas production freed the United States from Middle East oil. Currently, Zendian oil is exported to the developing world, leaving limited American interests at risk in Zendia. Thus, American leaders are reluctant to commit troops to the defense of the Zendian monarchy. But because US allies are concerned that violence will spread across the Middle East—and into Europe—the president is considering limited support, which will likely rely on airpower.

Zendia in 2030

Understanding Zendia's "human terrain"—composed of social, ethnographic, cultural, economic, and political elements—is a complex endeavor.[1] Zendia's 40–50 million inhabitants live in a society with a number of cleavages that are sometimes cross-

cutting but often at odds with one another.[2] Thus, Zendian society is deeply divided for a number of reasons.

Religion

The influence of religion—the single most significant variable within Zendian society—is pervasive. The state-supported Mahhadi sect of Sunni Islam has dominated Zendia's religious landscape since the establishment of the kingdom over 100 years before (in the 1920s). By the 1990s Mahalwi fundamentalists grew to challenge the Mahhadi religious establishment, which they view as heretical.[3] Mahalwists were joined in their fight against the government by some of Zendia's Shi'a population, who comprise 15 percent of the inhabitants.[4] Although 100 percent of Zendia's citizens are Muslim, internal cleavages within Islam are a primary factor for the current state of affairs.

Family and Tribe

Second only to Islam in importance to Zendian society is the family or tribe. The extensive network of familial relationships resembles a spiderweb and plays an important role in societal cohesion. Co-opting these relationships played a key role in enabling the monarchy's slow rise to power.[5] Conflicts between families or tribes can embroil large numbers of Zendian citizens and create localized unrest. Modernity, however, has weakened the relevance of tribal affiliations, but Zendian citizens are still aware of their tribe's prestige within society.[6]

Geography and Population

Zendia's four regions—the Hivaz (western), the Nokd (central), the Ator (southern), and the Heta (eastern)—are dominated by one of the world's most inhospitable landscapes (when the country expanded early in the century, the Nokd and Heta regions grew). With little arable land, Zendia's population is principally concentrated in urban areas that were once simple oases. The capital is home to an estimated 8 million people. Much of the nomadic tradition of the region is gone. The regions gained at the turn of the century are virtually unpopulated and have no importance other than their petroleum reserves. Almost two-thirds of Zendians are concentrated in the five major cities.

Age and Education

With a population growth rate averaging 2 percent over the last three decades, Zendia now has a large "youth bulge."[7] For those Zendians who do attend college, religion is the single most studied field. The focus on purely religious studies persists despite efforts to encourage the study of science, math, and engineering. While Zendia's industrial cities are in the south, the two religious centers controlled by the insurgents are also located in the south and are also home to the Mahalwi.[8]

Economy

Early in the twenty-first century the monarchy began implementing an aggressive plan to move the Zendian economy away from a heavy reliance on petroleum exports and toward a more diverse mixed economy. After almost a century of relying on oil as the principal means of economic prosperity, it was clear that the Zendian rentier economy was unsustainable—particularly after the national oil company reached peak oil production in 2025.[9] To prepare for the decline in petroleum as the foundation for the economy, the monarchy expanded government support for high-tech industry, creating entire cities devoted to research and development, manufacturing, and other enterprises.[10] The monarch also built the first coeducational university in the country, the Royal Zendia Institute of Science and Technology, in an effort to increase desperately needed human capital in core science and engineering fields.

Despite government efforts to diversify the economy, the problem of high unemployment among young men persists. Nearly three decades ago (2007), 44 percent of unemployed Zendians were between the ages of 20 and 24.[11] Three decades of aggressive moves toward a technology-driven economy were meant to reduce Zendian dependence on high-skilled foreign labor but were only partially successful. As a result, the government was unable to alleviate high unemployment among young men.

Diversification, privatization, and foreign investment have failed to produce sufficient capital to replace declining petroleum export revenue. The government has found it difficult to overcome the rentier mentality of Zendian society. Thus, for example, domestic industry is uncompetitive in the global marketplace. Zendian workers are less productive than their foreign counterparts. This problem is clearly illustrated in the failure of Zendian industry to exploit a domestic supply of natural gas estimated at 240 trillion cubic feet.[12] The opportunity to replace petroleum with natural gas as a principal export was missed because of a dearth of domestic human capital with the requisite skills needed to develop a nascent natural gas industry. Although the economy has experienced regular growth for more than two decades, it has failed to meet the demands of a growing citizenry.

Politics

The ascent of the Zendian royal family to its current position is a story of unpredictable events. Many historians date the beginning of the royal family's rise to power back to 1725, when a minor amir in the Nokd, Mohammed al Zend ibn Wazzir, joined forces with a fundamentalist Sunni, the self-proclaimed Mahdi, Mohammad Rahma Ahmad Al-Mahhab ibn Jazeer.[13] Over the next two centuries, the Zendi family resorted to warfare, assassination, external political alliances, and the co-option of tribal leaders to ultimately found Zendia.[14]

Soon after its founding as an independent nation, the Zendian monarchy became dependent on petroleum exports as the source of revenue needed to sustain its patronage system. However, it was not until the 1950s that the Zendian government

began to receive mineral royalties sufficient to fundamentally reshape society.[15] With the nationalization of oil production between 1977 and 1982, the royal family gained effective control over the (then) world's largest petroleum company, which played a vital role in creating domestic Zendian political stability over the next several decades. But with a population that grew from 27 to 45 million citizens between 2010 and 2030, the monarchy lost the ability to sustain a strong patronage network.

The rise of the Mahalwi radicals occurred despite the introduction of democracy at the local level, the reform of education, and the transformation of the economy. Political division within the royal family—between moderates and conservatives—also provided the political space needed by radicals to achieve critical mass. Internal division, territorial gains, and the rapid succession of elderly kings between 2010 and 2030 left the monarchy with a weakened hold over the institutions of government and less capable of suppressing challengers to the regime.

Technology

Advances in cyber warfare, nanotechnology, and remotely piloted aircraft (RPA) enabled opponents of the Zendian monarchy to wage an asymmetric conflict with unprecedented anonymity. While the Mahalwi and their Shi'a allies did not develop these or biological weapon technologies, they were able to acquire advanced technological and biological weapons whose potency and lethality were enhanced by developments in nanoware.[16] Selective targeting with enhanced biological weapons enabled insurgents to assassinate members of the monarchy, public officials, and anyone who criticized their objectives.

Equally important to the success of the insurgency was the ability of insurgents to use advanced cyber capabilities. Insurgents successfully attacked the Zendian military's command and control networks.[17] Because of Zendia's reliance on advanced American technology, hackers were able to disrupt military operations when attacks against insurgent strongholds were launched. False information was planted in electronic files, calling into question the integrity of intelligence and other data.

Regime opponents were also able to acquire micro-RPAs, which were deployed in urban environments for intelligence collection and, in some instances, armed attack.[18] Larger RPAs were also acquired and flown on intelligence and attack missions. Zendian government efforts to counter the use of advanced technology were successful in individual instances, but the widespread availability of a large spectrum of technologies made it impossible to completely prevent their use.

Identity and Motivation

For many in the West, Zendia may appear homogeneous, but Zendian society is cloven by three critical divisions.[19] First, the Sunni/Shi'a divide often pits the majority Sunni (85 percent) population against the minority Shi'a (15 percent). This has created lasting resentment among Shi'a, who still feel mistreated—a legitimate concern.[20] Second, Zendia is a country of many tribes. Tribal loyalties were co-opted

over a period of two centuries as the current monarchy slowly gained control of the country. Divergent tribal interests have, however, reasserted themselves as the monarchy has become increasingly incapable of maintaining a large patronage network. Third, the official Mahhadi religious establishment began to face a challenge from reformist, fundamentalist "true Mahdi clergy" more than a generation ago. The Mahalwi consider themselves uncorrupted by the regime, which they consider apostate.

As the population grew and oil revenues reached a plateau, the monarchy became less capable of maintaining the rentier economy so important in assuaging potential drivers of conflict. This situation, combined with a high unemployment rate among young men, makes the motivation behind the insurgency clear. The rise of al-Qaeda after the first Gulf War only served as a catalyst for disaffected Zendians, who felt increasingly alienated from a regime they felt was failing to meet its obligations to society. Disaffection was sufficient to drive the creation of an insurgency that was ultimately successful in gaining control over a large portion of Zendia.

Impact on US National Interests

With Zendia effectively divided between violent Islamic fundamentalists and the government, much of the world is deeply concerned over the fate of the nation for three reasons. First, Zendia's neighbors are concerned that violence will spread across the region and destabilize existing regimes as violent Islamist groups attempt to export jihad. Second, Western nations, particularly in Europe, fear an accelerated spread of terrorism to their shores. European leaders of countries with large Muslim populations are concerned with the threat of widespread terrorism inspired by the success of the Mahalwi. Third, there is real concern among many developing nations—some American allies—that a spike in the price of petroleum and a likely decline in production will lead to a collapse of fragile economies.

For the United States, the proper response to the Zendian insurgency is unclear. Because Americans spent much of the past two decades developing renewable energy, expanding domestic oil and natural gas production, and increasing the nation's nuclear power capacity, the United States no longer directly or indirectly depends on Middle East oil. Thus, America is less active in Middle East affairs. However, no other nation has eclipsed the United States in relevance to the region. This leaves the president facing intense pressure to act, as allies in the Middle East, Europe, and elsewhere call for American assistance to Zendia.

For the United States, three national interests are potentially threatened by the current crisis in Zendia. First, the American homeland may face an elevated risk of terrorism due to the magnitude of the successes achieved by terrorists in Zendia. Recent advances in technology enable terrorists to pose an unprecedented threat to national security. Advances in, for example, nanoware, RPA, and miniaturization coupled with chemical, biological, radiological, or cyber warfare could prove devas-

tating for the United States.[21] However, it is unlikely that terrorism has the potential to pose an existential threat to the United States.

Second, few countries benefit more from international commerce (free trade) than the United States. The potential disruption to the economies of trade partners—reliant on Middle East oil—could destabilize the international economy and cause great harm to American industry.[22] Should trade partners lose their ability to transport raw materials to the United States, the second-order effects have the potential to bring production in some American industries to a halt. Thus, consumers and producers will suffer.

Third, regional stability and the security of America's allies are at risk. The United States has a long-standing security arrangement with the Zendian government, based on a century of shared interests.[23] Abandoning Zendia would damage the credibility of the United States in the eyes of its allies and partners. Regional allies have supported the United States during previous operations, most notably throughout the crisis with Iran that played out between 2011 and 2014, though it should be noted that Zendia acquired additional territory and oil reserves as a result of US support.[24] Abandoning these allies would be a betrayal of a stable and enduring relationship. Similarly, although the strength of the North Atlantic Treaty Organization is no longer what it once was, the United States remains NATO's most influential member and is committed to stability in Europe. Thus, preventing the rise of Islamists in Europe is in the national interest.

While it is apparent that American interests are at risk in Zendia, an appropriate response is elusive. This is largely because threats to American interests remain unrealized. Currently, they largely fall in the category of potential threats. For this reason, the president has taken a cautious approach to the crisis and is looking to airpower as a primary tool for assisting the Zendian government.

The US Air Force's Role

As the president considers responding to the growing crisis in Zendia, the Air Force is reexamining its core functions and the capabilities it provides combatant commanders. This offers an opportunity to discuss Air Force core functions within the context of this scenario. Based on an understanding of the situation in Zendia and discussions with the royal government, five core functions are particularly relevant: (1) global integrated intelligence, surveillance, and reconnaissance (ISR), (2) global precision attack, (3) cyberspace superiority, (4) special operations, and (5) partnership building.

Global Integrated ISR

First, global integrated ISR and the capabilities it provides combatant commanders may be the single most important Air Force contribution to the defeat of violent Islamic fundamentalists in the region. According to Air Force Doctrine Document

2-9, *Intelligence, Surveillance, and Reconnaissance Operations*, "The goal of intelligence, surveillance, and reconnaissance (ISR) operations is to provide accurate, relevant, and timely intelligence to decision makers."[25] The American experience in Afghanistan and Iraq provides numerous examples of the effect adequate or inadequate ISR can have in the success of an operation.[26] Defeating the Mahalwi is likely to prove similar. Distinguishing between combatants and noncombatants; evaluating large amounts of human, imagery, and signals data; and selecting targets are perhaps the most critical contributions the Air Force can provide.

Separating good guys and bad guys will prove a daunting task that is made more difficult by the highly urbanized population of Zendia. When coupled with a prohibition of American troops on Zendian soil, the ISR provided by the Air Force's satellites and aircraft (manned and unmanned) will serve as a principal tool for successfully determining insurgent strongholds and separating the Mahalwi from loyal Zendian citizens. The persistence provided by Air Force surveillance and reconnaissance platforms is a distinct advantage few can replicate. Given the importance of intelligence in irregular warfare, there is good reason to suggest global integrated ISR is the single most important Air Force core function, as it relates to the crisis.

Global Precision Attack

Second, global precision attack will play a critical role in supporting Zendian efforts to defeat insurgents. Specifically, strategic attack and counterland capabilities can assist Zendian land forces in regaining control over disputed territory. Like global integrated ISR, the capabilities that comprise global precision attack are often unique to the US Air Force and are replicated by the militaries of other nations.

Global precision attack is defined as "the ability to hold at risk or strike rapidly and persistently targets anywhere on the globe and to create precise, swift, and decisive effects across all domains."[27] Because the United States is currently denied land-based access to the northern third of the country, Air Force strategic attack capabilities may "weaken the adversary's ability or will to engage in conflict," providing the Zendian army an opportunity to decisively defeat the insurgency.[28] If, however, strategic attack is unsuccessful in disrupting critical leadership functions, infrastructure, and strategy, a second precision-attack capability is available.

Counterland operations are designed to "dominate the surface environment by crushing an enemy's ability to fight on land."[29] Providing Zendian land forces with tactical air support may afford the Zendian government the opportunity to achieve victory.

Cyberspace Superiority

Third, for three decades, nonstate actors have turned to cyberspace as a place to plan operations, spread propaganda, acquire open source intelligence, and conduct attacks. Although the United States maintains a more advanced cyber-attack and defense capability than the Mahalwi or any other nonstate actors, civil and mili-

tary networks remain vulnerable. Thus, cyberspace superiority is a core function that is of particular relevance to the Air Force.

Cyber operations are "the employment of cyberspace capabilities where the primary purpose is to achieve objectives in or through cyberspace. Such operations include computer network operations and activities to operate and defend the global information grid (GIG)."[30] Because of the Air Force's heavy reliance on cyberspace, a network interruption, for example, could have dire consequences and must be prevented. As Joint Publication (JP) 2-01.3, *Joint Intelligence Preparation of the Operational Environment*, states, "Depending on the criticality of the system, the effects of data loss or even a short down time can result in a lingering ripple effect on military operations that may last days, weeks, or months."[31]

Denying the use of cyberspace to the Mahalwi is a capability that can seriously degrade insurgent communications and funding. Cyber attacks upon insurgent communications should be undertaken before commitment of airpower. The banks used by the Mahalwi for weapons purchases and for channeling external funding for the insurgency are well known, vulnerable to US cyber attack, and shunned by US allies and Zendia. US cyber capabilities can, and should, be employed from CONUS to strengthen the military command and control as well as civilian cyber defenses of Zendia and to preclude further disruptive cyber attacks by the insurgents. Zendia's use of cyber operations to spread counterinsurgent propaganda is strongly encouraged. The Air Force can provide technical advice regarding techniques and technologies to employ. The insurgents' reliance upon RPAs places this ability at risk; cyber efforts should be directed at disrupting the insurgents' ability to employ RPAs by both traditional jamming of RPA signals and disruption of RPA flight control commands at their flight control centers.

Conversely, US Air Force operations must be protected since they will be at risk once the United States begins support of Zendia. Therefore, entering an advanced state of cyber defense before operations commence is desirable. The unknown factor is the capability of the adversary. It is probable that non-Zendian terrorist groups will provide cyber assistance to the insurgency. Therefore, it is imperative that all US cyber operations appear to originate from Zendian cyber systems. Preventing the penetration and disruption of Air Force cyber operations is absolutely necessary.

Special Operations

Fourth, special operations play an important role in facilitating multinational and interagency interoperability.[32] Airmen in the special operations community serve as forward air controllers, conduct surveillance, seize and operate airfields, extract downed pilots, undertake direct attack missions, and have the cultural and linguistic expertise needed to facilitate joint operations with Zendian forces. They, more than any other group in the Air Force, are trained to work with foreign air forces in a train, advise, and assist capacity, which is likely to prove valuable in Zendia.

The American experience in Operations Enduring Freedom and Iraqi Freedom demonstrates the particular relevance for special operations forces.[33] For example, in the earliest days of Enduring Freedom, it was Air Force forward air controllers attached to Army special operations "A-Teams" who called in air strikes against Taliban and al-Qaeda positions. In Iraq, Airmen participated in a number of covert and clandestine operations while working with American allies. American assistance to Zendia will undoubtedly call upon the skills that proved critical in Afghanistan and Iraq.

Partnership Building

Fifth, defeating violent Islamic fundamentalists in Zendia requires building partnerships across the region. Because the American contribution to the restoration of Zendian control will primarily take the form of airpower, the Air Force should plan to establish, sustain, and expand strategic partnerships while providing partners the capability and capacity necessary to provide for their own security.[34] As the *Building Partnership Capacity: QDR Execution Roadmap* (2006) states, "Whenever advisable, the United States will work with or through others: enabling allied and partner capabilities, building their capacity and developing collaborative mechanisms to share the decisions, risks and responsibilities of today's complex challenges."[35]

The Zendian government's precarious position forced the king to seek American assistance. But for the United States to conduct air operations in support of the Zendian government, the Air Force will need regional bases from which it can operate. Thus, the partnerships the United States builds with Middle East governments will influence the overall success of American operations.

Summary

The preceding scenario envisions what is undeniably a future that will require American intervention. However, the circumstances surrounding the scenario make the role of the United States less readily apparent. No longer directly or indirectly reliant upon oil from the region, the United States has less incentive to spend the nation's blood and treasure in the defense of a government that often takes positions at odds with American interests. Thus, secondary interests draw the United States into what is a civil war. Fear of spreading violence and potential disruptions to the global economy lead the United States to act.

Because the Zendian government fears that an American presence in the country will only inspire insurgents and their supporters, US troops are not allowed on Zendian soil. This leaves air and cyber power as the primary tools available to the United States. Given the parameters of the scenario, global integrated ISR, global precision strike, cyberspace superiority, special operations, and partnership building are the Air Force core functions most relevant to American success. Excluding the remaining Air Force core functions from this scenario does not suggest that they

are irrelevant. The fact is that different scenarios will call upon a variety of capabilities. This scenario provides an opportunity to cover one area of planning that the Department of Defense and Air Force must consider.

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About the Contributors

Anthony C. Cain, PhD, is the deputy director of the Air Force Research Institute (AFRI). He has served as the AFRI dean, founding editor-in-chief of *Strategic Studies Quarterly*, and editor of *Air and Space Power Journal*. His publications include T e *Forgotten Air Force: French Air Doctrine in the 1930s* (Smithsonian Institution Press, 2002) and a chapter in *Why Air Forces Fail*, eds. Robin Higham and Stephen J. Harris (T e University Press of Kentucky, 2006).

Col Larry D. Carter, USAF, retired, is a military defense analyst for AFRI, with a broad background in education, research and development, national security strategy, and strike and attack operations. While on active duty, he commanded the 79th Fighter Squadron and the 48th Support Group. He has published articles in the *Air and Space Power Journal* and the Royal Air Force's *Air Power Review* and was chief editor of *A-10s over Kosovo* and several editions of the Air University "Research Bulletin."

Col John L. Conway III, USAF, retired, is a military defense analyst for AFRI and has served in numerous intelligence assignments supporting reconnaissance, f ghter, airlif , special operations, counterdrug, and space and missile missions. He held senior assignments at Headquarters Air Intelligence Agency, the North American Aerospace Defense Command, and the National Security Agency.

Col Karen W. Currie, PhD, USAF, retired, is a military defense analyst for AFRI. During her 28 years of active duty with the USAF, she taught at the Air Force Institute of Technology, the Defense Institute of Security Assistance Management, and the Air War College and commanded the Air Force Logistics Management Agency.

Chad Dacus, PhD, is a military defense analyst for AFRI. His research focuses on economic issues relating to national security. Prior to joining AFRI, he conducted research on readiness and infrastructure for the Center for Naval Analyses.

Col Steve Hagel, USAF, retired, is a military defense analyst for AFRI. As a logistics of cer, he served at the base, MAJCOM, center, joint, and Headquarters Air Force levels as a planner, researcher, war gamer, instructor, and strategy and doctrine developer. As a civilian, he has served as a logistics subject matter expert, a senior reliability analyst and process improvement specialist at FedEx Corporation, and a university instructor of logistics, transportation, and business.

Dale Hayden, PhD, is the chief of research for AFRI. He has served as deputy director and as a military defense analyst within the research institute. His recent publications include the 2008 Air Force Strategy Study, *In Service to the Nation* (editor), "Airmindedness" (*Air and Space Power Journal*, Winter 2008), and "T e Success of our ICBM Force" (*High Frontier*, 2009).

Lt Col Jeffrey Hukill, USAF, retired, is a military defense analyst for AFRI. His principal research interests include integration of air/ground operations, joint force command and control, USAF force presentation, and effects-based approaches to operations. He has been published in such periodicals as the *Armed Forces Journal*, *Joint Force Quarterly*, and *Defense Analysis* and in various Air University Press titles.

Col David "Scott" Johnson, USAF, retired, is a military defense analyst for AFRI, where he also serves as the leadership, strategy, and planning branch chief. His research interests include leadership, force development, planning, command and control relationships, and presentation of forces.

Adam B. Lowther, PhD, is a military defense analyst for AFRI. He is the author of *Americans and Asymmetric Conflict* (Praeger, 2007) and editor of *Terrorism's Unanswered Questions* (Praeger, 2009). His writing has also appeared in academic journals and major newspapers.

Lt Col Martin R. Stytz, PhD, USAF, retired, served as a military defense analyst for AFRI and is a subject matter expert in computer and information security and cyberspace. He has published extensively in academic journals, conferences, and monographs; appeared on television; and been on the editorial board for several security publications.

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