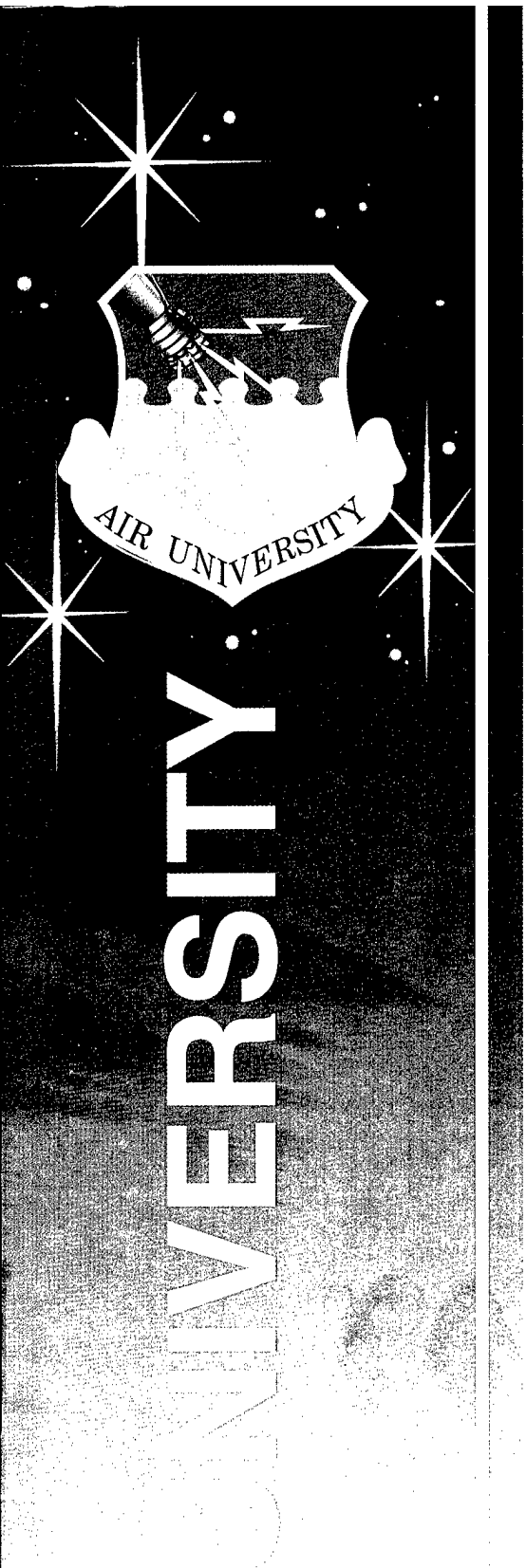

The Transformation Trinity

A Model for Strategic Innovation and Its Application to Space Power

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School of Advanced Airpower Studies

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Abstract

"The world that lies in store for us over the next 25 years will surely challenge our received wisdom about how to protect American interests and advance American values." With these words, the Commission on National Security in the 21st Century captured the exciting challenges this study sets out to explore.

First, this study develops a generalized model for United States military transformations in peacetime. To develop the model the author combines observations made by several historians about recurrent trends in military strategic innovation. The author concludes that, after taking into account inevitable uncertainty, there are three identifiable factors that occur in most cases of military transformation. The three key factors are the need for a coherent, congruent vision; an emerging culture that bolsters the vision and develops competing theories of victory to fulfill the vision; and a process for honestly assessing the maturing vision and its supporting theories of victory. After defining the limitations of the model and its usefulness, the author applies the framework to an important aspect of national security—the future of space power.

The framework is used to study the recent approach to space power from a civilian policy and military application perspective. Application of the transformation model highlights some important points about the present approach for developing space power. First, the civilian vision is not completely congruent with the military vision and the military vision is inconsistent. Second, the military—primarily the Air Force—has made moderate but hesitant progress towards nurturing a space power culture with some unexpected consequences. Third, the military has an uncoordinated, haphazard approach to assessment that blurs the merit of the space power vision and associated theories. The study closes with recommendations about how to apply the model in the future and possible approaches to the challenge of strategic innovation with regard to space power.

About the Author

Maj Bruce H. McClintock was commissioned upon graduation from the United States Air Force Academy with a bachelor of science degree in astronautical engineering in 1987. He received a master of science degree from the University of Florida. Upon graduation from Euro-NATO Joint Jet Pilot Training, he completed his first operational tour as an A-10 pilot at RAF Woodbridge, United Kingdom, where he upgraded to instructor pilot and flight examiner while flying missions in Europe, Turkey, Saudi Arabia, Kuwait, and Iraq. In 1992 he attended USAF Weapons School and then served as the squadron weapons and tactics officer for the 354th Fighter Squadron, McChord Air Force Base (AFB), Washington. Major McClintock attended the USAF Test Pilot School in 1995. From 1996 to 1998, he performed envelope expansion and weapons testing on the F-16 and A-10 as a member of the 39th Flight Test Squadron, Eglin AFB, Florida. A senior pilot with over 2,500 hours in 35 different aircraft, Major McClintock is a 1999 graduate of Air Command and Staff College. He is happily married to the former Tamara Huxell and has three daughters: Brittany, Victoria, and Alexandra. Upon graduation from the School of Advanced Airpower Studies in 2000, Major McClintock was assigned to the Space Warfare Center, Schriever AFB, Colorado.

Acknowledgments

No intellectual journey is completed without encountering some peaks and valleys. My short journey was filled with both; but thanks to those I encountered along the way, I stand much higher today than when I started. I truly believe that any of my fellow explorers could have reached higher than I did here, so for any missteps others might find when they retrace my path, only I am to blame.

I wish to thank Lt Col Peter Hays and Dr. Karl Mueller, my School of Advanced Airpower Studies advisor and reader. Colonel Hays, your enthusiasm and tremendous knowledge of space power history and policy impressed and inspired me to start this expedition. Dr. Mueller, your guidance, humor, and commitment to perfection proved to me that professionals come in many forms—and there are many authentic patriots, many who have never worn a uniform.

I started this venture as a novice, so the ideas I capture here are really the lessons I learned from a multitude of seasoned travelers. There were too many to thank here in detail, but I want to mention a few who reversed their own course to make sure I did not lose my way. Jane Adkison and her cohorts at the Space Warfare Center welcomed me into the forbidden land of Schriever and opened many doors for me that were closed to even them. Col Dave Anhalt, Rick Boller, Larry Brady, Dana Johnson, Tom Walker, Brian Anderson, and Maj Gen William Looney spent hours expertly explaining the challenges of travel in the foreign areas I stumbled upon. Colonel Anhalt, your support and direction was particularly important because it came when I was closest to my personal summit; when the air was most rarified and I might have stopped short. I thank you all for your patience.

Finally, I want to thank those that were always by my side regardless of the climate. God, You are my true guide, and I thank You for my many blessings. Tammy, you are the greatest of those earthly blessings, and I thank you for allowing me to climb when I should have let you rest. Brittany and Tori, thank you for reminding me that no intellectual summit is as important as you. I promise you and Alexandra I will always remember that.

While my journey has been a modest one in many ways, I can see much farther now than before I started. I hope that others who choose to travel this path can say the same when they reach the end.

Chapter 1

Introduction

The world that lies in store for us over the next 25 years will surely challenge our received wisdom about how to protect American interests and advance American values.

—The US Commission on National Security in the 21st Century

One does not have to look far to sense a common theme about the uncertainty that faces the United States in the future. In response to the future strategic environment, some call for a dramatic transformation of the "outmoded" US security structure. There is some bipartisan, but certainly not unanimous, agreement that a transformation strategy is needed to move beyond current security structures to those the nation will need in the future.[1] Still others claim that future success depends on refining existing concepts of warfare.[2] Some openly deride the military's awkward approach to the strategic future, while others denounce utopian efforts that risk current security to prepare for ambiguous future threats.[3]

These views raise several general questions about the US military and its ability to make major changes in the way it fights. Is there a pattern of strategic innovation that can help leaders shepherd change, or are military leaders prisoners of contingency—doomed to train for the last war only to scramble in response to an unforeseen or ignored last-minute development in combat? If there is a way to view innovation, in spite of all the uncertainty and contingency, is it a useful concept for military leaders or a plaything for the intellectual elite? I offer answers to these questions in preparation for the main study. In spite of omnipresent uncertainty, I find there are some common conditions of transformation worth studying. This study presents those aspects in a way useful for today's leaders challenged with adapting current military forces to the future strategic environment.

A superb example of the formidable task facing leaders is the long-running debate about how the United States should use space. The space operations issue epitomizes the broader debate about how the military is preparing for the future.[4] Military and civilian leaders both agree that space will become a critical and competitive environment requiring military control.[5] There is, however, little agreement over the best approach to capitalize on the promise of space power. I apply the trends apparent in historical transformation discussed earlier to develop a framework for studying the case of space power. I then investigate the last two decades of space power development to answer the following question for military

leaders: Is the United States military effectively transforming space power in order to enhance national security over the next quarter century?

How Is This Study Different?

This work draws on a large body of scholarship in order to develop a conceptual model of innovation. There are countless studies of military history investigating major changes in a *specific* method of warfare.[6] There are also several broad descriptive accounts of change throughout the course of warfare.[7] There are considerably fewer works that attempt to distill the events of history into meaningful *patterns* of change.[8] The main reason for this paucity of focused research is the sensible caution against a precise theory of innovation. This study avoids offering a predictive paragon, but it does refine the innovation trends articulated in a variety of sources. The focus on the US military and peacetime transformations results in a method to study the military and evaluate the *potential* for intended transformation.

With respect to space power, there is a large body of general historical investigations along with some works focused on military space.[9] In addition, there is a glut of books, studies, and articles on how to organize space forces, whether or not to use weapons in space, and the overall promise of space.[10] Many of these works are important and deserve careful inspection. What is lacking, however, is an analysis of how the military has attempted to make dramatic changes regarding space power since the emergence of a separate space command and the implications for the future. I offer just such a study here.

This paper studies the military's prospects for major change in one particular area: space power. Space power was chosen as an area for review because there are convincing arguments that the United States is growing increasingly dependent on space—militarily and economically.[11] In addition, the emerging strategic environment indicates the possibility of major changes in space power policy. For example, the demise of the Soviet Union allows more latitude in crafting space policy.[12] I believe there is a vast reservoir of ideas about how to develop space power, currently held back by an ever-weakening dam of policy largely crafted over 40 years ago.[13]

I broadly define space power as the spectrum of military operations possible in and through space, ranging from space support and force enhancement to space control and possibly force application.[14] Civilian and commercial space applications are important but are beyond the scope of a study of military transformation. While military space power includes the potential for active space control and force application, I avoid arguments over whether or not the United States should place weapons in space and which tools or weapons to use to exploit space power. This study focuses on the method rather than the objective of transformation for two reasons. First, there are already myriad efforts that offer preferred purposes for space power. Second, these debates are just one facet of the

larger concept of innovation discussed here. So while this study does not offer specific answers to space power questions, it does make a case for particular factors determining how well the military is transforming its understanding of space power. Rather than offer the "best" path to space power, this work offers a concept for evaluating how well the military is pursuing its chosen path. In the process, the value of the chosen path is implicitly considered.

This study is important because the military in general, and the Air Force in particular, have a bad reputation concerning their ability to innovate.[15] While the military often chafes at the accusation, the historical record indicates that this reputation is often fitting. Some downplay the lack of dramatic change within the services since "transformation aversion" is typical for large bureaucracies. But the military is not just any large organization. The military is charged with the defense of the nation, so failure to adapt quickly carries greater risks. Military misfortune does not imply another corporate merger or an insolvent corporation, military failure could mean lives lost and freedom threatened.[16]

In that light, this study is intended to be useful to military leaders who want to foster dramatic change. Much of this interest will be among space leaders and operators, but that is just a fraction of the intended audience. Senior leaders may find the history of the military space power vision enlightening. In particular, lessons on how a service vision may (or may not) lead to new career paths may surprise space and missile operators. Discussions about how effectively the military assesses its emerging theories of victory through war games and exercises lead to some surprising conclusions. Beyond the space arena, the study offers a comprehensive model for analyzing any potential military transformation. For instance, this study should be useful to military leaders struggling with the future of information operations or unmanned air vehicles. In sum, this work should interest anyone in the military who wonders how their organization grapples with unpredictable change.

Organization

The first step in this process is to devise a theory of transformation. Chapter 2 begins by discussing how a thorough study of history highlights the significant role of chance in shaping events. This factor leads to the underlying framework for this model—a tool helpful for observing nonlinear change in an uncertain environment. Chapter 2 also investigates and explains why attempts to study innovation are natural and necessary. I further develop the key aspects of the model based on an inductive analysis of historical trends supported by deductive reasoning. Three factors emerge that repeatedly influence the probable success of innovation: a coherent, congruent vision from senior military and civilian leaders; an evolving culture with pathways for officers that welcome the new vision; and, finally, an environment that encourages and responds to honest assessment of the competing theories of victory designed to fulfill the vision.

Chapters 3 through 5 each apply an element of the model to the case of space power. Significant events that influence each facet of the model are studied in the context of the expected patterns of innovation. The analysis in this area is based on review of major policy documents, military plans and pronouncement, academic "future" studies, demography, interviews with senior leaders and action officers, and records and data from exercises, war games, and trades studies.

Chapter 6 draws together the conclusions from the previous chapters. It provides a summary of the most basic aspects of the transformation model while stressing the nonlinear design of the model. For the specific case of space power, the conclusions are summarized and several recommendations are offered to help future space leaders improve the opportunities for innovation.

Limitations

There are four limitations of this study, two intended to focus the research and narrow the scope of the argument and two that were unanticipated. First, while classified operations were reviewed and classified interviews conducted, the study makes minimal reference to classified documents, and it is written at the unclassified level. While an unclassified report cannot address many of the details of space power, it does allow greater dissemination. If this study of space power later proves superfluous because history exposes truths that are currently hidden, then at least the study serves to reinforce the old observation that "we don't know what we don't know."[17] In that case, the argument that classification often stifles many of the facets of innovation would be reinforced. Specifically, the opportunity for honest assessment was lost at an unknown cost to the pace of transformation. In any case, the model will still apply to other aspects of military innovation.

Second, the study is focused on the last 20 years of *military* space power development. There are numerous accounts that skillfully describe the early space era, and these are cited when appropriate. For this study, research focused around significant factors that applied to the model since the advent of a separate space command within the Air Force (AF Space Command [AFSPC]) and a unified space command (US Space Command [USSPACE]). While 1980 provides an approximate boundary, the research goes as far back as necessary to draw conclusions relevant to each area of investigation.

Two other limitations resulted from unanticipated impediments to this work. The first speaks volumes about the current culture of the Air Force. Any attempt to research the career paths available to space and missile officers over the course of history was expressly prohibited by the responsible headquarters.[18] As a result, this report was forced to emulate earlier studies that used general officer demographics to draw conclusions about officer career paths. The resulting conclusions are still valid, but they would be more forceful if they had the full weight of statistical evidence

behind them. The difficulty of studying officer demographics demonstrates the importance of cultural issues imbedded in the model.

The second external limitation proved more of a disappointment than a restriction. While populated by an extremely helpful staff, the AFSPC history office could not provide the author with official command histories beyond 1993 because they do not exist.[19] While there are several worthwhile command-sponsored books that chronicle the unclassified history of USSPACE and AFSPC, they are no substitute for the level of detail and depth contained in official, classified history documents. It seems likely that many important aspects of the AFSPC story will be lost over time due to this documentation strategy.

In light of the final point, this study hopes to make at least a small contribution to the military space story. It is a story too important to be left untold.

Notes

1. The White House, *National Security Strategy for a New Century* (Washington, D.C.: 1999), 23–24. See also National Defense Panel, "National Security Strategy in the 21st Century: The Challenge of Transformation," *Joint Force Quarterly*, Summer 1997, 15–19. The National Defense Panel was established by Congress to conduct an independent, nonpartisan, comprehensive force structure review following the 1997 Quadrennial Defense Review.

2. For a summary of the spectrum of views regarding the nature of change in the military, see Eliot A. Cohen, "American Views of the Revolution in Military Affairs," in *Advanced Technology and Future Warfare*, Begin–Sadat Center for Strategic Studies, Mideast Security and Policy Studies No. 28, 7 April 1997, 1–11, on-line, Internet, 29 September 1999, available from http://www.biu.ac.il/SOC/besa/books/28book1.html.

3. Ibid., 6–9; Ashton B. Carter and William J. Perry, *Preventive Defense: A New Security Strategy for America* (Washington, D.C.: Brookings Institution, 1999), 175–215, cautions against "complacency born of post-cold war euphoria"; and Williamson Murray, "Drifting Into the Next Century: The USAF and Air Power," undated unpublished paper, provides a polemic view regarding Air Force myopia in the face of future threats.

4. The best example of ongoing concern about the Department of Defense approach to space is the space commission established to assess current national security space management and organization. *National Defense Authorization Act for Fiscal Year 2000*, Public Law 106-65, sections 1621–30 (5 October 1999). For a short discussion, see Colin S. Gray and John B. Sheldon, "Space Power and the Revolution in Military Affairs: A Glass Half Full?" *Airpower Journal*, Fall 1999, 23–38.

5. *National Security Strategy for a New Century*, 25–26. Specific recommendations from the *Report of the National Defense Panel*, Space Operations section, December 1997; US Commission on National Security in the 21st Century, *New World Coming: American Security in the 21st Century*, Phase I Report (Washington, D.C.: USCNS/21, 1999), 5, on-line, Internet, 8 May 2000, available from http://www.nssg.gov/Reports/reports.htm; Department of Defense Directive (DODD) 3100.10, *Space Policy*, 9 July 1999; and Defense Science Board Task Force, *Space Superiority* (Washington, D.C.: Office of the Undersecretary of Defense for Acquisition and Technology, February 2000). For additional military examples of this view, see chap. 3.

6. A few that cover the interwar period include Charles Messenger, *The Blitzkrieg Story* (New York, N.Y.: Scribner, 1976); Robert T. Finney, *History of the Air Corps Tactical School, 1920–1940*, USAF Historical Study 100 (Maxwell AFB, Ala.: USAF Historical Division, Air University, 1955); and James S. Corum, *The Luftwaffe: Creating the Operational Air War, 1918–1940* (Lawrence, Kans.: University Press of Kansas, 1997).

7. Martin van Creveld, *Technology and War: From 2000 b.c. to the Present* (New York, N.Y.: Free Press, 1991); J. F. C. Fuller, *Armament and History: A Study of the Influence of Armament on History from the Dawn of Classical Warfare to the Second World War* (New

York, N.Y.: Charles Scribner's Sons, 1945); and I. B. Holley Jr., *Ideas and Weapons* (Washington, D.C: Air Force History and Museums Program, 1983).

8. Two of the most important books on patterns of innovation are Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991); and Barry Watts and Williamson Murray, "Military Innovation in Peacetime," in *Military Innovation in the Interwar Period*, ed. Williamson Murray and Allan R. Millett (Cambridge, U.K.: Cambridge University Press, 1996). A study of transformation patterns with a focus on technological change worth review is Richard O. Hundley, *Past Revolutions, Future Transformations: What Can the History of Revolutions in Military Affairs Tell Us About Transforming the U.S. Military?* RAND Report MR-1029-DARPA (Santa Monica, Calif.: RAND, 1999). I am indebted to Dana Johnson of RAND for pointing out this work during the latter stages of my research.

9. Arguably the best work in this area is Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York, N.Y.: Basic Books, 1985). A dated but detailed view of the military aspects of space power is Paul B. Stares, *The Militarization of Space: US Policy, 1945–1984* (Ithaca, N.Y.: Cornell University Press, 1985). Michael J. Neufeld, *The Rocket and the Reich: Peenemünde and the Coming of the Ballistic Missile Era* (New York, N.Y.: Free Press, 1995) discusses the origins of space power. David Spires et al., provide the most current, albeit Air Force-centric, history of military space power in *Beyond Horizons: A Half Century of Air Force Space Leadership* (Maxwell AFB, Ala.: Air University Press, 1998). A very valuable, but spotty, account of various aspects of Air Force space history is found in R. Cargill Hall and Jacob Neufeld, eds., *The U.S. Air Force in Space: 1945 to the 21st Century* (Washington, D.C.: Air Force History and Museums Program, 1998).

10. A significant organizational study is Dana J. Johnson, Scott Pace, and C. Bryan Gabbard, *Space: Emerging Options for National Power* (Santa Monica, Calif.: RAND National Defense Research Institute, 1998). For one perspective on the case for weapons in space, see Karl Mueller, "The Phantom Menace: Assessing Threats to American Interests in Space," paper presented at the annual meeting of the American Political Science Association, Atlanta, Ga., 2 September 1999. For an alternative view, see Sen. Bob Smith, "The Challenge of Spacepower," *Airpower Journal*, Spring 1999, 32–39. The most recent Air Force studies were *SPACECAST 2020*, Department of the Air Force; Air University *SPACECAST 2020 Final Report*, vol. 1 (Maxwell AFB, Ala.: Air University Press, 1994); and *New World Vistas: Air and Space Power for the 21st Century*, Space Applications volume (Washington, D.C.: USAF Scientific Advisory Board, 1995).

11. *National Security Strategy for a New Century*, 25–26; The National Defense Panel, *Joint Force Quarterly*, Summer 1997, 18–19; *New World Coming: American Security in the 21st Century;* and United States Space Command, *Long Range Plan: Implementing USSPACE Vision for 2020* (Colorado Springs, Colo.: USSPACE Director of Plans, March 1998), 1–5.

12. A review of the present efforts to develop a national missile defense system supports this conclusion.

13. For a look at the origins and logic behind the "freedom of space" debate see McDougall, 135–94.

14. These four categories were introduced by the Department of Defense (DOD) in the 1980s and are still in use today. See DOD, *Department of Defense Space Policy*, 10 March 1987. More recently see DODD 3100.10, 6–9.

15. This trait is not unique to the military, but the closed nature of the military system often accentuates the characteristic. Most large organizations place a premium on "predictability, stability, and certainty." See Barry R. Posen, *The Sources of Military Doctrine* (Ithaca, N.Y.: Cornell University Press, 1984), 44–45, 54–57. On the Air Force, see Carl H. Builder, *The Icarus Syndrome: The Role of Airpower Theory in the Evolution and Fate of the U.S. Air Force* (New Brunswick, N.J.: Transaction Publishers, 1994). The Space Commission is one possible example of this reputation: "The (Senate Armed Services Committee) . . . is concerned that the Department of Defense (DOD) may not be ideally oriented—intellectually or organizationally—to fully exploit space for national security purposes." *Senate Armed Services Committee Report on the National Defense Authorization Act (NDAA)*, Report no. 106-50.

16. "We are thus faced with transforming national security structures while not precipitously abandoning central military capabilities that have kept us secure over the last quarter century. We ignore this summons at the Nation's peril." National Defense Panel,

Joint Force Quarterly, 15. For a polemic view that specifically criticizes the Air Force, consider Williamson Murray, "Drifting into the Next Century: The USAF and Air Power," n.d., unpublished paper.

17. Often attributed to Gen Charles Horner, this remark highlights how the employment of space capabilities is inhibited by overclassification.

18. While the promotion rates for pilots, navigators, and nonrated operations are publicly available, more specific data is sacrosanct. For more on this topic see the discussion in chap. 4.

19. The author's visit to the command history office (February 2000) and subsequent phone calls confirmed that there are no official histories after 1993. There is a five-year history document (1993–1998) under development, but no anticipated release date due to "a lack of manpower." Karen Martin, Air Force Space Command History Office, telephone interview with author, 8 May 2000. In a follow-up call, the head of the history office explained that due to senior officer guidance, office resources were devoted to unclassified publications with Air Staff approval and the end of 2000 expected a multiyear history. Dr. George Bradley, Air Force Space Command History Office, telephone interview with author, 30 May 2000.

Chapter 2

The Transformation Trinity

Innovation is a crapshoot.

—Adm William Owens

Is there an ideal model for military transformation? While proffering all-encompassing models of strategic innovation is reckless, several authors attempt to provide insight into patterns of innovation.[1] These studies demonstrate there are some recurring trends that warrant closer consideration. In that light, this chapter addresses the original question by systematically bounding the problem, then using the historical record and logical reasoning to identify potential facets of a transformation model.

First, I discuss the definition of innovation and transformation as they apply to my model. Next, I address the importance of contingency and its influence on likely patterns of transformation. The preponderance of the chapter then uses the rich historical record to refine patterns of innovation observed by others. This chapter offers a model of characteristics that appear through numerous cases of military transformation. Finally, the chapter closes with a discussion of other factors normally associated with transformation and explains why they are not explicitly included here. The final result is a convincing answer to the initial question. While there may not be one ideal model for transformation, there is substantial evidence to support recurring trends that warrant recognition and study.

Meaning and Method

The term *innovation* has gained increasing popularity in recent years. In its broadest sense, innovation means something new or unusual. This is how the term is used by the military—an innovation reflects any level of new equipment or application, from a field radio to a weapons system, from an idea to an organization.[2] Most of the authors that study military innovation imply strategic change.[3] Rather than invent new definitions, this work will return to the roots of the word and its basic meaning. When used here, innovation refers to *major* innovation—something new or unusual that emerges over a long period of time. In this sense, innovation is just the first part of true change. Many authors refer to innovation—the *introduction* of something new or different—when they were really talking about a change in the nature or function of something—transformation. While innovation writ large includes tactical changes and unproven ideas, military transformation requires the creation of a new hierarchy of combat arms. The new hierarchy occurs as a result of dramatic changes in

how the military intends to employ its resources. Innovation precedes transformation, and only rarely does true transformation occur. In sum, innovation is a necessary but not sufficient condition for transformation.

There are numerous examples of military transformation that fit this definition. The most common include the rise of "strategic" airpower, the development of carrier aviation, and the emergence of armored warfare—but there are many others.[4] These cases prove that transformation is possible, but they do not demonstrate that it is possible to model transformation precisely.

Why then, is it even necessary to study transformation? This is a reasonable question, but it suggests a sense of resignation. If one believes that "innovation is a crapshoot," the implication is that there is little reason to attempt to prepare for any future event. Granted, the Cold War world favored trend-based planning and "most-likely" future world scenarios suited to the perceived predictability of the era. However, during uncertain times such as today, no single, familiar future world is likely.[5] While there is less stability in today's world, civilian and military leaders must still make their best effort to plan in spite of unpredictability.[6]

In fact, transformation is *worse* than a crapshoot. A crapshoot is inherently linear, and the smart player knows the odds of each roll. Transformation, on the other hand, is a complex phenomenon involving interactive factors operating simultaneously resulting in a blend of order and unpredictability.[7] Nevertheless, it is the job of leaders to prepare for future uncertainties. While it cannot offer the luxury of simple probabilities available in a crapshoot, this model identifies the characteristics common to successful transformation for those who face the challenge of future leadership.

What makes this theory different? A common downfall of many models is their pursuit of universality. In reality, different organizations handle change differently; and innovation occurs for different reasons even within the same organization. This is true because there are multiple causal factors acting simultaneously. Any reasonably accurate theory of change breaks patterns of transformation into manageable categories.[8] For instance, in *Winning the Next War,* Stephen Peter Rosen separates American and British innovation into peacetime, wartime, and technological categories. More recently, noted historians Williamson Murray and Allan Millett focused on innovation in the period between the Great War and World War II among selected combatants.[9] These categories are important because they bound the application of their model. My model is limited to American peacetime military transformation. Since the focus is on strategic innovation, longer periods of peacetime better account for the gradual change necessary for military transformation. This chapter refines the paradigms of transformation articulated in a variety of sources and applies a new, limited framework. By narrowing the field and blending the elements that occur most often in the more detailed studies, a common pattern for successful conversion emerges.

This study also *applies* the model to present circumstances to draw conclusions for the future. The true benefit of any theory is its successful application to future circumstances. Nonetheless, this pattern is not a checklist. There is never any way to predict or, let alone, command innovation. Still, it is the job of the theorist to attempt an orderly interpretation of experience in order to guide future action. While more than descriptive, this theory does not claim to be prescriptive. At best, the model developed here is "counterpredictive"—it will help identify situations where transformation is least likely to occur (if elements of the model are ignored). In that light, this chapter offers general observations to help better understand innovations that could affect twenty-first century warfare by resulting in transformation.

The Model

The model has one overarching consideration and three major elements. Long-term innovation must adapt to an environment of unavoidable uncertainty. The existence of uncertainty highlights the importance of intuition as a precursor to the three elements of the model. First, civilian and military leaders must strive to recognize the changing security environment and encourage successful peacetime military innovation through coherent, congruent visions of the future. Next, credible senior military leaders need to catalyze and nurture the cultural modification necessary to develop competing theories of victory. Finally, as the culture changes, the emerging organization must create a process for candid assessment to develop, test, and refine the tools and ideas that fulfill the original vision. Working together with various levels of emphasis, these three aspects are present in all examples of peacetime military transformation. While presented in their typical order of occurrence, it is important to remember there is continuous interaction between the three elements that defies strictly linear application. The constantly changing facets of transformation repeatedly influence one another. In addition, the three facets can act at several levels (strategic, operational, and tactical) simultaneously. All three elements, however, depend on leaders able to accommodate uncertainty.

Adaptation to Uncertainty

Any attempt to bolster innovation must first acknowledge the significant impact of uncertainty. Uncertainty is the inability to predict precisely the outcome of events because of the influence of accident or chance on the course of history.[10] Uncertainty can influence all levels of events—from strategic to tactical. Carl von Clausewitz recognized the importance of chance in his writing, and in many ways it is that recognition that makes his work timeless.[11] There are volumes filled with examples in which seemingly unrelated events complicated all forms of innovation.

Even when services "try to do things right," their efforts can be thwarted by outside factors. This chaotic nature of transformation defies reductionist models that claim to provide linear solutions to complex problems that involve numerous actors, organizations, ideas, and rationales.[12]

The guarantee of uncertainty is not sufficient grounds to avoid adaptation to change. Even proponents of nonlinearity theory acknowledge that the absence of predictability does not imply the absence of causality.[13] More importantly, lack of clarity about future events accentuates the importance of intuition.[14] It is the importance of this insight that motivates greater understanding of transformation.

So how does one accommodate uncertainty? Theorists and historians have long tried to systematize planning to reduce the influence of contingency. J. F. C. Fuller developed a scientific framework to understand history and plan for future wars.[15] More recently, a RAND study sponsored by the Army presented a new strategic planning tool designed to account for uncertainty by hypothesizing about future strategic environments. The RAND model has gained wide acceptance within the Department of Defense (DOD).[16] The most common approach to uncertainty seems to be systematized hedging. Developing deliberate frameworks is helpful, but it is not a complete answer. Even the architects of these new paradigms acknowledge their limitations. For example, the authors of the RAND study wrote "Assumption-Based Planning is not a panacea. It does not obviate critical judgments. Planning under great uncertainty will only be as good as the insight and care of the people doing that planning."[17]

Insight is clearly important; unfortunately, there is no simple way to acquire it. In fact, Clausewitz referred to this concept at the operational level as "genius."[18] While the terminology has changed over time, there is broad consensus about how to "build" intuition to adapt to uncertainty. In order to gain intuition, leaders must attempt to understand fully the present and the expected security environments. A security environment is a combination of factors—economic, technological, and political—that have consistently influenced change over time.[19] These factors should be studied at the strategic level to build broader insights about potential future worlds.[20]

There are numerous examples of strategic insight, but one in particular will be used here. Historians have explained convincingly how the development of marine amphibious warfare was tied to an understanding of changes in the security environment.[21] Understanding the security environment does not result from cosmic inspiration, but from a carefully educated leadership aware of ongoing and potential shifts in the world order. The education to discern these shifts is not a simple process, but the added insight is necessary to adapt effectively to uncertainty.

Vision

Armed with strategic intuition, civilian and military leaders must initiate transformation through an innovative vision. Vision means "perceiving the future identity and mission within or for an organization." Studies

of organizations facing change show that "the single most determining factor for success in their adaptation is whether or not they have and can exploit an appropriate vision of themselves for decision making."[22] In the realm of military transformation, successful innovation depends on the vision of both civilian and military leaders.

Understanding both facets of the vision necessary for transformation is not as simple as some believe. Several theorists suggest that political leaders must provide vision for the services because the military is resistant to change.[23] Historians repeatedly cite the British government decision to favor interwar pursuit aircraft over bombers as an example of civilian leadership guiding stodgy military parochialism. While elegant in its simplicity, this perspective cannot explain most cases of long-term innovation. Rosen claims that political leaders have played a relatively minor role in the *advancement* of some innovations, but they can do much to stifle military innovation.[24] The *negative* impact civilians have on innovation is obvious. Since politicians control the purse strings, they can manipulate military budgets as well as how resources are allocated among different sectors of the military. In many cases, the military will "follow the money" to the preferred civilian mission at the expense of military visions that lack support. For example, Eliot Cohen cites the ineffectual development of armored warfare by Britain and France between the world wars because those governments saw little need for offensive forces on the continent. Put another way, there is a fine line between vision and hallucination—and it is often a budget line.[25]

This approach might lead one to believe that military commanders must devise visions that strictly follow national security policy. Taken at face value, this seems logical. However, while military commanders devise *present* plans that support civilian policy, there are numerous cases where civilian policy followed the lead of an emerging military vision. A common example is the US shift towards strategic bombardment before World War II as a result of emerging military theories of victory. While it eventually took the civilian leadership to bless the vision, the military vision actually shaped the civilian vision in this case and others.

The discussion above and most studies of organizational change demonstrate that both civilian and military leadership need to articulate their vision to catalyze transformation.[26] There are, however, many reasons why a proffered vision may prove inadequate. Often, military leaders cling to outmoded traditional visions or propose new visions that because of cultural or technical constraints, have little chance of success.[27] Just as often, civilian leaders try to force dramatic change on large organizations without allowing the time for those changes to take effect. In general, it is less important to argue over whether policy shapes strategy or vice versa than to recognize that miscalculations in either vision can lead to failure.[28] The one conclusive factor that emerges is that civilian and military visions must be harmonious for the transformation to have a chance.

This does not mean that visions must be immediately congruent. History demonstrates that the vision of one group can, over time, shape the views of other groups as long as the dominant vision is coherent. Even the military, equipped with a consistent, clearly articulated vision, can shape the views of the civilian leadership. The naval aviator devotion to the development of carrier aviation lasted for the 20 years that it took to fulfill the vision. Had this vision not remained consistent over time, the battleship admirals within the Navy could have easily squelched the transformation.[29] The consistent commitment to airpower present in both the Royal Air Force and the Army Air Corps also provided time for the eventual transformations. The power of consistency is supported by reason. The military vision must stand the test of time since the civilian vision is more likely to fluctuate with changing administrations.

The amphibious assault example demonstrates the significance of congruent, coherent visions. In 1920, Maj Gen John A. Lejeune, the Marine Corps commandant, recognized the growing importance of the amphibious assault mission. His vision of marine expertise in amphibious assault did not contradict the policies in place at the time, so the vision was generally congruent with the views of the other services. In addition, civilian recognition that the Pacific was an important portion of the American strategic environment encouraged development of war plans involving naval and ground forces working in concert. Just as important, the Marine Corps remained committed to the vision of amphibious assault for 20 years in spite of shifting support and interservice debate.[30] This example captures the common themes apparent in all of the cases mentioned earlier. It is worth noting that the vision advanced by General Lejeune was imprecise in nature. General Lejeune's vision recognized the potential of amphibious warfare in the future, but he stopped short of speculating how to best accomplish the new mission.

What follows are some concluding thoughts about the characteristics of a viable vision. When all leaders share congruent, coherent visions, transformation is more likely. A *congruent* vision is one that shares general acceptance by the civilian and military leadership. At a lower level, a truly congruent vision shares broad acceptance among the services. This congruence is difficult to achieve and provides one explanation for the infrequency of transformation. A *coherent* vision is one that is clearly stated and relatively constant over the longer periods needed for transformation. Leaders, both civil and military, can encourage success by acknowledging the uncertainty present in long-term innovation and recognizing the importance of a well-developed vision for the future. The interpretation of vision presented here highlights the measurable characteristics of congruence and coherency, but does not address the *validity* of the vision itself. This aspect is addressed later, but once again demonstrates the importance of senior leaders understanding the strategic environment. In sum, accurate political and strategic assessments of the security environment that encourage rather than inhibit innovation are prerequisites to success.

Culture

It takes credible military leadership to foster organizational change if a new vision calls for transformation, but organizational change depends to a great extent on changes to the broader group culture. Culture is the system of underlying, shared beliefs about the *critical* tasks and relationships within an organization.[31] While some popular definitions of culture compare it to the personality of an individual, this analogy ignores the fact that most large organizations have multiple subcultures. Even with multiple subcultures, a group that shares the overall purpose of the organization has what many theorists call a sense of mission.[32] This implies that some organizations lack a sense of mission—the US Air Force is often cited as a case in point.[33]

There are three important points to note about how a culture affects group performance. First, organizations in which two or more cultures struggle for supremacy will experience serious conflict. Second, organizations will resist taking on new tasks that are incompatible with their dominant culture.[34] Finally, changing an organizational culture takes time.[35]

Since the military is a collection of smaller groups struggling to legitimatize the activities of their members, there is an ongoing, time-consuming, ideological struggle to define new "theories of victory."[36] These theories of victory help determine the hierarchy within an organization. Those who accomplish critical tasks most important to the organization usually lead the organization.[37] Part of the reason civilians are less able to affect peacetime (vice wartime) transformation is because changing a culture is a long-term process which often outlasts their term of influence. It takes time for the military to turn an abstract vision of warfare based on the emerging security environment into concrete tasks and organizations.

There are numerous examples of successful military cultural change, but building on the amphibious assault example introduced earlier helps to clarify the point.[38] General Lejeune provided the vision of a growing role for amphibious assault, but it was up to his subordinates to develop potential strategies to fulfill the vision. Due to the small size of the Marine Corps, this task initially fell to one man: Maj Earl Ellis. Accepting Lejeune's vision, Ellis took the crucial step of converting the perceived need for a new war-fighting capability into definable tasks. Ellis's Operations Plan 712 provided a theory of victory that served as the basis for amphibious assault planning in the Marine Corps. This theory of victory provided a new identity for the corps as it searched for a strategic mission.[39]

All the evidence demonstrates that in order to succeed, respected senior military leaders must formulate a strategy for transformation that has both intellectual and organizational elements.[40] The intellectual component is the vision discussed earlier. The organizational component requires a growing pool of supporters committed to the long-term success of the vision. Many studies cite promotion opportunities as an important tool for change because in the services, rank equates to power. A few

examples of successful transfers of power based on new career paths include the development of carrier aviation, amphibious warfare, and airmobile operations.[41] While dominant cultures are resistant to change, the important point in these cases is that some members of the dominant culture accepted the need for change by developing the vision. This implies that a dominant culture can also change from the top down if the vision is consistently and clearly stated and enough leaders recognize the changes in the strategic environment. Military leaders have more time than civilians to develop followers that understand the intellectual underpinnings of the vision, and those followers are needed to develop the requisite theories of victory.

A few points warrant repeating. First, the leader with a new vision needs a group of supporters to develop a new culture that understands the vision. The supporters can then devise new theories of victory that fulfill the conceptual vision. Second, the dominant culture within the services (or service) will generally resist the change but may adapt to it. Finally, the required change to the military culture takes time, and this may make this aspect most important. In fact, it is often most neglected.

Assessment

With a vision of the future military roles based on insight into the future strategic environment, credible military leaders can nurture new groups to develop theories of victory to fulfill the original vision. Still, successful transformation depends on a military being willing to learn from open, honest assessment of competing theories rather than acceptance of a single "party line." Assessment includes exploration and evaluation with linkage to the original vision and the present environment.

Assessment is required for two reasons. First, uncertainty about future threats requires an approach that manages uncertainty through war games and simulations designed to explore the shape of potential wars. Second, the ambiguous costs and benefits of new tools and tactics can only be explored through critical evaluations designed to highlight and learn from mistakes.[42] The German Army and US Navy applied this approach between World War I and World War II when developing blitzkrieg tactics and carrier aviation. Both are examples of successful peacetime transformation that brought considerable success in World War II.[43] The recurring lesson is that candid exercises and evaluations help to compensate for uncertainty while allowing incremental improvements in equipment and procedures.[44] When appraisals validate the vision, support grows; and when they uncover faults, appraisals help to refine and strengthen the concept.

Assessment has two major aspects—exploration and examination. *Exploration* is unrestricted thinking that encourages new theories of victory and ideas about the equipment and strategies needed to support the theories. More precisely, exploration harnesses all of the possible ideas about new theories of victory and then applies those ideas to postulated future

environments. The intent of exploration is to build a practical understanding of the role of the new theory in military and policy operations through education and exposure. This kind of exploration differs from the conceptual thinking done as the culture matures. The symbiotic relationship between culture and assessment is apparent here. Without a culture open to new and different theories, the original vision may be stifled. This kind of environment gave rise to the term *battleship sailor* to refer to myopic thinking unwilling to consider new approaches to warfare. Exploration can occur in a wide variety of settings. Typically, exploration occurs via studies (both scientific and conceptual) and war games. All of these forums ideally gain an insight into the effectiveness of new theories, but the main objective is awareness of the new concepts.

The second aspect of assessment, *examination,* uses a variety of tools to learn which theories work best. Examination also scrutinizes the potential of new theories prior to implementation. Unlike the exploration phase, where ideas are widely accepted, examination implies the potential for failure or abandonment of theories. Typical forms of examination can include campaign analysis, trade studies, systems analysis, prototypes, and exercises. The decision on the part of Air Corps Tactical School (ACTS) and Royal Air Force theorists to discount apparent shortcomings in their unescorted bombing theory led to severe combat losses, demonstrating the danger of incomplete or ignored examination.[45]

Bomber theory before World War II highlights a critical element of assessment—linkage. There must always exist a connection between the vision of the expected environment and the strategy and operational realities of the time. Strategy helps define the context for evaluating the efficacy of new approaches to war fighting. One study defined strategy as the framework that "connects objective indicators with innovative outcomes."[46] More simply, operational realities are necessary to set limits on the range of theoretical future conflicts. This factor is crucial to honest assessment because exercise environments can be tailored to circumstances independent of operational realities. Whether intentional or not, improper design of simulations which ignores operational realities can incorrectly "prove" untested theories or theories that are operationally unrealistic.[47]

Returning to the amphibious assault example used earlier demonstrates the power of open, honest, and thorough assessment. Between 1921 and 1940, the US military conducted numerous fleet landing exercises (FLEX) designed to demonstrate or evaluate various concepts of amphibious landing. The Marine Corps and Navy experimented with almost every possible technique and approach allowed by their equipment. The open nature of debate at the time helped refine the concepts captured by Major Ellis decades earlier. Evaluation through FLEXs reinforced the idea that amphibious assault was possible with certain tactics, but it would never be easy.[48] Overall, the combination of an insightful vision, an emerging culture willing to advance the vision, and open and honest assessment

led to a new approach to amphibious assault that proved vital to success in World War II.

What about Technology?

Some readers, especially those familiar with the concept of a revolution in military affairs (RMA), might criticize the minimal tribute placed on the altar of technology thus far. This conscious omission was made for several reasons. First and most simply, not all military transformations involve technological breakthroughs. The amphibious assault example discussed throughout was used precisely because it did not depend on new technology. Similarly, American guerrilla tactics developed during the Revolutionary War represented a dramatic change in ground combat without any change in the weapons of the day. In addition, technology-driven transformation usually involves a combination of technologies unanticipated until highlighted by assessment—the third facet of the model.[49] Finally, technology alone changes the techniques used in war but not the general nature of warfare. In the words of Eliot Cohen: "It is not merely the tools of warfare but the organizations that wield them that make for revolutionary change in war."[50] While technological changes have catalyzed some military innovations, technological advances alone are neither necessary nor sufficient for transformation. Since few major transformations depend solely on technology, technology is considered a part of the strategic environment or a factor scrutinized by the assessment portion of the model. Other models place greater emphasis on the role of technology, but the evidence guides the thoughtful theorist towards more emphasis on the human factors presented here.[51]

There are alternative frameworks to the one presented here. Some provide greater detail, and one even offers an RMA checklist.[52] Taken as intended—as a tentative description of a system accounting for all known properties—this model can effectively guide leaders, but there are several things this model does not offer. This model is most decidedly not a checklist designed to manufacture future transformations. Any checklist ignores the uncertainty pervasive in long-term change. On the contrary, just like the vision expected of intuitive leaders, the aspects of this model are conceptual and therefore more encompassing. For this reason, this model does not offer repeatability; but transformation is more an art than a science.

Summary

This model highlights three common characteristics of military transformation. Transformation is most likely when senior leaders articulate coherent, congruent visions of future forms of warfare; when the military culture allows a group of advocates of the vision to develop competing theories

of victory; and when the theories are assessed in an honest and open manner. The strategic environment constantly influences all of these factors.

Perhaps the best way to view this model is in the manner Clausewitz viewed his paradoxical trinity in *On War*. Clausewitz realized that any effort to fix an arbitrary relationship between the elements of his model would "conflict with reality" and render the model "totally useless."[53] While Clausewitz aimed to develop a theory that maintained a balance between the three elements, the transformation trinity recognizes that any such balance is dependent on the underlying strategic environment, which has an influence all its own on the three elements of the model. The result is a model that allows anticipation of the overall pattern of change while recognizing that quantitative predictability is impossible.[54] On the other hand, it is clear from the evidence that transformation is unlikely without all of the elements of the model working in concert.

The model presented here provides a general framework for studying peacetime military transformation. By acknowledging the uncertainty inherent in long-range planning, the model provides an approach that encourages understanding of the emerging strategic environment to develop the critical insight (or genius) needed to form visions for change. The model highlights the power of civilian and military leaders. With power comes responsibility. Civilian and military leaders must recognize their ability to catalyze (or sabotage) successful innovation through their approach to transformation. Leaders who cling to traditional approaches to warfare in the face of change risk becoming the next generation of battleship sailors. On the other hand, leaders who imprudently force untested visions on unwilling followers risk the allegation of zealotry. Both types of leaders are likely to suffer in the heat of battle and the harsh judgment of history. Because the path is narrow and both sides are fraught with danger, the visionary leader of the future would be wise to foster cultural change and encourage honest assessment to avoid all-too-common failure.

Notes

1. Two important examples are Stephen Peter Rosen, *Winning The Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991), chaps. 1–3 and 7–9; and Barry Watts and Williamson Murray, "Military Innovation in Peacetime," in *Military Innovation in the Interwar Period*, ed. Williamson Murray and Allan R. Millett (Cambridge, U.K.: Cambridge University Press, 1996). See also Arnold Kantner, *Defense Politics: A Budgetary Perspective* (Chicago, Ill.: University of Chicago Press, 1979); and James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York, N.Y.: Basic Books, 1989). More recent studies include J. A. Isaacson, C. Layne, and J. Arquilla, *Predicting Military Innovation*, RAND annotated briefing, no. DB-242-A (Santa Monica, Calif.: RAND, 1999); and Richard O. Hundley, *Past Revolutions, Future Transformations: What Can the History of Revolutions in Military Affairs Tell Us about Transforming the U.S. Military?* RAND Report MR-1029-DARPA (Santa Monica, Calif.: RAND, 1999).

2. For instance, the Air Force Battlelab works on projects that can be completed in approximately 18 months. On the popularity of innovation see Harvey M. Sapolsky, "On the Theory of Military Innovation," *Breakthroughs*, Spring 2000, 35. For a recent example of

how the Air Force defines innovation, see William B. Scott, "Innovation Is Currency of USAF Space Battlelab," *Aviation Week and Space Technology*, 3 April 2000, 52–53.

3. According to one author: "A major innovation is defined as a change in one of the primary combat arms of a service in the way it fights or alternatively, as the creation of a new combat arm." Rosen, 7. In Air Force terms, this implies a change, which either creates a new core competency or renders obsolete a present core competency. For more on this modified definition see Hundley, 9–11.

4. Consider also the development of submarine warfare, the role of ICBMs, and the development of amphibious operations.

5. For an expanded discussion supporting this point, see James A. Dewar et al., *Assumption-Based Planning: A Planning Tool for Very Uncertain Times*, RAND Report MR-114-A (Santa Monica, Calif.: RAND, 1993), xi.

6. For a detailed argument explaining the greater instability of the post-Cold War era, see John J. Mearshimer, "Back to the Future," in *The Perils of Anarchy: Contemporary Realism and International Security*, ed. Michael Brown, Sean Lynn-Jones, and Steven Miller (Cambridge, Mass.: MIT Press, 1995), 78–129. An alternative view is found in Stephen van Evera, "Offense, Defense, and the Causes of War," *International Security*, Spring 1998, 5–43.

7. For a fascinating discussion of this point and its relationship to warfare, see Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security*, Winter 1992–1993, 59–90.

8. George W. Downs Jr. and Lawrence B. Mohr, "Conceptual Issues in the Study of Innovation," *Administrative Science Quarterly*, December 1976, as cited in Rosen, 5.

9. Rosen, 1–53; and Murray and Millett, 1–5.

10. Uncertainty can also be due to limitations on information available at the time.

11. "No other human activity is so continuously or universally bound up with chance." Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 85.

12. For instance, Watts and Murray summarize the case of a government economic decision regarding cruiser conversion ultimately costing Britain sea power dominance. It was not that the British admiralty downplayed carriers or made systematic errors—they were at least partly constrained by events beyond their control. Watts and Murray, 405–6. Dennis M. Drew and Donald M. Snow, *Making Strategy: An Introduction to National Security Processes and Problems* (Maxwell AFB, Ala.: Air University Press, 1988), 152–53; and Murray, "Military Innovation: Past and Future," 301–4.

13. Watts and Murray, 377–83.

14. "Continual change and the need to respond to it compels the commander to carry the whole intellectual apparatus of his knowledge within him. . . . By total assimilation with his mind and life, the commander's knowledge must be transformed into a genuine capability. . . . natural talent." Clausewitz, 147.

15. J. F. C. Fuller, *The Foundations of the Science of War* (London: Hutchinson and Co., 1926), 21–23, 30–46, 324–27.

16. James A. Dewar et al., *Assumption-Based Planning: A Planning Tool for Very Uncertain Times*, RAND Report MR-114-A (Santa Monica, Calif.: RAND, 1993). Versions of this system are taught at all military service intermediate schools.

17. Ibid., 57.

18. Clausewitz, 100–112.

19. Neustadt and May call this concept "placing" and extend the logic to individuals and organizations when studying decision making. See Richard E. Neustadt and Ernest R. May, *Thinking in Time: The Uses of History for Decision Makers* (New York, N.Y.: Free Press, 1986), chaps. 9–12. The important strategic factors shared common emphasis. Drew and Snow, 154–61; Rosen, 243–61; and Murray and Millett, 335–49.

20. Clausewitz, 141; and Fuller, 36–44.

21. Allan R. Millett, "Assault from the Sea," in *Military Innovation in the Interwar Period*, ed. Williamson Murray and Allan R. Millett (Cambridge, U.K.: Cambridge University Press, 1996), 70–73. Rosen cites the development of carrier aviation (68–71) and helicopter aviation within the US Army (71–75) as two examples of strategic insight along with amphibious assault (64–67). For a discussion of a leader's insight into the strategic environment for naval aviation, see Thomas C. Hone, "Navy Air Leadership: Rear Admiral William A. Moffett as Chief of the Bureau of Aeronautics," in *Air Leadership: Proceedings of a Conference*

at Bolling AFB, ed. Richard H. Kone and Joseph P. Harahan (Washington, D.C.: Office of Air Force History, 1986), 83–118.

22. John K. Setear et al., *The Army in a Changing World: The Role of Organizational Vision*, RAND Report R-3882-A (Santa Monica, Calif.: RAND, 1990), vi.

23. Wilson, 225. While not excluding the possibility of internally initiated innovation, Barry Posen claims that military innovation usually occurs as a result of combat failure or civilian intervention. Barry R. Posen, *The Sources of Military Doctrine* (Ithaca, N.Y.: Cornell University Press, 1984), 34–80. Rosen also cites the studies of Kurt Lang, 9–10.

24. Two of Rosen's examples demonstrating the minor role civilians play in initiating innovation: President John F. Kennedy's unsuccessful attempt to direct counterinsurgency innovation and President Lyndon B. Johnson's futile attempts to force new ways of war fighting on the military in Vietnam. Rosen, 96, 100–103, 10.

25. Eliot A. Cohen, "A Revolution in Warfare," *Foreign Affairs*, March–April 1996, 51–52. See also Rosen, 255. For a more recent example of the political setting stifling innovation, see Lawrence Freedman, *The Revolution in Strategic Affairs* (Oxford: Oxford University Press, 1998), 22–24. For a dated but convincing discussion of "budget-making as policy-making," see Kantner, 59–94. I am indebted to my classmate, Maj Michael Plehn, for the insightful "hallucination" observation.

26. See Wilson, 227, for cited studies. Wilson explains that this significant role of the executive explains why so few theories of innovation exist. "It is not easy to build social science theories out of 'chance appearances.'"

27. The impact of inconsistent political objectives and military strategy is often studied. On the Vietnam War, see H. R. McMaster, *Dereliction of Duty: Lyndon Johnson, Robert McNamara, the Joint Chiefs of Staff, and the Lies That Led to Vietnam* (New York, N.Y.: HarperCollins, 1997); U. S. G. Sharp, *Strategy for Defeat: Vietnam in Retrospect* (Novato, Calif.: Presidio Press, 1978); and Robert S. McNamara, *In Retrospect: The Tragedy and Lessons of Vietnam* (New York, N.Y.: Random House, 1996). The same effect is present in peacetime disconnects between civilian and military visions. See Wilson, 225.

28. Murray, "Innovation: Past and Future," 305. Also note Murray and Millett's footnote (13) there: "It is more important to make correct decisions at the political and strategic level. Mistakes in operations and tactics can be corrected, but political and strategic mistakes live forever."

29. For a condensed account of the development of carrier aviation, see Lt Col Mark P. Jelonek, *Toward an Air and Space Force: Naval Aviation and the Implications for Space Power* (Maxwell AFB, Ala.: Air University Press, 1999), 13–33.

30. Allan R. Millett, "Assault from the Sea," 70–87. For additional background on the civilian attention toward the Pacific dating from the Spanish–American war, see Rosen, 64–66.

31. Many recent works refer to Schein's three levels of culture, but even Schein says "Although culture manifests itself in overt behavior, rituals, artifacts, climate, and espoused values, its essence is the shared tacit assumptions." Edgar H. Schein, *The Corporate Culture Survival Guide: Sense and Nonsense about Culture Change* (San Francisco, Calif.: Josey-Bass Publishers, 1999), 186.

32. Wilson, 91–95. See page 95 for references to several scholars who refer to "mission."

33. Carl H. Builder, *The Icarus Syndrome: The Role of Airpower Theory in the Evolution and Fate of the US Air Force* (New Brunswick, N.J.: Transaction, 1994). See also James M. Smith, *USAF Culture and Cohesion: Building an Air and Space Force for the 21st Century* (Colorado Springs, Colo.: USAF Institute for National Security Studies, 1998).

34. Ibid., 101–9.

35. Schein, 26; Wilson, 107-9; Murray and Millett, 308; and Cohen, 52.

36. Rosen, 20.

37. Smith, 2–10.

38. Similar evidence exists for the development of tactical and strategic bombing, naval air, and submarine operations to name a few. The early history of attack aviation is contained in Ronald R. Fogleman, "The Development of Ground Attack Aviation in the US Army Air Arm: Evolution of a Doctrine, 1908-1926" (master's thesis, Duke University, 1971); and Benjamin F. Cooling, ed., *Close Air Support* (Washington, D.C.: Office of Air Force History, 1990). On strategic airpower, see Lee B. Kennett, *A History of Strategic Bombing* (New York, N.Y.: Scribner, 1982), 39–104; and Robert T. Finney, *History of the Air Corps Tactical School, 1920–40*, USAF Historical Study 100 (Maxwell AFB, Ala.: USAF Historical Division, Air University,

1955). A few of the many works on naval aviation that discuss the role of culture include Kenneth J. Hagan, *This People's Navy: The Making of American Sea Power* (New York, N.Y.: MacMillan, 1991), 281–305; and John Keegan, *The Price of Admirality: The Evolution of Naval Warfare* (New York, N.Y.: Penguin Books, 1990), 183–328.

39. Millett, "Assault from the Sea," 72. Rosen calls Ellis "an authentic military genius," 67.

40. Ibid., 21. Isaacson, Layne, Arquilla, vii, 4, 16–18. I am indebted to Dana Johnson of RAND for pointing out the following two studies during the later stages of my research: Richard O. Hundley, *Past Revolutions, Future Transformations: What Can the History of Revolutions in Military Affairs Tell Us about Transforming the U.S. Military?* RAND Report MR-1029-DARPA (Santa Monica, Calif.: RAND, 1999), 21–34; and John Birkler et al., *An Acquisition Strategy, Process, and Organization for Innovative Systems*, RAND Report MR-1098 (Santa Monica, Calif.: RAND, 2000); and Murray, "Military Innovation in Peacetime," 309.

41. A modern example of cultural change is found in Mike Worden, *The Rise of the Fighter Generals: The Problem of Air Force Leadership (1945–1982)* (Maxwell AFB, Ala.: Air University Press, 1998); Cohen, 37; and Rosen, 11–18, 76–95. See footnote 39 for other examples.

42. "National Security Strategy in the 21st Century: The Challenge of Transformation," *Joint Force Quarterly*, Summer 1997, 15–19; and Rosen, 243, 259–60.

43. For a detailed discussion of the adaptation to armored warfare by the Germans, see James S. Corum, *The Roots of Blitzkrieg: Hans von Seeckt and the German Military Reform* (Lawrence, Kans.: University Press of Kansas, 1992); and Charles Messenger, *The Blitzkrieg Story* (New York, N.Y.: Scribner, 1976). See also Williamson Murray, "Armored Warfare: The British, French, and German Experiences," in *Military Innovation in the Interwar Period*, ed. Williamson Murray and Allan R. Millett (Cambridge, U.K.: Cambridge University Press, 1996), 6–49. For the adoption of the aircraft carrier, see Geoffrey Till, "Adopting the Aircraft Carrier: The British, American, and Japanese Case Studies," in *Military Innovation in the Interwar Period*, ed. Williamson Murray and Allan R. Millett (Cambridge, U.K.: Cambridge University Press, 1996), 191–226.

44. Andrew Krepinevich, "Cavalry to Computer: The Pattern of Military Revolutions," *The National Interest*, Autumn 1994, 30, cited in Freedman, 8; Rosen, 244; and Murray, "Innovation: Past and Future," 312–18.

45. On the evidence of shortcomings in the unescorted bomber theory available to ACTS faculty and Army Air Corps leaders before the war, see Hugh G. Severs, "The Controversy Behind the Air Corps Tactical School's Strategic Bombing Theory: An Analysis of the Bombardment versus Pursuit Aviation Data Between 1930–1939" (master's thesis, Air Command and Staff College, 1997); and James D. Perry, "Air Corps Experimentation in the Interwar Years—A Case Study," *Joint Force Quarterly*, Summer 1999, 42–50. On Royal Air Force decisions to skew or ignore exercise results that demonstrated bomber limitations and pursuit capabilities, see Scot Robertson, *The Development of RAF Strategic Bombing Doctrine, 1919–1939* (Westport, Conn.: Praeger, 1995), 37–38, 97–108. For a discussion of the development of air superiority doctrine between the wars, see Benjamin F. Cooling, ed., *Case Studies in the Achievement of Air Superiority* (Washington, D.C.: Air Force History and Museums Program, 1985), 9–53.

46. Isaacson, Layne, and Arquilla, 54.

47. Watts and Murray, "Military Innovation in Peacetime," 407-9.

48. Millett, "Assault from the Sea," 73–78.

49. Hundley, 14. Blitzkrieg warfare was enabled by the combination of the tank, two-way radio, and dive bomber while long-range ballistic missiles, lightweight fusion warheads, and accurate inertial guidance enabled intercontinental ballistic missiles.

50. Cohen, 46; and Freedman, 21.

51. For greater support for this conclusion, see Posen, 46–59 and 236–39.

52. Rosen, 251–63. Murray and Millett, 369–416. For a Revolution in Military Affairs "checklist" see Hundley, especially chap. 6, "What Does It Take to Bring about a Successful RMA?" 59–73.

53. Clausewitz, 89. "A paradoxical trinity—composed of primordial violence, hatred and enmity . . . of the play of chance and probability . . . and of its element of subordination, as an instrument of policy."

54. For greater discussion on this point, see Beyerchen, 66–72.

Chapter 3

The Space Power Vision: Mecca or Mirage?

Where there is no vision, the people perish.

—Proverbs 29:18

Any Air Force which does not keep its doctrines ahead of its equipment, and its vision far into the future, can only delude the nation into a false sense of security.

—Gen Henry H. "Hap" Arnold

We are never completely contemporaneous with our present. History advances in disguise; it appears on stage wearing the mask of the preceding scene, and we tend to lose the meaning of the play. Each time the curtain rises, continuity has to be reestablished. The blame, of course, is not history's, but lies in our vision, encumbered with memory and images learned in the past. We see the past superimposed on the present.

—Régis Debray
Revolution in the Revolution?

Since the dawn of the space age, the US military has struggled to develop a space power vision.[1] For 40 years, competition with the Soviet Union shaped the military approach to space exploitation. The fall of the Berlin Wall and the success of space support in Operation Desert Storm heralded a new era for space power. Still, much of the promise of space power has gone unfulfilled in the last decade because of inconsistent concepts about how to control and exploit the advantages offered by space. In that light, this chapter investigates the question: "Does the military have a coherent, congruent vision for the future of space power?"

First, I explain the term *vision* and demonstrate its relevance to the space power debate. I then begin the analysis by considering the impact of the strategic environment and reviewing current administration and DOD policies regarding space. Next, I review service doctrine, service visions, and space-specific visions to assess agreement and consistency. Before concluding, I briefly consider varying organizational options regarding the military vision for space. Some insights emerge from the study; and at the end of the chapter, I offer recommendations for a more effective approach to space power development.

Why Does Vision Matter?

A vision helps an organization recognize what roles it must fulfill in the future and its relationship with other organizations. Even with this working

definition one may ask, "Why does vision matter?" Studies of organizations facing change show that "the single most determining factor for success in their adaptation is whether or not they have and can exploit an appropriate vision of themselves for decision making."[2] A vision does more than answer the question, "What are we trying to accomplish?" It articulates a sense of identity and purpose that military members usually cannot detect in strategies or long-range plans alone. To furnish an organization a common sense of identity and purpose, a vision connects the past, the present, and the future.[3]

There are a few important characteristics of a useful vision. A vision must be congruent and coherent to have a chance to mature, and it must eventually demonstrate linkage with the current strategic environment. *Congruence* is a measure of general acceptance by the civilian and military leadership. At a lower level, a truly congruent vision shares broad acceptance among the services. A vision that is clearly stated and relatively constant over the longer periods needed for transformation is *coherent.* Finally, *linkage* is apparent when a vision is fully developed and assessed. Recognizing the importance of a well-developed vision for the future is a crucial aspect of successful transformation.[4]

The Evolution and Influence of Civilian Policy

An innovative vision usually emerges as a result of a change in the strategic environment that requires great change in the way an organization fulfills its mission. In the case of the military, the vision usually predicts some new form of warfare or a change in the relationship between existing forms of combat. Next to an understanding of the emerging strategic environment, the most important influence on a military vision is national security policy. Prussian theorist Carl von Clausewitz recognized this in the 1800s, and it applies just as readily to modern military space policy.[5] The current "peaceful use of space" policies have their roots in decisions from the Dwight D. Eisenhower era and, with some exceptions, stood largely unchanged through the 1980s. Some discernible change began, however, almost two decades ago. Before the Cold War ended, the Ronald W. Reagan administration reinvigorated a dormant debate over space weapons by introducing the Strategic Defense Initiative (SDI). Even though the Soviet Union eventually collapsed and many aspects of Reagan's vision proved technologically impractical at the time, SDI catalyzed renewed thought about space and resulted in growing DOD emphasis on space power.[6] This renewed emphasis on space control was reminiscent of past cycles of military space interest, all of which were preceded by national emphasis on perceived threats. National security strategies from the last two decades have catalyzed military thinking by providing a new impetus for the space control debate. It remains to be seen if

the present national strategies are just short-term rhetoric or long-term commitment to a new approach to space power designed to match the growing American dependence on space.

While still acknowledging the heritage of "free access," current US national space policy is very explicit regarding the need for space control. For instance, current policy directs national security space activities to contribute to national security by "assuring that hostile forces cannot prevent our own use of space (and) countering, if necessary, space systems and services used for hostile purposes."[7] The policy also states that, consistent with treaty obligations, "the United States will develop, operate and maintain space control capabilities to ensure freedom of action in space and, if directed, deny such freedom of action to adversaries."[8] Taken at face value, the current national space policy clearly places strong emphasis on the space control mission, but arguably not as strong as the emphasis a decade ago.[9]

In response to the latest White House guidance, Secretary of Defense William Cohen issued a revised DOD space policy in 1999. The new DOD policy also emphasizes the space control mission and describes space as a medium, "within which military activities will be conducted to achieve U.S. national security objectives." Further, the DOD policy states, "The capability to control space, if directed, will contribute to achieving (conditions) necessary for success in military operations. Similarly, the ability to perform space force application in the future could add a new dimension to U.S. military power."[10] Together with the latest DOD policy, recently formed civilian policy provides the clearest indication of a new era of space power. Based on these published policies, future military use of space will not only include the accepted missions of space support and force enhancement but will also involve space control and entertain the possibility of force application.[11]

While the written civilian policy presents a relatively clear mission for space, the actions of the William J. Clinton administration cloud the picture. The ongoing antiballistic missile debate and lack of consistent administration guidance demonstrates the inconsistent civilian support for space-related issues.[12] In addition, the space power mission prescribed for the military is not well supported by legislation or funding. The administration's cancellation of military space programs that support written White House policies sends a mixed signal to the military.[13] In fact, while the published policy advocates space control writ large, the administration preference is for space control by means that do not result in weapons in space.[14] This ambiguous civilian vision makes it difficult for the military to adopt a coherent vision of its own.

Military Politics and Doctrine

This inconsistency in administration guidance directly affects the actions and perceptions of the services. While beyond the scope of this

paper, there are myriad historical examples of the frustration caused by military visions and programs not being in harmony with shifting or unstated national policy. One need only consider the military's inability to successfully complete any major military programs tied to the space control or force application missions, in spite of numerous attempts.[15]

Within the military there is also a long history of an incongruent long-term vision. Between services there is a pattern of parochial debates over who should develop and control specific space programs, not to mention leadership of the military space effort.[16] Since the earliest days of the space age, the Air Force has claimed overall leadership for military space planning but has not always lived up to the role. Air Force-lead service status for space, which dates back to the Eisenhower era, was mainly a tool used to sway service debates to favor Air Force funding. In 1987 even the secretary of the Air Force recognized a void in space leadership—the Air Force seemed only grudgingly to support space activities. Even the formation of AFSPC in 1982 was mainly directed at centralizing space management within the Air Force rather than providing a form of interservice leadership. Outside the Air Force, the creation of USSPACE in 1985 signaled the growing importance of space expected due to SDI—or possibly just a quid pro quo for the Air Force creation of AFSPC.[17] Throughout the end of the 1980s, however, AFSPC and USSPACE were mired in political wrangling rather than efforts to form a space vision. Several panels and studies highlighted the unfulfilled promise of Air Force space leadership and called for a "coherent vision."[18] These debates were important in shaping the present space vision because they highlighted the lack of consensus over the proper model for space power. The debate surfaced again in 1995 during the committee on roles and missions. More recently, the creation of a commission to assess US national security space management and organization demonstrates continuing dissension over the best vision for military space.[19]

In spite of a history of disagreement, on the surface the current overall military vision for space seems consistent and widely accepted. The first place to look to understand what the services believe about the best way to function is doctrine, because doctrine is designed to capture the accumulated experience of the services.[20] The recent emergence of joint doctrine provides a worthy starting point because joint publications pass through a rigorous approval process designed to satisfy each service.[21]

The concept of future joint operations depicts space as a warfare theater and relates how "the ability to locate and destroy . . . targets on earth and in space may fundamentally change how we think about the conduct of war."[22] Joint documents discuss a new concept of "battlespace," which will include the US homeland as well as space.[23] Joint doctrine professes a commitment to the "right balance" of air, land, sea, and space forces while explicitly acknowledging the leadership role of the Air Force in space. In fact, joint doctrine describes the USAF as "the preeminent source of integrated air and space power." This assertion is important

because while the stewardship role of the Air Force has long been established, the Air Force claim to the space control and exploitation missions has normally been reserved for Air Force publications.[24]

The Air Force asserts—and the other services acknowledge—Air Force leadership in space power, so one would expect the Air Force space doctrine to be refined. However, this is not the case. Historically, Air Force doctrine has often neglected or inappropriately developed space doctrine. Earlier Air Force doctrine was often criticized for blurring the environmental and operational distinctions between air and space, usually at the cost of rigorous space doctrine. For example, speed, range, and flexibility—key characteristics of airpower—were inappropriately attributed to space power. Finally, some commentators maintain that Air Force space doctrine does not clearly describe *what* the Air Force should do in space or *how* to proceed to accomplish those preferred tasks.[25]

This criticism of older Air Force doctrine still applies to current Air Force thinking. One needs look no farther than the first page of Air Force space operations doctrine for obvious contradictions regarding the "aerospace medium."[26] In fact, the word *aerospace* itself has become a lightning rod for intraservice and interservice debate.[27] As in the past, the Air Force claims responsibility for the "seamless medium" above the earth without explaining *how* it intends to conduct operations through or in space. Also, consider that space doctrine is still given substantially less attention than other areas of Air Force doctrine in spite of repeated attempts to better integrate the mediums.[28] Doctrinally, the Air Force is falling short of its claim to leadership in the aerospace medium because of the difficulty integrating concepts as diverse as low-level bombing and low earth orbit.

Service Visions

While doctrine provides the best historic view of accepted missions and identities, service visions articulate projected missions and identities. The emphasis on Air Force leadership in space control and exploitation that is found in doctrine is also evident in individual service visions.

The Army, Navy, and Marines generally consider space as a source of support for their traditional service missions. *Army Vision 2010* explicitly discusses how space can *support* the surface war by shaping the battlespace and providing real-time information to land forces.[29] The Navy vision, *Forward . . . From the Sea,* and the Marine vision do not even explicitly mention the role of space—they simply refer to the *support* provided by advancing technologies.[30]

While other service visions barely mention their relationship with space power, and only do so with respect to space support to the war fighter, the Air Force vision has evolved dramatically even in the last decade and now devotes a significant amount of attention to the Air Force role in space. After Desert Storm, Air Force leadership issued a new vision statement, *Global Reach-Global Power,* promoting long-range power projection and precision bombing. While the 1991 vision emphasized air operations, it

modified the Air Force mission to read "*control* and exploitation of air and *space.*" *Global Reach–Global Power* marked a shift away from exclusive attention on space exploitation and emphasized the importance of space control. The "new" attention to space control was in part a result of the space contribution to success in Desert Storm. The emphasis on space control was, however, reminiscent of views held by the Air Force as early as the 1950s—before the consistent civilian emphasis on the peaceful use of space shaped the military view. Finally, *Global Reach–Global Power* reflected the renewed Air Force commitment to space apparent in the latter part of the 1980s.[31]

Six years after *Global Reach–Global Power,* and after an 18-month study, the Air Force introduced a refined vision. The 1996 vision, *Global Engagement,* identified air and space supremacy as a core competency and confirmed the Air Force mission as "control and exploitation of air and space."[32] *Global Engagement* went on to describe the Air Force commitment to innovation in space and the plan to prevail in the use of space by calling for a transition from an "*air* force into an *air and space* force on an evolutionary path to a *space and air* force." The overall emphasis of *Global Engagement* was the desire to provide America the air and space capabilities required to deter, fight, and win.[33] Through the end of the millennium, the overall Air Force vision was clearly stated and emphasized the importance of space—even if the service doctrine did not live up to the vision.

Within a year of the new vision's release, Air Force leadership reconsidered their wording and focus on *air and space.* As early as 1998, senior Air Force leaders were calling for a new approach to emphasize space power—one designed to overcome entrenched beliefs and stove-piped structures. According to Gen Howell M. Estes III, the USSPACE commander in chief (CINC) from 1996 until 1998, using "those words (air and space) resulted in community entrenchment and fruitless debate about when the transitions might occur."[34]

At present the Air Force is modifying, and possibly abandoning, the *Global Engagement* vision of a "transition to a space and air force" to espouse an "integrated aerospace force."[35] Senior leaders described a recently released white paper, *The Aerospace Force: Defending America in the 21st Century,* as a key pillar to the new Air Force vision.[36] The white paper gave substantial attention to important space power issues. For instance, while demonstrating responsibility for the majority of space capabilities, budget, and personnel, the paper stated, "We (the Air Force) are not America's only operator in air and space, and we make no exclusive claim to the vertical dimension."[37] The paper also identified a number of initiatives designed to accelerate career broadening, training, and education efforts. In this sense, the emerging Air Force vision may enhance the focus on space power begun in 1988.[38]

The most surprising aspect of the white paper is that a mere three years after calling for a transition to a "space and air force" over the next 25 years, the Air Force intends to return to the aerospace concept. There is

substantial history—much of it negative—surrounding the term *aerospace,* and even Air Force leaders are struggling with how to define the relationship between air and space components of the force as they pursue the new vision built around the concept of "aerospace integration."[39] The term *aerospace* is also anathema to the other services. A Joint Publication (JP) 3-14, *Tactics, Techniques and Procedures for Space Operations,* working group found that "*any* reference to 'aerospace' would lead to a nonconcur from the Army and possibly the other services as well."[40]

Clearly the Air Force has a difficult task balancing intraservice and interservice concerns about how to emphasize the growing importance of space power. This chapter does not attempt to argue the validity of the term *aerospace,* but it does recognize the challenges associated with the term. For instance, one argument for an aerospace focus is a desire to move away from the divisive impact of the *Global Engagement* "air and space" terminology. Still, even if the forthcoming vision is "better," it may only obscure the identity of the service by making *major* vision changes before earlier efforts are allowed to take effect. Some of the same senior leaders that support the emerging vision acknowledge that transformation takes time—substantially more than the few years between Air Force visions.[41]

Supporters of the anticipated change in the Air Force vision compare it to a course correction—a quick change in an aircraft flight path that expends minimal energy and results in a more direct route to the target. It makes sense to adjust a conceptual vision based on strategic changes and long-term indications of success. It is more difficult to justify replacing a vision designed to last 25 years after only three years. The "course correction" analogy highlights a misunderstanding of the dramatic impact caused by rapid changes in an organizational vision. A more apt analogy of change in an organizational vision is a satellite orbital maneuver—a gradual alteration of a satellite orbit that expends substantial energy. Visions, like orbits, should be altered rarely because energy is limited and previous corrections need ample time to take effect.[42]

Space-Specific Visions

Policy, doctrine, and overarching service visions provide the clearest view of the context, accumulated experience, and identity of the services; but to completely assess the coherency of the military vision for space, one must consider the space-specific visions. The two most important vision documents are the USSPACE *Long Range Plan (LRP)* and the AFSPC *Strategic Master Plan (SMP).*

The *LRP* is unique because it not only acknowledges existing military functions but also proposes future military functions and capabilities. In addition, the *LRP* was the number one priority of the command for nearly a year because of the commitment of General Estes, the former USCINCSPACE. The USSPACE vision statement is "Dominating the space dimension of military operations to protect US interests and investment. Integrating Space Forces into warfighting capabilities across the full spectrum of

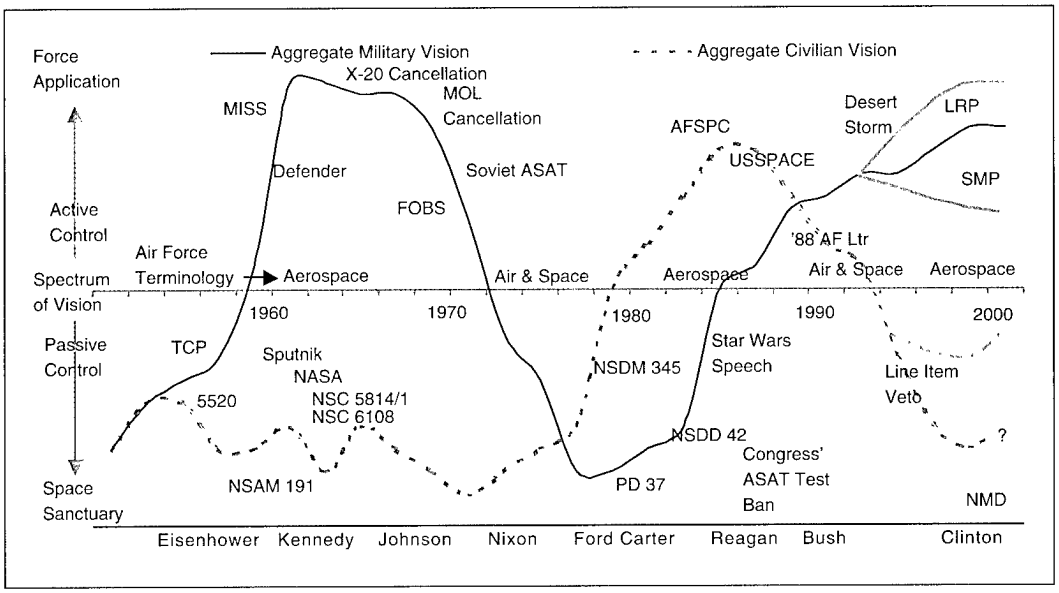
conflict." The *LRP* forcefully pursues the space control mission as no other vision statement has done before.[43] The *LRP* describes USSPACE as the single focal point for military space and claims responsibility for ensuring access to and protection of US interests in space. The *LRP* goes beyond the presentation of concepts of operations and presents road maps for acquisition of systems and organizational changes.[44] While the execution of joint space operations is normally the mission of USSPACE, the services—primarily the Air Force—are expected to organize, train, and equip forces for the accomplishment of space missions.[45]

This dilemma is further confused by the *supporting* nature of the AFSPC *SMP*. The *SMP* explicitly describes how it *supports* the *LRP*.[46] It is interesting that the "lead service" would publish a vision that more closely aligns with the vision of the unified command than with its own service vision. This situation indicates a lack of clearly defined roles and responsibilities for the unified command and the major Air Force command.[47] Overall, the authority and responsibility for developing a military space vision is disorganized and confusing.

The good news is that the *LRP* is a superb document in terms of clarity of purpose and definition of critical capabilities. General Estes' successor, Gen Richard B. Myers, increased the space vision coherence by fully supporting the *LRP*. The *SMP*, for its part, does a very good job of integrating an acquisition strategy that supports the *LRP*. The result is a complicated impact on organizational hierarchy and military vision. While USSPACE has, albeit informally, usurped space leadership through the bold vision of the *LRP*, the Air Force has strengthened the unified vision through subordination of the *SMP* to the *LRP*. The space-specific vision is the most encouraging aspect of the overall military vision. In spite of a complex organizational relationship, USSPACE and AFSPC have produced a generally coherent military plan for space power. The ultimate frustration is the lack of well-defined leadership responsibility for the space power mission.

In addition, a military vision that promotes space control and force application is apparently at odds with the implicit civilian vision that emphasizes the exploitation of space without weapons. Figure 1 provides a qualitative depiction of the historic pattern of inconsistency between the military vision and the civilian vision.[48] The only exception was the period in the 1970s when the consistent civilian vision drove the military vision towards a space sanctuary mind-set.

In addition to the inconsistency in military doctrine and policy, the spotty record of funding for military space power reinforces the case that the military vision is incoherent and incongruent. While some deny that a funding problem exists, the Air Force *SMP* calls for a two-fold increase in the space budget over the next 15 years (from 9 percent of the Air Force's total obligation authority to 20 percent). In 1999 General Estes further stated that 20 percent of the Air Force budget must go to space systems in fiscal years 2003 through 2015.[49] A Government Accounting Office report released in May 2000 took exception with the Air Force funding pro-



Legend:
AFSPC—Air Force Space Command
ASAT—antisatellite
FOBS—Fractional Orbital Bombardment System
LRP—long-range plan
MISS—man in space soonest
MOL—manned orbiting laboratory
NASA—National Aeronautics and Space Administration
NMD—national missile defense
NSAM 191—National Security Action Memorandum, "Assignment of Highest National Priority to Project Defender"
NSC 5814/1—National Security Council, "U.S. Policy on Outer Space"
NSC 6108—National Security Council, "Certain Aspects of Missile and Space Programs"
NSDD 42—National Security Decision Directive "National Space Policy"
NSDM 345—National Security Decision Memorandum (ASAT Guidance)
PD 37—Presidential Directive, "National Space Policy"
SMP—(AFSPC) Strategic Master Plan
TCP—Technical Capabilities Panel

Figure 1. The General Relationship between Military and Civilian Visions of Space Power

jection because the projection assumed several billions of dollars in funding increases for space programs during fiscal years 2000 through 2017.[50] Taken together, the lack of solid funding and inconsistent, incongruent military visions for space power paint a picture of irresolute space leadership. The fundamental question that faces the nation now is "Will the civilian vision remain constant and once again shape the military vision, or will the changing strategic environment steer the civilian vision toward the military mindset?" Some predict that only a Pearl Harbor in space will shift the civilian vision, but such a "wake-up call" might come too late.[51]

Organizational Visions

As a result of growing concern over the future of space power, long-running debates over space force structure have gained greater prominence.[52] There are numerous *organizational* proposals to correct the perceived dilemma of ambiguous space leadership. The most commonly

discussed alternatives are (1) absolute and convincing Air Force leadership, (2) a joint space force along the lines of special operations command, or (3) a separate space force or corps.[53] While just one part of the complete space vision equation, this examination would not be complete without a brief consideration of these alternatives.[54]

The first option is the one most appealing to the Air Force and most unappealing to the other services. The Air Force has tried many times to *completely* control military space power. As late as 1994, the Air Force lobbied to become the single manager for DOD space acquisition and space operations.[55] While the Air Force cites dominant spending on space development and operations, they are continually thwarted in their attempts to entirely control the space mission—for some valid reasons.[56] The strategic nature of space requires that the unique interests of other services be considered. This consideration is only guaranteed when every service has some amount of stake in the space vision. For instance, Colin Gray writes, "If we lack a vision of what naval power and space power can mean for each other, the agenda of the U.S. military space development will be set by people and organizations not oriented primarily toward the advancement of maritime excellence."[57] The Air Force has acknowledged the interest of other services and government agencies in their recent white paper. This valid need to involve every service in space power development implies a second option—a joint space force.

The idea of another major force program structure like the one used for US Special Operations Command (USSOCOM) has many advocates, including a former USSPACE commander.[58] By granting substantial control over development and operations to a unified command, the needs of each service would be considered. A big advantage to this approach is that USSPACE already has a powerful and practical development strategy—the *LRP.* However, this approach does have drawbacks. For instance, one of the biggest complaints about the USSOCOM paradigm is that it adds another layer of bureaucracy and actually stifles individual service integration of special operations forces. In addition, some argue that unified CINCs become too focused on executing the mission and stop thinking ahead imaginatively.[59] The present lack of a substantial space control or force application mission and Air Force management of most space support operations actually allowed CINCSPACE the freedom to develop the robust road map in the *LRP.* In the future, however, the increasing tempo of USSPACE operations will reduce the time and energy devoted to long-range thinking. In addition, there is little likelihood that a change of this type would result in a greater bottom line for the military overall. The end result might be reduced fiscal efficiency with the same amount of money. This "zero sum game" logic applies to the final option as well.

The most controversial—although certainly not the newest—organizational vision calls for a separate space force or space corps. The most prominent supporter of a separate space force is Sen. Bob Smith (R-N.H.).[60] Smith and other separatists argue that only in an independent service or corps, similar

to the Marine Corps or the Army Air Corps before World War II, can space get the respect (and funding) it deserves. Another argument is based on the substantial differences between space and the other warfare mediums.[61] While many argue the Air Force *is* devoting substantial attention and capital to space, and the fiscal benefit gained by separatism would be offset by the inevitable overhead, there are more compelling arguments against separation right now. The two big distinctions between the Army Air Corps and the would-be space corps are theory and capability. As discussed earlier, there is not a concise and convincing theory about *how* to perform the space control mission. Before World War II, ACTS articulated a comprehensive theory showing that an independent air force could accomplish the national security strategy better than a subordinate force. No such theory exists for space power.[62] In addition, the separatists would be generals without armies. Until a substantial capability exists to perform space control and force application missions, it seems best to let the space community mature within the existing services.

All of the organizational visions have drawbacks. The point is not to make the case for the best organizational vision but to highlight the wide array of competing organizational models. The lack of consensus on the best organization for military space power reinforces the lack of harmony regarding a military space power vision. In the words of one observer, the 1990s might be called "the decade of competing visions and diminishing resources."[63] Unfortunately, the ongoing debate over organizational structure misses the larger point and may just confuse the issue.[64] No organizational structure can succeed without a coherent, congruent vision for the future. The first and most important step in any review of space power transformation is to identify the roles the military must fulfill in the future and then consider various organizational relationships.

Trends and Options

A few points warrant review. First, in spite of civilian declarations supporting the emphasis on space control, the actions of the current administration and Congress speak louder than the words. Even the easing of Cold War constraints and the added boost provided by the growing strategic significance of space power has not resulted in the "escape velocity" necessary to separate the civil vision from the powerful gravity of the Eisenhower-inspired sanctuary mentality. Until civilian funding matches the rhetoric, the military will be hesitant to aggressively pursue the expensive prospect of space control for fear of yet another failed "launch attempt." The policy makers must present a clear mission for the military *and* be prepared to consistently support that mission with the necessary funding to allow the mission to mature quickly. For their part, military leaders should devote the available resources needed to support their own visions of space power, or acknowledge that their visions are worth little more than the paper on which they are printed.

Even if the government leaders do not provide a consistent, supported mission, it is up to the military to focus their vision based on the strategic environment. Since the civilian vision is subject to more frequent change, it is the military that bears responsibility for fostering the long-term vision. In this way the military can help shape the vision of the next generation of civilian leaders.[65] To a great extent, the groundwork is already in place. Joint doctrine shows surprising consistency about the Air Force's leadership role in space operations without yielding complete control. In addition, the review of service visions supports the description presented in joint doctrine. Finally, the powerful program provided by the *LRP* set the stage for a greater overall vision. The joint contribution to the space vision is clear and consistent.

In this light, the lack of coherent Air Force doctrine on how to best operate in the medium of space is especially troubling. This shortcoming is partially a result of Air Force inconsistency regarding their service's identity. The mercurial changes made to the Air Force vision reflect an uncertainty about the best way to include space in the historically air-centric Air Force mission. The Air Force must make substantial headway in their doctrine—which will not occur until the service vision changes direction less like a nimble fighter and more like a predictable satellite.

In spite of the disjointed efforts of the Air Force to integrate the space mission over the past decade, the competing organizational visions that call for dramatic change are not the solution, at least for the present. Like service visions, which need time to allow an "orbital adjustment" to take effect, the competing organizational visions should allow the status quo organizational arrangement to adapt to the new strategic environment and the emerging emphasis on the space control mission.

Overall, the modern military lacks a coherent, congruent vision for military space power. Nonetheless, the fuzzy image of military space power could still come into focus. Even without a credible mission mandate from policy makers, the military can act on its own to improve the picture. If the military builds on the inspiration of the *LRP*, applies the cooperative structure described in the joint publications, and the Air Force patiently invests the intellectual energy necessary to develop detailed doctrine and the capital necessary to support their own plan, a brilliant vision may yet emerge.

Notes

1. The most detailed account of the military pursuit of a vision for space and the effect of policy on that vision is Paul B. Stares, *The Militarization of Space: US Policy, 1945–1984* (Ithaca, N.Y.: Cornell University Press, 1985). A broader account of the Space Age is found in Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore, Md.: Johns Hopkins University Press, 1997).

2. John K. Setear et al., *The Army in a Changing World: The Role of Organizational Vision*, RAND Report R-3882-A (Santa Monica, Calif.: RAND, 1990), vi.

3. Ibid., 67–69.

4. Leaders that transform organizations "project a compelling vision of the tasks, culture, and importance" of their organizations. James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York, N.Y.: Basic Books, 1989), 96, 217. See Setear, especially 67–83.

5. "Policy, then, will permeate all military operations, and . . . it will have a continuous influence on them." Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 87.

6. Curtis Peebles, *High Frontier: The United States Air Force and the Military Space Program* (Washington, D.C.: US Government Printing Office, 1997), 67–68; and David N. Spires et al., *Beyond Horizons: A Half Century of Air Force Space Leadership* (Maxwell AFB, Ala.: Air University Press, 1998), 231.

7. White House, *Fact Sheet: National Space Policy* (Washington, D.C.: National Science and Technology Council, 19 September 1996), 4.

8. Ibid., 5.

9. The wording in Reagan's *Presidential Directive on National Space Policy*, 11 February 1988, is certainly the most forceful and reflected the administration's commitment to space power. President Clinton's 19 September 1996 *National Space Policy* is quoted here.

10. Department of Defense Directive (DODD) 3100.10, *Space Policy*, 9 July 1999, 6–9.

11. Ibid. DOD introduced the four-part model for space in the 1980s when the space control and force application areas were given substantive attention.

12. For details see Frederick W. Kagan, "Star Wars in Real Life: Political Limitations on Space Warfare," *Parameters*, Autumn 1998, 112–20.

13. President Clinton's line-item cancellation of the military space plane, the KE ASAT program, and Clementine II in 1997 is a commonly referenced example.

14. While the current administration is not against space power in general, it usually avoids programs that could lead to weapons in space or the direct application of force in space. Lt Col Steve Rinaldi, senior national security officer, White House Office of Science and Technology Policy, interviewed by author 18 April and 31 May 2000.

15. A short list of military involvement in "space plane" development alone would include the Dyna-Soar/X-20 program (late 1950s to early 1960s), X-24 hypersonic and lifting body program (1960s to 1970s), Transatmospheric Vehicles and Military Aerospace Vehicle concept studies (early 1980s), and the National Aerospace Plane program (1980s to 1990s). For a general account of each of these programs, see Stares. The most prominent military program which was doomed by the commitment to secret spy satellites was the manned orbiting laboratory (MOL). Stares 239–42.

16. Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, N.Y.: Cornell University Press, forthcoming), 242–43. At one point DOD took steps to limit military "study projects" on space warfare systems because they were perceived as parochial. Stares, 78.

17. Spires et al., 229–30. See pages 217–21 for both perspectives on the rationale for USSPACE. For important insights on the formation of AFSPC and the interservice debates, see R. Cargill Hall and Jacob Neufeld, eds., *The U.S. Air Force in Space: 1945 to the Twenty-first Century* (Washington, D.C.: USAF History and Museums Program, 1998). See especially Brig Gen Earl S. Van Inwegen, "The Air Force Develops an Operational Organization for Space," in *The U.S. Air Force In Space*, 135–43.

18. Ibid., 202–5, 234–36.

19. The "Space Commission" was directed by the *National Defense Authorization Act for Fiscal Year 2000*, sections 1621–30, Public Law 106-65 (5 October 1999). See also Defense Science Board Task Force, *Space Superiority* (Washington, D.C.: Office of the Undersecretary of Defense for Acquisition and Technology, February 2000).

20. "The primary source of beliefs about how to 'best' conduct military affairs is the experience of how things were conducted in the past. . . . Theory provides the framework for future application and is the second major source of doctrine." See Dennis M. Drew, "Of Trees and Leaves: A New View of Doctrine," *Air University Review*, January–February 1982, 40–48.

21. At times the joint approval process dilutes joint doctrine, but this fact only makes the few definitive joint statements that do survive scrutiny that much more credible.

22. Joint Warfighting Center, *Concept for Future Joint Operations: Expanding Joint Vision 2010*, May 1997, 24, on-line, Internet, 14 February 2000, available from http://www.dtic.mil/jv2010/cfjoprn1.pdf.

23. Ibid., 31. Also see *Joint Vision 2010*.

24. "The Air Force is the nation's preeminent source of integrated air and space power. The Air Force is organized, trained, and equipped to defend the United States through control and exploitation of air and space." Joint Publication (JP 3-33, *Joint Force Capabilities,* 13 October 1999, vi–vii. None of the other service capability descriptions in JP 3-33 even mention space. On the other hand, the absence of a revised JP 3-14 highlights that there are still contentious issues regarding space doctrine.

25. For a rigorous discussion of the development of space doctrine, see Peter L. Hays, "Struggling Towards Space Doctrine: US Military Space Plans, Programs, and Perspectives during the Cold War" (PhD diss., Fletcher School of Law and Diplomacy, 1994); Dana Johnson, "The Evolution of Military Space Doctrine: Precedents, Prospects, and Challenges" (PhD diss., University of Southern California, December 1987); and Charles D. Friedenstein, "The Uniqueness of Space Doctrine," *Air University Review,* November–December 1985, 13–23. For the points summarized here, see Hays, 400–23.

26. For instance, consider the following paradox: "While the Air Force believes that space and air are a seamless continuum, the space environment has different characteristics from the air environment. The characteristics of space are sufficiently different from air that a complete understanding of both is required to leverage their contributions." After defending the concept of a seamless continuum, Air Force Doctrine Document (AFDD) 2-2, *Space Operations,* August 1998, 1, goes on to refer to a general boundary of 100 kilometers between terrestrial-based forces and space-based forces.

27. For conflicting views on the validity of the term *aerospace,* see Frank W. Jennings, "Doctrinal Conflict Over the Word Aerospace," *Airpower Journal,* Fall 1990; and Kenneth A. Myers and John G. Tockston, "Real Tenets of Military Space Doctrine," *Airpower Journal,* Winter 1988. The best examination of the roots of the term *aerospace* and its implications in today's world is found in Maj Stephen M. Rothstein, *Dead on Arrival? The Development of the Aerospace Concept, 1944–58* (Maxwell AFB, Ala.: Air University Press, 1999).

28. The latest draft of AFDD 2-1, *Air Combat,* is over three times longer than AFDD 2-2, *Space Operations.* The amount of space used to describe "air warfare fundamentals" in AFDD 2-1 exceeds the total size of AFDD 2-2. One can easily make the case that air combat has a greater history (than space operations) from which to develop doctrine. Accepting that, it is even more troubling that the air combat document devotes an entire chapter to "Training and Education for Air Warfare," and there is no mention of training and education in the space operations doctrine.

29. *Army Vision 2010,* n.d., n.p., on-line, Internet, 14 February 2000, available from http://www.army.mil/2010/.

30. *Forward From the Sea,* n.d., n.p., on-line, Internet, 14 February 2000, available from http://www.dtic.mil/jv2010/navy/b014.pdf; and *Operational Maneuver from the Sea,* n.d., n.p., on-line, Internet, available from http://www.dtic.mil/jv2010/usmc/omfts.pdf.

31. On 2 December 1988, the Air Force issued a policy letter that concluded space operations "can have a decisive influence on future terrestrial conflict." The letter included three tenets of Air Force space policy including "Spacepower will be as decisive in future combat as airpower is today." Letter, Gen Larry D. Welch and Secretary E. C. Aldridge Jr., "Memorandum for ALMAJCOM-SOA, subject: Air Force Space Policy—Information Memorandum," Department of the Air Force, HQ USAF, 2 December 1988, 1–2. For complete development of this point see Hays.

32. Gen Ronald R. Fogleman, chief of staff, US Air Force, "Strategic Vision and Core Competencies," address to the Air Force Association Symposium, Los Angeles, Calif., 18 October 1996, n.p., on-line, Internet, available from http://www.maxwell.af.mil/au/awc/csafafa.htm. See also *Global Engagement,* November 1996, n.p., on-line, Internet, 14 February 2000, available from http://www.xp.hq.af.mil/xpx/21/nuvis.htm.

33. It is interesting to note the change from the traditional Air Force motto of fly, fight, and win. See *Global Engagement.*

34. Gen Howell M. Estes III, "The Aerospace Force of Today and Tomorrow: Transforming Our Service to Control the Vertical Dimension," in Peter L. Hays et al., ed., *Spacepower for a New Millennium: Space and US National Security* (New York, N.Y.: McGraw-Hill, forthcoming).

35. Gen Michael E. Ryan, chief of staff, US Air Force, "Beyond the Horizon: Realizing America's Aerospace Force," address to the Air Force Association, Los Angeles, Calif., 19 November 1999. See also his remarks in the (oft-renamed) *Aerospace Power Journal.* Gen Michael E. Ryan, "A Word from the Chief," *Aerospace Power Journal,* Winter 1999.

36. Department of the Air Force, *The Aerospace Force: Defending America in the 21st Century* (Washington, D.C.: Aerospace Integration Task Force, 8 May 2000).

37. Ibid., 5.

38. In fact, many of the initiatives discussed in the 2000 white paper were introduced in 1988 (see footnote 30) and again in 1992. See chap. 4 for further discussion of this point.

39. Stephen P. Aubin, "Stumbling Toward Transformation: How the Services Stack Up," *Strategic Review*, Spring 2000, n.p., on-line, Internet, 18 April 2000, available from http://ebird.dtic.mil/Apr2000/s20000417stumbling.htm. For conflicting views on the validity of the term *aerospace* see Frank W. Jennings, "Doctrinal Conflict Over the Word *Aerospace*," *Airpower Journal*, Fall 1990; Kenneth A. Myers and John G. Tockston, "Real Tenets of Military Space Doctrine," *Airpower Journal*, Winter 1988; and Rothstein.

40. Maj Shawn P. Rife, Air Force Doctrine Center, background paper on October 1999 JP 3-14 Working Group, 27 January 2000. The final compromise excluded the terms *aerospace* and *medium of space*.

41. "It's no surprise that after two years of trying to institutionalize our vision, we still find ourselves at the initial stages of transforming our Service—culture change takes time." Estes, in Hays et al., *Spacepower for a New Millennium*.

42. "Centralized decision makers who zig with one sense of identity and purpose one year then zag with another vision the next year will confuse those who look to their decisions for validation of, and guidance from, the implied vision." Setear, 78. Prior to Desert Storm it took *over a month* to move a single communications satellite already on orbit into a position more favorable for direct support. Spires, 248.

43. The timing of the *LRP* took advantage of changing policy guidance and *Joint Vision 2010* to credibly pursue the roles of space control and force application, mission areas that initially appeared in policy statements in 1987. See *Long Range Plan: Implementing USSPACE Vision for 2020* (Peterson AFB, Colo.: US Space Command Director of Plans, March 1998).

44. For a summary of the methodology used see the *Long Range Plan*, Executive Summary, 5.

45. JP 3-33, II-10 and III-4. See also Dana J. Johnson et al., *Space: Emerging Options for National Power*, RAND Report MR-517 (Santa Monica, Calif.: RAND, 1998), 70–73.

46. "Since AFSPC is also a force provider for a number of unified commands, our Vision supports the USSPACE Vision for 2020, NORAD Vision 2010 and the USSTRATCOM Vision." The AFSPC (2000) vision is "A globally integrated aerospace force providing continuous deterrence and prompt engagement for America and its allies . . . through control and exploitation of space and information." *Air Force Space Command Strategic Master Plan for FY02 and Beyond* (Peterson AFB, Colo.: Air Force Space Command Director of Plans, 9 February 2000), 6, iii. Compare this to the 1998 vision: "Fully integrated aerospace systems capable of rapidly and decisively engaging forces worldwide." *Air Force Space Command 1998 Strategic Master Plan* (Peterson AFB, Colo.: Air Force Space Command Director of Plans, March 1999), i–iv. For a summary of the various visions that drove the AFSPC vision, see the *Strategic Master Plan for FY02 and Beyond*, 6–8.

47. What makes this situation especially ironic is that the USSPACE CINC is also the AFSPC commander. For a complete development of the convoluted organization for military (and civil) space power, see Hays et al., *Spacepower for a New Millennium*, chap. 11.

48. The figure is intended to provide a qualitative depiction of the general nature of the pattern of aggregate civil and military visions and key documents and events are listed for illustrative purposes. The figure does not attempt to depict individual perspectives that differ dramatically from the historical record. To reflect the uncertainty in the "aggregate" vision present in the recent past, the figure depicts a wider range of potential visions. The main point of the figure is to reflect the historic disparity between the military and civilian visions of space power. For a more detailed discussion of the documents and events listed refer to the works listed in footnotes 1, 6, 17, 25, and 27. Thanks to Brian Anderson for asking the questions that led to this figure.

49. *2000 Strategic Master Plan (SMP)*, 68. Estes, in Hays et al., *Spacepower for a New Millennium*. In spite of these distinct challenges, later portions of the *SMP* reinforce the lack of institutional commitment to the space power vision. See the FY 2002 Program Objective Memorandum (POM) priorities and prioritized Far-Term Capabilities that demonstrate a clear preference for legacy systems and terrestrial operations, 81–83. One AFSPC representative who helped write the *2000 SMP* said that after all the effort was expended to write

the *SMP*, the priorities discussed in the POM priorities represented the leadership's "real bottom line."

50. National Security and International Affairs Division, *Defense Acquisitions: Improvements Needed in Military Space Systems' Planning and Education*, Report to the Chairman, Subcommittee on Strategic Forces, Committee on Armed Services, and to the Honorable Robert C. Smith, US Senate (Washington, D.C.: General Accounting Office, May 2000), 28–32.

51. "I personally believe we will not realize full freedom to operate in space until we have some kind of watershed event that highlights our dependence." Maj Gen William Looney III, Director of Operations, Air Force Space Command, interviewed by author, 10 and 12 April 2000.

52. The most recent manifestation of this is the Space Commission described earlier. See footnote 19.

53. These are just a few of the many options under consideration. For an alternative "Space Guard" concept see Lt Col Cynthia A. S. McKinley, "The Guardians of Space: Organizing America's Space Assets for the Twenty-First Century," *Aerospace Power Journal*, Spring 2000, 37–45.

54. Regardless of the source, the wildfire of change is burning brightly now; and it is not yet clear which way the winds will blow or which bureaucratic structure lies in its potentially devastating path.

55. For an overview of the (failed) Air Force effort to determine overall space leadership for the military see Spires, 275–84.

56. By 2001 the Air Force will devote more than 50 percent of its research budget toward aerospace-related technologies. Craig Covault, "USAF Shifts Technology for New Future in Space," *Aviation Week and Space Technology*, 17 August 1998, 40. Even these figure belie the reduced Air Force budget devoted to aerospace research and development. Air Force Association (AFA) Science and Technology Committee, *Shortchanging the Future: Air Force Research and Development Demands Investment*, AFA Special Report (Washington, D.C.: AFA, January 2000).

57. Dr. Colin S. Gray, "Vision for Naval Space Strategy," *Proceedings*, January 1994, 67. More to the point: "If the DoD makes space the province exclusively of NASA and the Air Force, then the Navy may suffer the same fate that befell the Army, when the Air Force's focus on strategic bombardment all but stripped the infantry of close air support." Rear Adm W. J. Holland Jr., US Navy, retired, "The Navy's Case," *Proceedings*, February 1990, 37.

58. Gen Charles A. Horner, USAF, retired, often advances the cause of a major force program for space to secure funding denied space development.

59. Holland, 39.

60. Sen. Bob Smith, "The Challenge of Space Power," *Airpower Journal*, Spring 1999, 32–40.

61. Bruce M. DeBlois, "Ascendant Realms: Characteristics of Airpower and Space Power," in Phillip S. Meilinger, ed., *The Paths of Heaven: The Evolution of Airpower Theory* (Maxwell AFB, Ala.: Air University Press, 1997). See also footnotes 25 and 27.

62. For the best discussion of this point, see Maj Shawn P. Rife, "On Space-Power Separatism," *Airpower Journal*, Spring 1999, 21–31.

63. Aubin, 39.

64. "I was to learn later in life that we tend to meet any situation by reorganizing; and a wonderful method it can be for creating the illusion of progress while producing confusion, inefficiency, and demoralization." Petronious, as cited in Martin van Creveld, "Caesar's Ghost: Military History and the Wars of the Future," *The Washington Quarterly*, Winter 1980, 76.

65. One example of this kind of "shaping" was the use of the joint military vision to guide the Quadrennial Defense Review. Secretary William S. Cohen called *Joint Vision 2010* his "template" for ensuring future military dominance. Cohen, "Report of the Quadrennial Defense Review," *Joint Force Quarterly*, Summer 1997, 9.

Chapter 4

Cultural Change in the Military Space Community

Messiahs are not enough; they need disciples.

—Allan R. Millett
Military Innovation in the Interwar Period

New technologies will increasingly bring to the fore the expert in missile operations, the space general, and the electronic warfare wizard—none of them a combat specialist in the old sense.

—Eliot Cohen
A Revolution in Warfare

The last chapter demonstrated that the military space power vision has been cyclical. Presently, rapid change and a lack of demonstrated congruence with the civilian vision impede the military vision. Even if the modern civil-military vision for space power is unclear, it is important to study the evolution of the military space power culture. Chapter 2 explained why culture was important to the success of transformation in greater detail, but a few points bear repeating. The vision crafted by senior leaders is mainly conceptual, so it falls to the military community to develop competing theories of victory—military strategies—to fulfill the vision. Understanding how the military develops their competing theories requires an awareness of their culture—the system of underlying, shared beliefs about the *critical* tasks and relationships within the organization. Since it takes longer to change a culture than to develop a clear vision for innovation, the culture of an organization may be the driving factor that determines the long-term success of transformation. If the United States waits until it gets a wake-up call demonstrating a critical dependence on space power, the time it takes to change the culture may not be available.[1]

In light of the time it takes to change culture, I begin by summarizing the military attitude towards space from the 1950s through the formation of AFSPC in 1982. I then look at the military space organizations that have emerged since the early 1980s and consider in detail one internal struggle that sheds light on the complexity of the Air Force culture—the space and missile career field merger. This Air Force case study highlights the changing definition of "critical tasks" for space and missile operators. Taken as a whole, this chapter defines the three cultural "eras" in the space community.[2] The early "Engineering Era," the present "Support Era," and the potential for a "Warrior Era." I consider the efforts to, and the results of, creating career paths designed to help space and missile

operators reach higher ranks in order to advance the vision created by leaders. The ongoing debate between those who value space as a force enhancement tool and those who value space as a potential war-fighting medium demonstrates the difficulties inherent in cultural change. This composite examination provides a general picture of the military space culture and indicates areas for improvement.

The Foundation of Space Culture

One should not consider organizational culture in isolation because it is influenced by the legacy of its past. While there is not enough room here to recite the early development of the military space culture, there are already numerous accounts of the early space age that discuss in detail the interaction of military organizations and civilian policy makers.[3] These works taken together provide a relatively consistent description of the military culture with respect to space power through the late 1970s. A brief summary is sufficient to set the stage for a closer look at the space culture since the 1980s.

In general, the US military was initially drawn to the promise of space power, and all of the services fought aggressively to capture all or part of the space prize. Over time, however, the original Eisenhower policy of peaceful use of space became the norm for subsequent civilian leaders. The combination of nuclear standoff with the Soviet Union and emphasis on national assets for space surveillance led to a grudgingly accepted military view that space was mainly a place for unmanned communication, navigation, and intelligence satellites (and for ballistic missiles to transit). This image of space power took several generations to gain acceptance, but eventually even the military preached the gospel of space sanctuary.[4] As a result of decades of thwarted efforts to exploit the military potential of space, the services were resigned to leave space operations to the scientists, spies, and nuclear missileers.

Space was out of the mainstream of the operational military organization. For the Army and Navy, space only provided communications and navigation tools to enhance their traditional terrestrial missions. Even though the Air Force claimed to be the leader in space development, the peripheral nature of the space culture was especially prevalent within their service. The official history of Air Force space development admits that "building consensus internally for space required time, patience, and far greater understanding than was forthcoming in the 1970s."[5]

A Focus on the Air Force

Rather than examine the space culture of each service, this review will focus on the Air Force. The Air Force provides a logical locus of study for three reasons. First, the Air Force has the largest share of personnel and funding directly associated with the space mission.[6] Second, in spite of its

missteps, the Air Force has played a pivotal role in the emerging importance of space through the organizational changes described below. Finally, the clashes within the Air Force described here provide the most dramatic indications of the unpredictable nature of cultural change within the space community. While the details presented here focus on the Air Force, the lessons drawn apply just as well to the other services as they slowly grow space-centric career paths.[7]

A closer look at overall Air Force culture reinforces the hypothesis that numerous intraservice groups with competing theories of victory vie for control of the overall organization. The best Air Force example of this competition is the recent rise of the fighter generals. Arnold Kantner provided the earliest convincing statistical information that showed how the promotion opportunities for bomber pilots declined in comparison to what he called "limited war pilots."[8] This discussion of shifting control in the Air Force is important for two reasons. First, it shows that organizations can change priorities if given ample time and just cause. For instance, due to institutional inertia, the shift to fighter dominance took anywhere from two to more than four decades depending on the criteria being measured. In spite of this resistance, the transition was successful because a focus on strategic bombing proved untenable in a limited war era.[9] Second, the shift from bomber aircraft to fighter aircraft (rather than intercontinental ballistic missiles [ICBM] or satellites) reinforced the air-breathing platform focus of the Air Force. As late as 1975, in spite of vigorous (albeit inconsistent) application of the term *aerospace*, the Air Force remained very much an air-centric flying organization.[10]

Even with the apparent air dominance, several factors combined in the late 1970s to change the Air Force view regarding the priority and promise of space. Renewed Soviet antisatellite testing and military expansion in general prompted civil and military reviews of the space program. For the Air Force in particular, the concept of a space shuttle solidified the image of space as a regime friendly to pilots and not just a place for esoteric, unmanned satellites. Growing attention toward the space mission helped to build the ranks of "space cadets" willing to voice their opinions on the need for a major space command organization. The process still took time. In spite of the growing momentum, "Air Force leaders acted as much to avoid external dictation as they did to direct the elements for change within the service."[11]

Separate Space Commands

In response to the growing pressures, internal and external, the Air Force finally created a separate space command in 1982. The creation of a separate command was hotly debated and related more to bureaucratic politics than rational decision making. There were a number of competing organizational and cultural issues at work, ranging from the aerospace debate to research-versus-operations mentalities.[12] As an example of the growing overall military emphasis on space and the interservice tension

over control of the space mission, USSPACE stood up in 1985.[13] The growing internal influence of AFSPC is apparent in the steady growth in the number of personnel assigned to the command even in the face of overall force reductions. For instance, the authorized strength of AFSPC increased from 1,963 at inception to 27,829 in 1994.[14] The present strength of AFSPC is approximately 33,600 people, a small but influential portion of the total Air Force.[15]

In spite of the growing strength of AFSPC, the reasons for its existence initially had less to do with growing space influence than with "normalizing" space.[16] Normalizing meant reversing the long-term trend of emphasizing technical expertise over operations experience. Since military space professionals evolved from the secret world of space research and systems acquisition, their career development "steeped them not in the warrior arts, but rather, for the most part, in applied science, engineering, and systems management."[17] For instance, in 1985 about one-third of space operations officers had technical degrees—five times more than required.[18] This research mind-set created a wide chasm between early space engineers and pilots who prided themselves on operational experience. The creation of undergraduate space training in 1986 helped to narrow the divide slightly by emulating the traditional undergraduate pilot training program, but the differences between the two communities ran much deeper.[19] As late as 1991, many military leaders still viewed space missions as "something outside the 'real world' of Air Force or Navy or Army operations."[20] Space personnel were pushed to the side and had to fight for everything. According to one Air Force general, there was "neither understanding nor strong support for all the things that space could do for the Air Force."[21]

While the creation of AFSPC set the stage, Operation Desert Storm was a turning point for the space culture because it demonstrated to the entire military community the importance of space when fighting terrestrial wars. There are numerous accounts of the importance of space capabilities in the Gulf War—many of which border on hyperbole.[22] The point is that so much attention was paid to the role of space in the war. While the importance of space as a force enhancement tool gained wide acceptance through the 1990s, the emerging space culture still suffered growing pains.

The Space and Missile Merger

An important example of the vicissitudes of the space culture is the merger of the space and missile fields beginning in 1992. While often cited as an example of the early attempts to "operationalize" space, the space and missile career merger occurred for other reasons. After an unsuccessful attempt to integrate the ICBM fleet into Air Combat Command, it was moved to AFSPC.[23] Shortly after that, in an unrelated move, Air Force Chief of Staff Merrill A. McPeak worked to reduce the number of career codes (AFSC) throughout the Air Force. His intent was to foster more generalists to produce "universally assignable officers" and eventually produce

commanders with "multi-mission area experience."[24] In AFSPC this vision resulted in the merger of the widely disparate space operations and missile operations career fields. As part of the program, the long-term command goal was to have more than half of the AFSPC officers and most senior leaders experienced in both the space and missile areas by 2003.[25]

All indications are that the command is well ahead of their *overall* cross-flow goal. Presently, "early" missileers command three of the seven wings and one of the two numbered Air Forces in AFSPC while "early" space operators command two wings.[26] At the operations group level, six of seven commanders have experience in both space and missile mission areas. The preference given to officers with experience in both areas is also apparent in command promotion trends and other cultural artifacts. While promotion information is carefully guarded, there are persistent indications that as many as 80 percent of the officers selected for promotion have dual experience. There are also other indications of continuing command efforts to remove distinctions between space and missile operators.[27]

While breadth of experience is a generally laudable objective, a closer look at the cross-flow trends within the space community highlights the law of unintended consequences. Even at the inception of the career field merger, there was much higher interest on the part of missile officers to cross train into space operations billets than vice versa. The first career field integration board selected more than four times as many missile officers for training in space operations as space operators for training in missiles. A number of factors combined to prejudice the broadening towards the missile field. First, most space operators showed little interest in missile operations for reasons ranging from elitism to poor assignment location. Second, a larger pool of missile officers meant their community had to employ competitive selection for limited billets in space operations. This practice made the cross-flow opportunity even more attractive to missileers because it provided another "discriminator" for later promotion.[28] The result: a bias towards leadership with a predominant missile operations background. For instance, as of 1996 officers with unit-level missile experience held most of the leadership positions not held by pilots in AFSPC. At present, six of the seven operations group (OG) commanders began their career in the missile field and the only OG commander without dual experience is a missileer.[29]

This discussion of space and missile cultures, while subordinate to the discussion of the space culture within the Air Force, is important for a number of reasons. First, it validates the first two steps of the general pattern for innovation. The personnel vision held by General McPeak called for greater emphasis on multimission experience. In spite of stiff resistance on the part of the space operations community, senior leaders implemented the vision and, over time, changed the command culture—shaping the present leadership of AFSPC. Second, the merger highlights the lack of consensus within the space community about how to define their critical tasks. The quest for officers with multimission area experience

led to a pool of senior officers with mostly operational missile experience. Since the only commonality between space and missile functions is console operations, there is a danger that unique space operations experience will diminish at command levels. This could result in less diverse theories of victory within the command. Similarly, the Air Force debate over critical service tasks could limit the range of strategies designed to fulfill a space power vision.

The Debate over Critical Tasks

The space and missile debate provides interesting insights that help clarify the overall discussion about the present and future role of space. To understand the present role of space, one must return to the legacy of Desert Storm and investigate the force enhancement mission familiar to traditional war fighters.

Space Support to the War Fighter

The impact of space on the conduct of operations in Desert Storm set the stage for new emphasis on space operations. The 1992 selection of Gen Charles A. Horner, the joint forces air component commander for Desert Storm, as CINC of USSPACE and commander of AFSPC began a continuing trend of fighter pilots leading space command and emphasis on the force enhancement mission from space.[30] The emphasis on force enhancement was not the only desire of the Air Force leadership, however. In 1992 General McPeak, Air Force chief of staff, redefined the Air Force mission to "defend the United States through *control* and exploitation of air and *space*" (emphasis added).[31]

General McPeak then tasked a blue ribbon panel to conduct a comprehensive review of Air Force space policy and organization. In 1993 the Moorman Report—named for the chairman of the panel and the vice commander of AFSPC, Lt Gen Thomas S. Moorman—published their classified results. The panel concurred with the chief's view that space was a core Air Force mission; but there were "deficiencies in policy, organization, processes, and infrastructure."[32] Included in the 17 major findings and associated recommendations were several that highlighted the cultural problems still facing the Air Force and the services in general. Besides the well-established reference to the early strategic nature of space forces, the panel recognized that space knowledge and expertise within the Air Force was inadequate for future integrated operational planning and execution. While unrelated to the career field merger directed by General McPeak, the Moorman Report also advocated two-way cross flow between space and air *beginning at the field grade level.*[33] Another major recommendation called for the creation of a "Space Applications and Warfare Center" designed to bring together users, operators, and developers to develop concepts and tactics "*with a focus on warfighting*" (emphasis in original).[34] The Moorman

Report and the vision of General McPeak set the foundation for a dramatic change in the nature of the space force.

Once again, the best intentions did not produce the desired results. In spite of strong emphasis on the need for two-way career cross flow, the results were similar to those seen in the case of the space and missile merger—but for different reasons. First, rather than conduct cross flow at the field-grade level, most joint "war fighter" interaction with space forces came at the hands of AF space support teams (SST)—often young captains sent to provide theater CINCs with space expertise.[35] While many SST members were Weapons School graduates, normally a means of "instant credibility" among pilot graduates, there were many problems with the concept when applied to the space career.[36] Often SST members were "captains bobbing in a sea of colonels" who were only used to help with monitoring theater missile defense. Many saw this pigeonholing of young space experts as a waste of a valuable resource.[37] While all the CINCs valued the expertise provided by the SST, most felt it would be better to have integrated expertise rather than on-call support teams. This view, echoed by the current vice chairman of the Joint Chiefs of Staff, simply confirms the recommendation made by the Moorman panel nearly a decade ago.[38]

The case of the Space Warfare Center (SWC) provides a similar example. While the Moorman panel envisioned a center designed to exploit space capabilities for force enhancement *and* develop concepts for space control and force application, the organization created to fulfill the Moorman recommendations has focused most of their energy on force enhancement. The move away from development of conceptual space control missions was evident within weeks of the Moorman Report. The Space Applications and Warfare Center was actually named the Space Warfare Center when General Horner deleted the reference to "Applications" in the name in order to focus on space force support and force enhancement.[39]

The decisions to focus AFSPC on force enhancement shaped the culture of the space community throughout the 1990s, and the artifacts of that decision are apparent within AFSPC and across the services today. The Army, Navy, and Marines still see space operations as a force enhancement tool for their traditional service missions.[40] What is most interesting is the continued Air Force focus on force enhancement. Most command briefings, unit missions, and contemporary discussions focus on the role of space "support to the war fighter."[41] The result of this emphasis is a narrow understanding of the critical tasks and roles of space operators that excludes the areas of space control and force application.[42]

Space Operators As War Fighters?

If the 1990s were the era of "support to the war fighter," the indications are that the twenty-first century will begin by shifting the space culture towards a warrior mentality. Senior leadership perceives a need for a cultural shift, but the present identity crisis and shifting service visions

will impede the change. In addition, the space community lacks the theory and doctrine necessary for a complete shift. The result is a short-term cohesion problem that could potentially fracture the force at a critical time.

The senior leaders within the space community acknowledge the need to shift away from a support mentality. Before leaving the helm of USSPACE and AFSPC, General Myers talked about a corporate identity problem. He stated that some space operators did not think like warriors and were still too concerned with hiding behind secrecy. In his words, "We (in the space community) must talk about ourselves right and develop a warrior mentality."[43] The vice commander of AFSPC put it another way: "First we need to get rid of the term 'support to the war fighter.' Rather than focus on the support issue we need to build a culture where space operators are not considered second-class citizens. Space operations *are* warfighting because we all need to rethink what warfighting means in the 21st century."[44]

In spite of the emerging patterns in senior leadership emphasis, the current space force is still suffering an identity crisis about its place in the military. The crisis is exacerbated by a rapidly changing service vision that currently discusses a "space and air force" but is beginning to emphasize an integrated aerospace force.[45] Space officers are not sure whether they are operators, warriors, war fighters, or airmen; and the Air Force does not provide clear definitions for any of those terms.[46] Because the leadership of the organization has difficulty consistently defining the critical tasks and relationships within the organization, there is not a clear sense of mission. This lack of a clear sense of mission has led to a "cohesion crisis" in the Air Force, with the rift between air and space described as the single largest discontinuity.[47] While the level of crisis and its causes are debatable, the Air Force focus on functions, technologies, and specific occupations is well documented and acknowledged even within the service.[48] Besides the predictable frustration associated with changing service visions and confusion over identities, there are more serious impacts.

As a result of the cultural turmoil, there is a lack of well-developed theory and doctrine necessary to advocate a space war-fighting culture. The weaknesses in AFDD-2 and the military's inability to publish a joint publication on space operations for over nine years highlight this point.[49] Partly as a result of the search for a common theme to unite space and air operations with one unifying mission, current doctrine is more organizational than basic or environmental.[50] As a result, Air Force doctrine is more concerned with justifying current bureaucratic structures than determining the best ways to fight future conflicts. In the words of one highly motivated but realistic space operator: "We are trying to make ourselves look like an elite force rather than concentrating on becoming an elite force."[51] Two examples that support this claim are the lack of understanding in the space community about what tactics, techniques, and procedures are and the difficulty of training space (and nonspace) operators because of classification issues. The result is a space force that has a shortage of operationally useful doctrine.[52]

Course Corrections

There are some efforts within the military—and the Air Force specifically—that signal promising adjustment. The first effort is an attempt to correct the shortfall of broadly educated space leaders called for by the Moorman Report and earlier studies. Next, the Air Force space community is making changes designed to generate the kind of thinking needed for space control theory.

Career Paths, Present and Future

The number of opportunities for space operators to reach positions of influence remains low, but the tide appears to be slowly turning. For instance, one 1996 study concluded that even after 14 years with an operational space command, "there are simply not enough Air Force generals today with space experience."[53] The study generally discounted the value of missile experience, and that disposition highlights the continuing tension between the space and missile specialties. Unfortunately, the study ignored the long-term plan that intentionally favored operators with both space and missile experience. Present senior officers acknowledge the time it takes to "grow" leaders with new forms of experience, and the growth of the missile community is used often as an example.[54]

The present situation has changed, but not substantially. One telling aspect of this issue is the way the Air Force presents career path data. The Air Force publicly releases promotion data through the rank of colonel (O-6) based on four occupational categories: pilot, navigator, nonrated operations, and mission support.[55] The fact that space and missile operators are part of the broader nonrated operations category may say more about their status in the Air Force than any amount of discourse on aerospace integration can. This delineation is important because, historically, pilots are promoted at higher rates than those in other career areas.[56] While a better source of data would be the comparison of pilot rates with space and missile career rates, the Air Force Personnel Center (AFPC) jealously guards promotion rates by career field.[57] The fact that AFPC refuses to release sanitized promotion data by specific occupation highlights another cultural facet of the Air Force—a lack of candor regarding their own culture.

While the implicit data for promotion rates supports the existence of limited career paths for space and missile officers, current general officer demographics are even more telling. As of March 2000, less than 50 percent of the general officers in AFSPC operational leadership positions had prior operational space or missile experience.[58] Does this statistic represent a lack of space and missile leadership within Space Command? In the eyes of many space separatists, the leadership experience is unfavorably biased towards pilots. While the commander of North American Air Defense Command (and therefore USSPACE and AFSPC) is customarily a pilot, the same precedent does not exist for other positions within AFSPC. While the concern over pilot presence in AFSPC is warranted, this opinion

ignores the long view. By the summer of 2000, less than one-half the senior leadership within Space Command will be from outside the command.[59] The amount of space and missile experience at the senior leader level in AFSPC is higher than it has ever been since 1991.[60] The important point is not the percentage of leadership with a flying background within AFSPC but the overall trend towards increased space and missile representation within the Air Force. For some, the amount of representation is still inadequate since there is a very limited amount of senior space/missile leadership outside of AFSPC. There is, however, little benefit to debating the hypothetical "proper" balance of senior officers. It does make sense to consider the approach, unintentional or otherwise, the Air Force chooses to grow future space leaders.

One thing is clear—the Air Force has consistently failed to effectively implement recommendations (from as early as 1988) for *two-way* air and space cross flow. There were attempts, albeit limited in scope, to expose midcareer space officers to broader Air Force missions. Overall, though, most of the flow was from the air community to the space community. The result is a shortage of senior leaders with grassroots space or missile experience. While this problem is not unique to the Air Force, its role as space steward and the earlier guidance provided by senior leadership make the Air Force more accountable than the other services.[61]

There are major efforts under way to improve the career paths for space operators. Lt Gen Donald G. Cook, vice commander of AFSPC, took an active role in officer career development within AFSPC. "Right now the command is heavily led by aviators with ops experience, but we are beginning to grow our next generation of space commanders from both within and from outside the command."[62] In early 2000, General Cook stood up an "Aerospace Officer Development Section" designed to track the career paths of promising space personnel to make sure they were getting the qualifications they needed to make them more competitive for senior rank. In order to encourage cross flow, the AFSPC staff is designing programs to better integrate air and space, including programs to allow nonspace officers the opportunity to command space squadrons. These programs will, in theory, support recent initiatives outlined in the Air Force white paper on integrating air and space.[63]

There are two pitfalls with the proposed programs that deserve mention. First, if the cross flow is of short duration, the strength of space advocacy may diminish. Many believe that bringing a nonspace officer in for one tour and calling them "space smart" is dangerous. Indeed, in many cases it takes at least six months to understand the overall missions and nuances associated with a new organization.[64] The second consideration deals more with the continued lack of two-way cross flow. While nonspace operators have many opportunities to work in the space community, there are few opportunities for space personnel to gain experience in the flying world. For example, there are no space operators working in the air battle manager or unmanned aerial vehicle communities, but there are nu-

merous pilots (and even more navigators) working in the space and missile fields.[65] The result of this one-way flow could easily follow the pattern set by the space and missile merger—those with the opportunity to "broaden" will eventually rise to command the organization. In this scenario, the current missile-trained and space-broadened leaders would eventually pass on organizational control to pilot-trained and space-broadened leaders. Unless the planned programs are modified, the "pure" space operators could once again be hindered from rising to senior leadership positions. If the Air Force truly wants an integrated aerospace force, then it should aggressively cross flow space personnel into the air operations community. While recent Air Force ideas suggest improvement in this area, the track record on execution is not encouraging. Many of the current initiatives merely echo chief of staff and secretary of the Air Force guidance provided as early as 1988, with minimal success.[66]

Organizing to Develop Space Theory and Doctrine

Within the space community, there is some effort to fill the doctrinal void created by years of having organizational doctrine without supporting environmental doctrine. One example of this effort is the emerging effort by the SWC to return their focus to that originally intended by the Moorman recommendations. In a restructuring approved by General Myers in December 1999, the SWC will become the space community hub for space power doctrine development.[67] While retaining the original missions designed to develop tools for space support for flight operations, the SWC will shift its emphasis to space control and force application missions.

In an interesting analogy, the SWC intends to model itself after the Army's ACTS and become the "ACTS of space."[68] The intent of the organization is an effort to develop coherent doctrine in order to catalyze the development of space power from an enhancement tool to a combat arm. While not an original idea, this plan should be encouraging to space operators.[69] The change shows a sincere interest, regardless of the background of senior leaders, on developing much-needed theory and doctrine for space war fighting.

The ACTS analogy used by the SWC brings to mind some interesting considerations. First, in spite of the substantial work accomplished by ACTS theorists in the interwar period, their overall theory of unescorted high-altitude precision daylight bombing was flawed and did not stand the test of combat.[70] The important point to remember is that any peacetime theory without thorough evaluation risks failure when tested in the fiery cauldron of combat. This point is covered in detail in the next chapter, which examines the role of honest appraisal of a new theory of victory.

The second point is one that demonstrates the danger of analogies. Some claim the reason ACTS worked so hard to develop strategic airpower doctrine was in order to build justification for a separate service.[71] This view ignores their equally likely, and nobler, motivation to serve the nation as effectively as possible. Regardless of the rationale for forming and

supporting an Air Corps tactical school, ACTS theories did contribute to the case for a separate Air Force. In the case of space power, to date the theory to justify a separate space force simply does not exist.[72] Most of the space separatist arguments focus on the lack of respect for the space mission or the obvious environmental differences. There are substantial environmental differences between air and space, but none of the theories of victory advanced so far explain why a space force must be separate to succeed. Ironically, the new effort on the part of the SWC, regardless of the original intent, may eventually provide the space separatists with the doctrine they need to justify a separate force.

Nevertheless, the new SWC organization will likely result in useful doctrine regardless of where the space force eventually resides. One of the reasons that ACTS doctrine was flawed was the lack of balanced discussion to counter their complete commitment to unescorted strategic bombing. The ACTS theorists operated in an isolated environment and shunned criticism. Officers from other branches were brought in as students to disseminate Air Service doctrine throughout the Army and "destroy prejudices that existed against the Air Corps."[73] Many airpower advocates soften their critiques of the ACTS focus on strategic bombing by highlighting that ACTS was working in a theoretical environment and had no basis for empirical analysis. This argument proves inadequate for two reasons. First, there was some evidence at the time that the ACTS theories were flawed.[74] Second, at exactly the same time that ACTS developed their theory, Sir John C. Slessor wrote an insightful theory of airpower that accurately reflected the eventual World War II (and modern) mix of strategic attack, interdiction, and close air support.[75] The main difference was that Slessor, a Royal Air Force officer, developed his theories in the critical environment of the British Army Staff College. Like Slessor's experience at Camberley, space power theory will most likely benefit by having a mix of space operators and earth aviators working together to develop balanced space power theory and doctrine.

Conclusions

Several conclusions can be drawn regarding the evolution of the space culture. Clearly, cultural change takes time, sometimes as short as five years but often as long as a generation or more.[76] In the most basic terms, the time from the 1950s to the 1980s was the "Engineering Era," when space operators behaved like acquisition officers designing national systems with little regard for war fighting. This chapter has shown that the 1990s were the "War fighter Support Era," when the culture was shifted towards an operational mentality—but only in a support capacity. While the space community may be poised at the beginning of the "Warrior Era," it is apparent that the change will not occur overnight.

Another important point is that cultural change is possible but not always predictable in the absence of a well-defined mission. The influence of Desert

Storm and a decade of fighter general leadership in AFSPC and USSPACE established a space community geared towards "support to the war fighter." In addition, the career paths resulting from the McPeak efforts to reduce the number of service specialties inadvertently led to a missileer ascendance in AFSPC. Both of these factors highlight a need for change. Because cultural conflict is epitomized by ideological struggles to define new theories of victory, the lack of credible "pure space" voices in the strategic debate could limit the range of theories considered. A future space force designed to emulate traditional aircraft and missile forces might suffer for not considering the views of personnel with grassroots space experience. Put simply, a space force based on just conventional ICBMs and aircraft-like space vehicles *may* be the best force, but military leaders should not assume this without hearing the now muffled voices of the pure space operators. The voice of the traditional space community should be heard, and to be heard they must be given greater opportunities to succeed.

Current Air Force efforts are a good initial move towards a warrior mentality in space, but there is room for improvement. First, the Air Force needs to embrace a comprehensive vision for space power and begin to pursue aggressively the development of space control theory and doctrine.[77] This step requires the members of the Air Force to stop expending substantial intellectual energy on the organizational "aerospace" debate described in the previous chapter and focus on the development of a vision for space power. For their part, service leaders will need to demonstrate their commitment to integration by developing career paths for space operators that include cross flow *into* the air operations business. This demonstration will require more action and less talk, because the words have been around since the late 1980s.

While the vision of the future space force is clouded by intraservice debate, Air Force leaders appear to recognize the importance of space to the health of their service.[78] Space separatists, on the other hand, will need to focus on their functional missions and how to best accomplish them rather than merely discussing separatism for separatism's sake. Part of this effort will need to include a realistic appraisal of proposed space theories to avoid overselling unproven ideas—this is the focus of the next chapter.

Cooperation on the part of both groups, the aerospace advocates and the space separatists, will accelerate the change required for true transformation. Lack of cooperation or an incremental shift will more than likely result in a military culture "behind the power curve and ill-prepared to grow and sustain an officer career force which can field, operate, and lead future space missions."[79]

Notes

1. A prime example of the impact of culture on demands for rapid mission changes is the Kennedy administration's unsuccessful attempts to develop counterinsurgency capa-

bilities in the early 1960s. See Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991), 100–103.

2. An era is defined as any period of time required to complete a cultural transition. For the flying world, the bomber era lasted from the 1930s to the 1970s, while the fighter era is ongoing. See Col Michael Worden, *Rise of the Fighter Generals* (Maxwell AFB, Ala.: Air University Press, 1998).

3. The best overall view of this development is Walter A. McDougall, *The Heavens and the Earth* (Baltimore, Md.: Johns Hopkins University Press, 1997). For a closer look at the military efforts in space through the early 1980s, see Paul B. Stares, *The Militarization of Space: U.S. Space Policy, 1945–1984* (Ithaca, N.Y.: Cornell University Press, 1985). Another summary that provides an emphasis of the relationship between civilian policy and military doctrine is Peter L. Hays, *Struggling Towards Doctrine: U.S. Military Space Plans, Programs, and Perspectives during the Cold War* (PhD diss., Fletcher School of Law and Diplomacy, 1994).

4. One example of this slow change is the influence of policy on doctrine. By the mid-1960s, even Air Force doctrine was written based on policy restrictions rather than the basic nature of warfare. This policy influence on military space doctrine is readily apparent in the 1975 Air Force doctrine manual: "The underlying goal of the U.S. national space policy is that the medium of space must be preserved for peaceful use for the benefit of all mankind." Air Force Manual (AFMAN) 1-1, *USAF Basic Doctrine*, 15 January 1975, 1–2. For a full development of this point, see Lt Col Charles D. Friedenstein, "The Uniqueness of Space Doctrine," *Air University Review*, November–December 1985, 13–23. See chap. 3, fig. 1, for a graphic depiction of this trend.

5. Curtis Peebles, *High Frontier: The United States Air Force and the Military Space Program* (Washington, D.C.: US Government Printing Office, 1997), 208.

6. The Air Force is responsible for a majority of DOD space capability: 90 percent of the space personnel and infrastructure, 85 percent of the space budget, and 86 percent of the space assets. Gen Michael E. Ryan, chief of staff, US Air Force, "Beyond the Horizon: Realizing America's Aerospace Force," address to the Air Force Association, Los Angeles, Calif., 19 November 1999. Also, until recently USAF was the only service with a space operations career field. See a number of stories on the changes to the military space community by William B. Scott, *Aviation Week and Space Technology*, 18 September 1995, 40–59.

7. Even though Army officers now have a "space operations" career path, they must still qualify in a basic branch. For a description of the FA40 career path, see "FA40 Career Path," n.d., n.p., on-line, Internet, 22 March 2000, available from www.smdc.army.mil/FA40/career.html.

8. Arnold Kantner, *Defense Politics: A Budgetary Perspective* (Chicago, Ill.: University of Chicago Press, 1979), 99–115.

9. For the complete book-length account of the transition to a fighter-led Air Force see Worden.

10. Franklin D. Margiotta, "Making It in the Air Force: Officer Perceptions of Career Progression," paper presented at the 1975 biennial meeting of the Inter-University Seminar on Armed Forces and Society, Chicago, Ill., as cited in Kantner, 108. See chap. 3, fig. 1, for a brief look at the Air Force's inconsistent application of the term *aerospace*.

11. Peebles, 188–93, 208.

12. Ibid., 196–208. Examples of internal pressures include the efforts of Lt Gen Jerome F. O'Malley on the Air Staff and the Scientific Advisory Board Summer Study on Space prepared in 1980. External pressure came from the Reagan administration and members of Congress. See also Brig Gen Earl S. Van Inwegen, USAF, retired, "The Air Force Develops an Operational Organization for Space," in *The U. S. Air Force in Space: 1945 to the 21st Century*, eds. R. Cargill Hall and Jacob Neufeld (Washington, D.C.: USAF History and Museums Program, 1998), 135–43. For a compilation of some of the arguments raging at the time, see Maj Peter A. Swan, ed., *Military Space Doctrine: The Great Frontier, A Book of Readings for the USAFA Military Space Doctrine Symposium 1–3 April 1981* (Colorado Springs, Colo.: US Air Force Academy (USAFA), Department of Astronautics and Computer Science, 1981). Vol. II deals specifically with space organization issues.

13. David N. Spires et al., *Beyond Horizons: A Half Century of Air Force Space Leadership* (Maxwell AFB, Ala.: Air University Press, 1998), 217–21.

14. History, Air Force Space Command, January 1992–December 1993 (U), 83. (Secret) Information extracted is unclassified.

15. Directorate of Public Affairs, *Air Force Space Command Fact Sheet,* December 1999, n.p., on-line, Internet, 21 January 2000, available from www.spacecom.af.mil/hqafspc/library/facts/afspc.html. While this number amounts to less than 10 percent of the personnel in Air Combat Command (ACC), the Air Force spends a larger percentage of DOD money on space personnel and budget than they do on fixed-wing personnel and budget. See footnote 6.

16. Creating a specialized subunit is one traditional tool for implementing desired change. See James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989), 231; and Peebles, 211–34.

17. Benjamin S. Lambeth, *The Transformation of Airpower* (Ithaca, N.Y.: Cornell University Press, forthcoming), 242.

18. History, Air Force Space Command, January–December 1986 (U), 24–25. (Secret) Information extracted is unclassified.

19. History, US Space Command [USSPACE], Aerospace Defense Command [ADC], AF Space Command [AFSPC], January–December 1985 (U), 46-9. (Secret) Information extracted is unclassified. The undergraduate space training curriculum was still criticized in 1988 for a bias towards those with engineering and science backgrounds rather than accommodating officers from a variety of backgrounds. History, Air Force Space Command, January–December 1989 (U), 25. (Secret) Information extracted is unclassified.

20. Peebles, 73. Lt Gen Donald L. Cromer, commander of Space Systems Division in 1991, quoted in Peebles, 76.

21. Cromer.

22. Spires et al., 255–59; Peebles, 73–79; and Lambeth, 207–11.

23. For a brief discussion of the "uncomfortable fit" of the ICBM fleet and its move to AFSPC, see Lambeth, 247–51. The difficulty in rapidly merging disparate cultures is clearly reinforced by the orphan status of the ICBM fleet in ACC.

24. "We have too many Air Force Specialty Codes (AFSC). We need fewer, and when we have fewer, people will have to be more broadly trained." Gen Merrill A. McPeak, quoted in History, Air Force Space Command, January 1992–December 1993 (U), 89. (Secret) Information extracted is unclassified. Briefing, HQ AFSPACECOM/DP, "Space and Missile Career Field Opportunities," May 1993, AFSPC/HO document I-340.

25. History, AF Space Command, 1992–1993, 91–2 (U). (Secret) Information extracted is unclassified.

26. I use "early" here to signify cross flow between the space and missile communities with early (prior to colonel) experience in the area listed. Present command experience for AF Special Operations Command based on Lt Gen Donald G. Cook, vice commander, AFSPC, interviewed by author, 25 January 2000.

27. While active duty officers are hesitant to discuss promotion policy, interviews with several staff members at AFSPC implicitly confirmed that the command assignment and promotion policy favored "generalization over specialization." What is interesting about the secrecy is that the present policies simply support a publicly stated goal from nearly a decade earlier. In another example of the effort to complete the merger, General Myers, commander in chief of USSPACE and AFSPC, supported an initiative to "merge" the space and missile badges—an idea originally suggested a decade earlier as part of General McPeak's initiatives. Gen Richard B. Myers, Briefing, School of Advanced Airpower Studies and interview with author, Maxwell AFB, Ala., 26 January 2000.

28. History, AF Space Command, 1992–1993, 91 (U). (Secret) Information extracted is unclassified. Numerous interviews with space operations officers confirm the stated reasons for avoiding the missile career field.

29. For a "pure space operator" view of AFSPC leadership, see Lt Col D. Tom Clark, "The Transition to a Space and Air Force: Proposed Solutions to the Dilemma," Research Report no. RWP030/97-04 (Maxwell AFB, Ala.: Air War College [AWC], 1997), 20–36. Information on current career histories of wing commanders and operations group commanders provided by AFSPC personnel staff.

30. Prior to General Horner, AFSPC was led by three pilots (Generals James V. Hartinger, Robert T. Herres, and Donald J. Kutyna), a navigator (Gen Maurice C. Padden), and an intelligence officer (Gen Thomas A. Moorman Jr.). Since Desert Storm, every USSPACE CINC/AFSPC commander has been a fighter pilot. Information obtained from AFSPC History Web site. General Horner's appointment was not part of any master plan or service vision, however. Lambeth, 247–51.

31. Quoted in Lt Gen Thomas S. Moorman Jr., *Blue Ribbon Panel of the Air Force in Space in the 21st Century, Briefing and Executive Summary* (U), 4. (Secret) Information extracted from executive summary is unclassified. Copy available in the AFSPC History Office archives.

32. Moorman, chart 10 and attached notes. (Secret) Information extracted is unclassified.

33. Ibid., chart 34 and attached notes. This recommendation was nearly identical to that made by an earlier blue ribbon panel in 1989. For a summary of these recommendations, see Lt Col Mark P. Jelonek, *Toward an Air and Space Force: Naval Aviation and the Implications for Space Power* (Maxwell AFB, Ala.: Air University Press, 1999), 39–40.

34. Moorman, chart 31 and attached notes. For a detailed account of the creation and work of the Space Warfare Center see Brig Gen Gary R. Dylewski, "The USAF Space Warfare Center (SWC): Bringing Space to the Warfighter," in *Spacepower for a New Millennium: Examining Current US Capabilities and Policies*, ed. Peter L. Hays (New York, N.Y.: McGraw-Hill, forthcoming), chap. 4.

35. Dylewski, 11–13.

36. One example is the slow acceptance of the space branch at the USAF Weapons School. For instance, the space division is housed in a different building from the "main" school and there are numerous stories about how "space guys are not accepted and often felt unwelcome unless they were wearing a green bag." Capt Dwight Andersen, AFSPC/DOY/SEWT, interviewed by author during visit to SWC, 24 February 2000. The slow acceptance by the Weapons School of nontraditional mission areas is disappointing but not surprising. The author witnessed a similar entrenchment when he attended the Weapons School as an A-10 pilot in 1992. At that time, the "Fighter Weapons School" became the "USAF Weapons School" in order to include new divisions of bombers as part of the transition from Tactical Air Command to ACC. There was often heated debate by traditionalists about the damage done to the school by the "dilution" of the core mission.

37. Maj Ron Huntley, AFSPC/DPAO, interviewed by author during visit to AFSPC headquarters, 22 February 2000. Members of SWC/XRC (Maj Jane Adkison, Maj Doug McCarty, Capt John Grenier, and Linda Orlicky), interviewed by author during a tour of the SWC, 24 February 2000.

38. Gen Richard B. Myers, interviewed by author, 26 January 2000.

39. Dylewski, 4.

40. *Army Vision 2010* explicitly discusses how space can *support* the surface war by shaping the battle space and providing real-time information to land forces. The Navy vision, *Forward . . . From the Sea*, and the Marine vision do not even explicitly mention the role of space—they simply refer to the *support* provided by advancing technologies. The one exception to this is the renewed emphasis on ballistic missile defense, which all the services claim is best suited to their control.

41. The command briefing and fact sheets for AFSPC refer repeatedly to "Space Support to the Warfighter." Consider also the subtitle of the chapter written by the SWC commander: "Bringing Space Support to the Warfighter." Another example is the mission statements typical of space operations squadrons. Even the 11th Space Warning Squadron, arguably the most combat-oriented squadron within AFSPC outside of ICBMs, has a mission to "Provide assured missile warning to warfighters worldwide through space exploitation."

42. Space control and force application are two of the four mission areas claimed by AFSPC. See *Air Force Space Command Fact Sheet*. Traditionally, the mission areas of control and force application have been limited by policy constraints, but a slow change is apparent. Consider, for instance, the renewed emphasis on ballistic missile defense.

43. Myers interview.

44. Cook interview.

45. For one explanation of the change, see Gen Howell M. Estes III, "The *Aerospace Force* of Today and Tomorrow: Transforming Our Service to Control the Vertical Dimension," in *Spacepower for a New Millennium: Examining Current U.S. Capabilities and Policies*, ed. Peter L. Hays (New York, N.Y.: McGraw Hill, forthcoming).

46. For a detailed discussion of the identity crisis, see Lt Col Thomas C. Walker, "Implementing Aerospace Integration: The Quest for Aerospace Culture," Research report (Maxwell AFB, Ala.: AWC, 2000).

47. The most focused analysis of the Air Force cohesion problem is James M. Smith, *USAF Culture and Cohesion: Building an Air and Space Force for the 21st Century*, Institute for National Security Studies (INSS) Occasional Paper 19 (Colorado Springs, Colo.: USAF

Academy, INSS, 1998), 16–48. A book-length treatment of this topic is found in Carl H. Builder, *The Icarus Syndrome: The Role of Airpower Theory in the Evolution and Fate of the U.S. Air Force* (New Brunswick, N.J.: Transaction, 1994).

48. Kantner, 18–20; Smith, 45–48; and Walker, 6.

49. See chap. 3 for a discussion of AFDD 2-2. According to one of the senior coordinating officials, Joint Pub 3-14, *Joint Doctrine, Tactics Techniques, and Procedures (TTP) for Space Operations*, has been in draft for over 10 years. Col James Painter, USSPAC/J5X, interviewed by author during visit to USSPACE, 23 February 2000. Even if the publication gets approved, all indications are that it will be nothing more than a compilation of compromises. See also Maj Shawn P. Rife, Air Force Doctrine Center, background paper, Subject: October 1999 JP 3-14 Doctrine Working Group, 27 January 2000.

50. For a full development of these concepts, see Lt Col Dennis M. Drew, "Of Trees and Leaves: A New View of Doctrine," *Air University Review*, January–February 1982, 40–48. For a dated example of how the doctrinal structure relates to the space mission, see Friedenstein, 13–23.

51. Andersen interview.

52. It was not until 1998 that the Air Force published a volume of space tactics, techniques. See AFTTP 3-1, vol. 28, *Space (U)*, March 1998. General Myers commented on the lingering difficulty with classification issues during his January 2000 visit to Air University.

53. Clark, 35.

54. Cook interview. "It takes 22 years to grow a new kind of general officer. Look at the ICBM career track. When they started out there were no career missile officers so they brought in navs and pilots to lead the lieutenants. Today we have missile generals, we have three wings commanded by missileers and 20th Air Force."

55. Air Force Demographics, Air Force Personnel Center, 1 February 2000, n.p., on-line, Internet, available from http://www.afpc.randolph.af.mil/sasdemog.

56. Ibid. For the years 1991 to 1999, pilots were promoted at a rate three percent higher than nonrated operators. In fact, the trend line indicates even higher promotion rates for pilots in the future.

57. After numerous attempts to obtain specific data from a variety of offices (in both Washington, D.C., and Randolph AFB, Tex.), the author was told that he would "never" be allowed to use promotion data for specific career fields for research. When asked how far back such data was considered "sensitive," the author was told "forever." Major Patterson, Air Force Personnel Center, Promotion Analysis Section, conversation with author, 16 March 2000.

58. Data based on "operational" leadership positions in AFSPC such as commander, vice commander, numbered Air Force commander, or major branch commander (such as DO, DR, DP, DDO, and SWC). Data obtained from Air Force general officer biographies, n.d., n.p., on-line, Internet, available at www.af.mil/news/biographies.

59. The summer of 2000 will see an increase in the number of "pure" space operators leading the command when Lt Gen Roger G. DeKok becomes the AFSPC vice commander. General Officer Announcement, 18 April 2000, n.p., on-line, Internet, available at http://amc.scott.af.mil/dp/dpo/dpoiss.htm.

60. On the other hand, in 1991—when AFSPC leadership was separated from USSPACE—there was a period where not a single general officer in AFSPC was rated. In 1991 the five general officers in AFSPC headquarters came from the intelligence (1), missile (2), weapons director (1), and communications (1) career fields. History, Air Force Space Command, January–December 1991 (U), 183. (Secret) Information extracted is unclassified.

61. For examples of similar underrepresentation in the Navy, see Cmdr John S. Andrews, "Breaking the Command Barrier," US Naval Institute *Proceedings*, February 2000, 70–73.

62. Cook interview.

63. The AFSPC aerospace officer development programs are called Vigilant Look, Vigilant Scholar, and Vigilant Eagle. Maj Ronald L. Huntley, AFSPC/DPAO, interviewed by author during visit to AFSPC headquarters, 22 February 2000. See also Maj Ronald L. Huntley, AFSPC/DPAO, "Aerospace Officer Development: Vigilant Scholar," Briefing, 21 January 2000. The Air Force has outlined seven initiatives designed to demonstrate its commitment to integration, but the detailed Aerospace Integration Plan (AIP) is not yet approved. Department of the Air Force, *The Aerospace Force: Defending America in the 21st Century* (Washington, D.C.: Aerospace Integration Task Force, 8 May 2000), 17.

64. For confirmation of this point, see Gen Ralph E. Eberhart's responses to questions from the US Senate Armed Services Committee, Strategic Subcommittee, 8 March 2000.

65. While space operators seem ideally suited for air battle manager jobs, there are no such examples of cross flow in that community. At present, only rated officers are eligible for unmanned combat air vehicle assignments. The latest Air Force white paper discusses initiatives along these lines; but, at present, there are no plans in place to make these assignments occur.

66. Letter, Gen Larry D. Welch and Secretary E. C. Aldridge Jr., "Memorandum for ALMAJCOM-SOA, subject: Air Force Space Policy—Information Memorandum," Department of the Air Force, HQ USAF, 2 December 1988. The Developing Aerospace Leaders (DAL) program may do much to help with this cross-flow shortfall, but it is not yet clear that the DAL program will have the staying power to result in long-term change. At present the DAL program office has a 24-month charter. Maj Jennifer Graham, director of staff, Chief of Staff of the Air Force's Developing Aerospace Leaders Program Office (AF/DP DAL), E-mail to author, Subject: SAAS Officer Forum Feedback, 26 April 2000.

67. Brig Gen Gary R. Dylewski, SWC/CC, "Space Warfare Center Long Range Plan," Briefing, General Eberhart, incoming AFSPC commander, 15 February 2000.

68. Ibid., slide 6.

69. The original (based on this author's research) idea of an "Air Corps Tactical School for space" came in a September 1980 paper. See Michael A. Syiek, "The Air Force and the Space Force: The Role of the Air Corps Tactical School in the Development of Air Power," in *The Great Frontier: Military Space Doctrine*, ed. Peter A. Swan (Colorado Springs, Colo.: USAFA, Department of Astronautics and Computer Science, 1981), 554–81. At the time, the idea met with mixed reviews but was advanced in various forms by several other officers. See also Maj Paul Viotti, *Military Space Doctrine: The Great Frontier*, Final Report of the USAFA Military Space Doctrine Symposium (Colorado Springs, Colo.: USAFA Department of Political Science, 1981), 14–17.

70. While the impact of high-altitude precision daylight bombing (HAPDB) is vigorously debated to this day, the inability of unescorted bombers to penetrate German defenses in World War II without suffering horrendous losses is unquestionable. "Certain principles . . . have stood the test of time. Other ideas, like unescorted daytime bombing . . . have not." Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, September 1997, 74. For a brief look at Air Corps Tactical School (ACTS) theory and a critical view of its results, see Lt Col Peter R. Faber, "Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower," in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Col Phillip S. Meilinger (Maxwell AFB, Ala.: Air University Press, 1997), 183–238; and James D. Perry, "Air Corps Experimentation in the Interwar Years—A Case Study," *Joint Force Quarterly*, Summer 1999, 42–50. For a balanced summary of the efficacy of HAPDB (and British area bombing), see Air Vice Marshal Tony Mason, *Air Power: A Centennial Appraisal* (London: Brassey's, 1994), 1–61. The best overview of the ACTS organization, curriculum, and doctrinal development is Robert T. Finney, *History of the Air Corps Tactical School, 1920–1940*, USAF Historical Study 100 (Maxwell AFB, Ala.: Air University, Documentary Research Division, 1955).

71. Faber, 186–87.

72. For one confirmation of this view, see Shawn P. Rife, "On Space Power Separatism," *Airpower Journal*, April 1999, 32–40.

73. Finney, 19–20. For a complete development of this point, see Bruce H. McClintock, "Airpower and the Interwar Years: A Comparison of Anglo-American Views," unpublished paper, School of Advanced Airpower Studies, Maxwell AFB, Ala., 1999. For the demographics of the ACTS classes see Finney, 115–41.

74. Gen Laurence S. Kuter, who instructed bombardment at ACTS, was asked if there was awareness within ACTS about the need for fighter escort aircraft during the 1930s. He responded, "I wish I could say yes, but I can't. We just closed our minds to it; we couldn't be stopped—the bomber was invincible." The best concise discussion of the interwar evidence that refuted HAPDB theory is Maj Hugh G. Severs, "The Controversy behind the Air Corps Tactical School's Strategic Bombardment Theory: An Analysis of the Bombardment versus Pursuit Aviation Data Between 1930–1939," Research Report no. 97-0126c/97-03 (Maxwell AFB, Ala.: Air Command and Staff College, 1997), 5–6.

75. John C. Slessor, *Air Power and Armies* (Oxford, U.K.: Oxford University Press, 1936).

76. Smith, 9.

77. The comprehensive vision found in the USSPACE *Long Range Plan* is an excellent starting point if refined to account for fiscal realities outside the control of the Air Force.

78. See Kantner, 114–15, for a brief discussion of the "good of the service" concept.

79. Statement made by Lt Gen Donald J. Kutyna, AFSPC commander in 1991, as part of discussion notes provided to Moorman panel. AFSPC/HO archives.

Chapter 5

Assessing Space Theories of Victory

The future is unknowable. But that is no excuse for inaction. A more prudent course is to experiment, develop diverse and sometimes competing operational concepts, make the necessary preliminary investments, then play out the options.

—National Defense Panel

Institutional processes for exploring, testing, and refining conceptions of future war are literally the sine qua non of successful military innovation in peacetime.

—Barry Watts and Williamson Murray
Military Innovation in the Interwar Period

The final characteristic of successful transformation that requires scrutiny is assessment. Regardless of the force behind the space power vision or the essence of the military culture, the services claim to effectively assess theories of victory in all areas. The goal of this chapter is to determine how valid that claim is with regard to space power. The focus is on military assessment for two reasons. First, civilian leaders generally depend on a management structure that responds to agenda proposals or emerging threats. For instance, the National Security Council staff is not set up to conduct systematic space topic reviews, but responds to events individually. Second, the competing military theories of victory that emerge require exploration and scrutiny at lower levels than those normally considered by civilian policy makers. As a result, civilian agencies often depend on the military experts for assessment information.[1]

Before beginning the analysis, I review the aspects of assessment introduced in the general model followed by some external justification for the importance of honest appraisal. While briefly considering the recent history of space power assessment, this chapter applies more of a topical organization to present assessment activities. First, I review the types of exploration occurring in the military space community. This includes a survey of the various studies and war games used to build a broader understanding of potential space theories. I conclude that while there is exploratory effort, it seems poorly coordinated among the services and generally stuck in a status quo mind-set. I offer some general approaches that will encourage more effective exploration. Second, I discuss the limited amount of examination that presently takes place. The scarcity of honest examination is, in part, a result of combined exercises and demonstrations often designed to prove service preferences rather than honestly scrutinize new theories. The role and implications of prototyping is also addressed.

I close with a discussion of some of the causes of the present situation and offer some recommendations for change.

Defining and Justifying Assessment

As discussed in chapter 2, there are two main facets of assessment. First, the military should allow open exploration of new ideas and competing theories of victory related to the overarching vision. The intent of exploration is to build an understanding of the new vision in practical, rather than conceptual, terms. There are a variety of vehicles to foster this kind of exploration, but studies and war games are the most common. Second, the military must honestly examine competing theories of victory to determine which ones are viable, preferable, and have the necessary linkage to the overall vision. Normally examination occurs through trade studies, "experiments," and prototyping.

The analysis in chapter 2 demonstrated the historical value of assessment, but is there a present need for assessment of new ideas about space power? The vice chairman of the Joint Chiefs of Staff thought so when he was CINCUSSPACE in 1999. General Myers listed assessment as one of the four primary actions in his space action plan. This emphasis followed the guidance provided by Congress in 1998 and the commander in chief, US Atlantic Command (USACOM, now Joint Forces Command). Both emphasized aggressive experimentation as an important tool for innovation.[2] The recent emphasis might lead one to believe that what is popularly called "experimentation" is a new concept. On the contrary, the focus on experimentation—a subset of assessment—simply fills a void in the creation of doctrine regarding emerging forms of warfare. Ideally, doctrine—what is generally believed and taught about the best way to conduct military affairs—is based on experience.[3] With emerging forms of warfare, the source of doctrine is theory. Theory tested by combat becomes experience. In the absence of warfare, theory is validated by assessment.[4] The importance of assessment for successful transformation is clear. The remainder of this chapter investigates how well the military performs that assessment with regard to space power.

Exploration

There is a pattern of exploration throughout the history of space power theory. Some of the earliest ideas about how to exploit space power came from conceptual studies. Some famous examples include the *Toward New Horizons* study produced by Theodore von Kármán in 1945 and the RAND paper, *Preliminary Design of an Experimental World-Circling Spaceship,* written in 1946. These studies epitomized the concept of open thinking about new concepts of warfare. They spawned an ongoing string of studies sponsored by all of the services about what might occur in and through space.[5] More recent Air Force studies include *SPACECAST 2020* and *New*

World Vistas. Both are fine examples of conceptual studies that consider the shape of future warfare, but they often tend to revisit older ideas without offering specific solutions (beyond more research).[6] In this sense, unfortunately, when it comes to *new* thinking about space warfare, the well has nearly run dry. Many of the ideas cited in the recent studies were presented over 40 years ago.[7] Today, the studies temporarily motivate a new focus on space power when they are published, but the attention seems to fade because of a lack of commitment to the vision. This transitory interest is true even in more detailed studies designed to provide assessments of the merging strategic environment, typical of the Office of the Secretary of Defense and RAND.[8]

Current exploration of space power extends beyond "white paper" studies and into war games. According to one military definition, war games are "A simulation, by whatever means, of a military operation involving two or more opposing forces, using rules, data, and procedures designed to depict an actual or assumed live situation (DOD dictionary). War games generally serve educational or analytical purposes."[9] War games used in the exploration phase of assessment are conceptual and educational. They explore the potential implications of various courses of action (COA) rather than indicate which COA is "better."[10]

The modern use of war games has its roots in the games that led the Navy to develop carrier aviation and amphibious assault in the 1920s and 1930s. Most of the history of war gaming is imbedded in the Navy, but the Army and DOD national missile defense (NMD) organizations also have a solid history of using war games to better understand future concepts. For this study, the efforts of NMD organizations are not reviewed in detail—there is a robust history of exploration and examination in this area, but most of the data is classified.[11]

Across the military "Title X" war games are the most visible. Title X games are service-level forums defined by US codes, and they attract national-level military officers and civilian leaders. The Navy Title X game evolved from the Naval War College "Global" war game series begun in 1979.[12] More recently, in early 1997 the Army After Next war game included the effects of space warfare in their scenario and served as a dramatic wake-up call to many military members regarding the importance of space control on Army operations.[13] Shortly after the Army results were publicized, the Air Force conducted their Title X game and drew similar conclusions. Even though the Air Force has talked about space control as a core competency for years, Global Engagement 1997 was the first major Air Force war game that included space as a key element.[14] While these top-tier games provide substantial conceptual benefit, their analytical worth is limited. For one thing, it is often alleged that the top-tier games often are shaped more by the domestic-political environment than by the projected strategic environment.[15] This means that the threats, forces, and potential weapons simulated in Title X games are driven more by the current

budget environment and force structure than by a desire to honestly evaluate future visions of warfare.

Another factor limiting the analytical value of Title X games is the small amount of data. A common theme in war-game theory is the danger in drawing conclusions from a single event or war game.[16] Decision makers should use individual war games to build intuition through experience and increased understanding of the concept rather than to draw conclusions or lessons learned. Unfortunately, this is often the opposite of the approach used. There are many examples of how one war game or experiment is used to "prove" a concept, whether or not there were bureaucratic incentives behind the conclusion. This approach ignores the fundamental reality that war gaming is not a means for producing a thorough, quantitative analysis of a problem. In this context, Title X war games are only valuable for raising awareness about myriad military issues, of which space control is just one.

Below the top tier, numerous war games are conducted by all of the services. Presently, the Air Force Wargaming Institute includes space play in almost all of its senior war-fighting scenarios. War gaming is conducted by all of the services at the intermediate and senior service school level. All the games mentioned so far included space activities as a subset of a larger scenario. One exception was the Aerospace Future Capabilities Game played in 1998. Begun in 1996, the 1998 "Futures Game" considered a "space heavy force" and determined that such a force would have value in many scenarios. AFSPC is currently planning a space game for early 2001 designed to focus solely on space operations.[17] The war gaming described here is also designed to educate the participants about the potential capabilities and impacts of a wide variety of space systems ranging from space-based lasers to space maneuver vehicles. As with Title X games, there is very little quantitative analysis of the actual performance of these systems. For the exploration phase of assessment, this is appropriate.

What is less fitting is the lack of coordination between the numerous military agencies regarding space play in conceptual war games and experiments. This condition is apparent within the Air Force, arguably the service with the greatest commitment to the space power mission. Very few of the Air Force agencies coordinate how to best emulate potential space systems in war-game scenarios. For example, the Air Force Wargaming Institute includes conventional ballistic missiles in many of their scenarios even though senior Space Command officials discount their political viability. With few exceptions, staff officers within the exercise and war-game community recognize a lack of coordination. This is in spite of recent efforts to coordinate and synchronize exploration across the Air Force. Even when the Air Force experimentation and war-gaming community provides approved overarching guidance, success will require a collegial approach because there is no single executive with authority to cut across all the agencies.[18] The lack of a concerted effort is even more apparent in the joint experimentation community.[19]

Is the dissonant state of exploration unexpected? First, the modern military exploration effort through war games is relatively new—less than a decade old. By most accounts the war-gaming community did not highlight dependence on space power until 1997, so there is something to the case that the military exploration process is maturing.[20] There is potentially a more fundamental reason for the lack of exploratory focus. In order to create synergy among various forms of exploration, the military needs a coherent vision for the future of space power. Chapter 3 demonstrated that the *Long Range Plan* provided the closest thing to a coherent military space vision, but it was not completely embraced by the Air Force or the other services. In addition, the lack of a powerful culture to propagate the vision results in exploratory emphasis on other topics of concern. According to their own advocacy organization, the Air Force has weakened its long-term ability to fight wars by spending too many research dollars on short-term needs.[21] The military is not completely at fault, however. Some members of Congress have directly blocked some joint experimentation related to future space operations, another factor that affects the quality and depth of exploration within the military community.[22]

There are some logical remedies to these apparent inadequacies in military exploration beyond the call for more funding. First, the military should focus future space studies to further develop the existing ideas on space power theories of victory. A successful example of this approach is the challenge issued by Dr. Hans Mark, secretary of the Air Force, to the students and faculty of the US Air Force Academy (USAFA) in 1980.[23] The present military also needs to encourage academic research that proposes specific strategies for improving space power in all areas. These strategy proposals can then become the competing theories of victory applied in educational war games.[24]

Second, the military community should better integrate their academic war-gaming efforts to educate the entire military community on the most important theories of victory for space power. Of course, this approach assumes a coherent, congruent vision as described in chapter 3. One way to improve this integration is to increase the number of space operators assigned to war-gaming agencies. An important point that requires further research is which agency is best suited to coordinate the space power war-gaming effort. While Joint Forces Command seems the obvious choice, current congressional restrictions will continue to stifle space power creativity in that venue. Nevertheless, it is clear there must be a high-level military agency that has the power to coordinate war-gaming efforts both across the Air Force and, ideally, across the services.

Finally, the military should fully develop their space theories of victory in lower level games. To this end, there should be more educational war games to allow more opportunity to develop competing theories of victory in a variety of forums. It is unlikely that the modern military will rival the large number of war games played at the Naval War College during the interwar period, but there is a need for more than the handful of games presently

played by all of the services.[25] Spacegame 2001 is a good start with respect to space power, but the military needs to increase the number of data points to avoid single-game conclusions or transitory interest in a topic.

Examination

Some of the same shortfalls apparent in the exploration facet of assessment are also apparent in the examination aspect. The two most prominent forms of space power *examination* used today are trade studies and experiments, but there are also some examples of prototypes.

Trade studies are the name for the broader area of systems analysis most popular in the 1950s and 1960s. Still a powerful examination tool, trade studies normally involve the use of models or simulations. Models are used "when the real thing is not available or is too expensive to experiment with."[26] In general, models are designed to systematically represent future systems.[27]

The specific models and simulations used to drive current trade studies are not as important as some of the considerations associated with the models and studies. The following factors are not unique to space, but their impact is greater since much of the examination of space power issues is limited to models and simulations. First, there are numerous pitfalls and limitations associated with models. The most important limitation is the often forgotten fact that the representation of the real world is certain to be imperfect. The biggest pitfall is usually shaping the model to adhere to cherished beliefs rather than being open to critical inputs. Both of these factors can skew the outputs of the underlying models and, therefore, the study.[28] For instance, most combat simulations do not correctly represent the pivotal contribution of command, control, communications, intelligence, surveillance, and reconnaissance to force-on-force engagements, so those functions are consistently undervalued relative to weapons functions.[29]

Models and simulations can also be used to execute analytical war-game scenarios, often called experiments in today's military parlance. The military has mixed the concept of conceptual war gaming with laboratory demonstrations in the latest form of "experimentation." For example, the Air Force Joint Expeditionary Force Experiments (JEFX) are designed to "create knowledge, gain insight, develop a mindset for innovative ways to achieve victory, and to provide our airmen the most capable, lethal aerospace force possible."[30] The publicized difference between a JEFX and a war game is that "initiative systems" and concepts are used during JEFX and evaluated by "war fighters" for "value added to operations." While specifically described as experiments, JEFXs are in fact a combination of war gaming, demonstrations, and exercises.

The first danger with the JEFX experiment combination is that it mixes conceptual thinking about new forms of warfare with training for current forms of warfare. As a result, only initiatives that are adaptable to the current concept of warfare are demonstrated in any given JEFX. This structure

favors incremental improvements to the status quo theory of victory rather than examination of truly innovative concepts.

In addition, JEFX-style experiments, which have greater visibility to policy makers and senior leaders than laboratory testing, are subject to the same pitfalls and limitations as models and simulations. The biggest danger in attempting this kind of examination is the temptation to use the experiment to support decisions already made.[31] This is the "dirty little secret" of war games and experiments used in the military community—a strong pressure to "cook the database" when there is a lack of thorough field testing. In the worst of cases, "some gaming efforts are contrived to underwrite the need for certain numbers of platforms or weapon systems in a disingenuous bending of war-gaming rules to support objectives previously prioritized by bureaucratic and organizational imperatives."[32] While there is no direct evidence of *intentional* misrepresentation in military war games and experiments, it is possible that the models driving the analyses and the mind-set behind the hypotheses for experimentation may distort the potential contribution of future forms of warfare.

There is some data to indicate that outmoded paradigms have improperly shaped recent examinations of space theories of victory. The first example comes from the Air Force Experimentation Campaign Plan produced by the Air Force Experimentation Office (AFEO). The inaugural document does an admirable job of attempting to coordinate and describe the breadth of experimentation across the Air Force, but it has some obvious shortcomings. One of the plan's "transforming concepts" is aerospace integration, which includes the propositions that the Air Force needs to prevail in space and protect space-based capabilities. While an arguably valid concept with a detailed description of space as a US center of gravity and the imperative for space control, the testing hypothesis designed to examine this transforming concept reverts to the status quo mind-set of space intelligence, surveillance, and reconnaissance (ISR) integration. Specifically, rather than asking a question about how the Air Force can best "prevail and protect," the testing hypothesis reads as follows: "If the Joint Force Commander can integrate space-based ISR capabilities, then we will be able to provide more accurate and reliable real-time surveillance, immediate target identification, combat assessment, and continued information dominance."[33] The stated hypothesis addresses important questions about space asset integration, but misses the point of the vision and capstone concept it is designed to examine. Once again, there is little opportunity for competing theories of victory to emerge and be compared to accepted forms of warfare.

The second example highlights the role of analysis and implementation—the most important part of the examination process.[34] While JEFX 1999 did place some emphasis on air and space integration, it is not clear how much of a lasting impact will be made by the lessons learned. For instance, early in the experiment, space superiority was degraded significantly because air operations center (AOC) planners did not have an

"adequate appreciation of what was required to achieve and maintain space superiority *and the dire effects of losing it*" (emphasis in original).[35] This was the same lesson learned in Global Engagement 1997 and stated clearly since Desert Storm. It would seem that even after a decade of education, there are still war fighters who do not fully grasp the importance of space resources for battlefield success. Another lesson resulted from a senior space officer serving as the combined air operations center deputy commander. Several recommendations were made, based on positive results in JEFX 1999, to have a senior space officer serve as a member of the combined forces air component commander staff, "for future experiments (and) real-world AOC operations." In spite of these powerful lessons obtained through analysis, implementation seems to be moving in the opposite direction. One indication of the transient interest in space experimentation is the reduction of emphasis on space in JEFX 2000 and the lack of senior Air Force leadership focus on space experimentation until 2003.[36]

Lessons and insights are only worthwhile if they lead to policy changes, further experiments designed to more carefully scrutinize assumptions, doctrinal revisions, or concentrated technology development efforts. Unfortunately, there is no indication that any of these will occur in the current system of experimentation. For instance, a recent DOD and a General Accounting Office study both determined that the military lacks the necessary modeling and simulation tools necessary to assess objectively the utility and worth of alternative systems.[37] Even a 1998 Air Force Scientific Advisory Board report concluded that there were major deficiencies in modeling and simulation capabilities for space missions, but there is little evidence of change.[38] For this reason, it makes sense that truly innovative analysis might best occur separated from the mainstream. That was exactly the conclusion drawn by a recent study by the Chief of Naval Operations executive panel. Valid mechanisms to explore new theories of victory, especially ones that threaten the organization's core competencies, usually require separation of the innovative activities from the mainstream activity of the organization.[39] This "newfound" conclusion was apparent over 50 years ago.[40]

Prototypes also serve to examine new theories of victory by demonstrating the potential of new tools for effectively performing some portion of the mission. Like conceptual studies, prototyping has a long history in the space community. For instance, the first US antisatellite system entered operation as an interim experimental system developed by the Army.[41] Since 1966 the military has had a mechanism for testing of modest prototype and developmental systems. As of 1992 the Space Test Program had conducted over 320 experiments designed to evaluate military systems in space.[42]

More recent examples of successful modest prototypes include MightySat and the Space Maneuver Vehicle. MightySat is a low-cost, adaptable space platform designed to accelerate the maturation of military space science and technology. The Space Maneuver Vehicle is a small,

powered, reusable, space vehicle technology demonstrator. Eventually, an operational version could perform missions such as reconnaissance, identification and surveillance, or space-based logistics. The prototype has already demonstrated autonomous control and landing capability and is preparing for orbital and return from orbit space flight tests.[43] There are many other small-scale prototypes that have proven successful as well.

At the other end of the spectrum, the military has had a few ambitious programs designed to field major space control systems. All of these programs have been cancelled for political, fiscal, or technological reasons.[44] Recently, portions of the SDI program have gained renewed interest as the current political debate shifts toward NMD. The present focus on an NMD system highlights one of the many dangers of an ambitious, high-profile program. One consequence of this kind of pressure is temptation to manipulate the assessment data to ensure the system gets fielded. Some imply exactly this kind of thing happened with Brilliant Pebbles in the 1980s and 1990s. Besides the loss of integrity associated with this approach, the risk of pursuing an inadequate tool for the new concept of operations is enormous. While not yet in the limelight, the prototype for the space-based laser (SBL) has all the characteristics of a high-profile, high-visibility experiment.[45] The integrated flight experiment, scheduled for the 2010 time frame, will draw a lot of attention to a concept of warfare exactly when it is most prone to failure. Ambitious, large-scale experiments that fail often kill the concept they support rather than provide lessons for the future.

So what is the best approach to prototyping? History seems to indicate that smaller, less ambitious programs stand a better chance of political and technical success in an uncertain environment. Logic supports this conclusion as well. Earlier discussions validate that the biggest problem with managing military research and development is that uncertainty about the future threats, costs, and benefits of new technologies make it impossible to identify the optimum path to innovation. This point of view is common among systems analysts, and the normal response is a move toward flexibility.[46]

While there are a variety of approaches to flexibility, the two most divergent are discussed here in their idealized forms. Type I flexibility is the purchase of multipurpose weapons systems or a wide array of systems designed to perform every conceivable emerging form of warfare. Since this approach is obviously untenable, the preferred form of flexibility in an uncertain strategic environment is Type II flexibility. This form of flexibility adapts to uncertainty by buying information about potential systems and concepts through small-scale prototyping and deferring production decisions. This can mean buying several prototypes in order to develop valid concepts of operations, but full-scale production decisions are delayed until long-term uncertainties become short-term threats.[47]

The obvious danger with this approach is that a lack of urgency about long-term uncertainty can result in program delays. Consider NMD—what

was once a long-term uncertainty became a short-term requirement because of program delays and the changing strategic environment. As a result, the exploration and examination process is not given a chance to honestly assess future concepts and systems. This risk is apparent in space power systems as well. The space maneuver vehicle prototype program is continually unfunded, and the SBL prototype has already slipped at least four years. Other programs "pushed aside" recently include hypersonic, scramjet, and spacecraft defender vehicle research.[48] If innovation is to be successful, the military needs to commit the resources necessary to prototype the tools and concepts described by future theories of victory.

Review and Analysis

There are numerous examples of assessment of military space power concepts, but many caveats to those examples. While the desire to conduct new studies is always present, many of the most powerful ideas about space warfare were born over 40 years ago. Because of the cryogenic freeze imposed by two generations of Cold War and a policy of freedom of space, most of those ideas are still infants. The military should continue to study the possible theories of victory that support space power, but more energy needs to be directed towards nourishing the infant ideas freed in the Cold War thaw. As the civilian vision allows the military vision of space superiority to prosper, studies need to more carefully examine the concepts of operations associated with the most promising theories of victory.

The most robust theories deserve greater exploration in war games, but the current approach is problematic. First, the military community must better integrate their war-gaming efforts. Joint Forces Command may be the ideal agency to do this, but this point requires further study. To catalyze the needed change, space operators should be assigned to all of the major war-gaming and experimentation agencies. As the space culture grows, their level of influence in these venues will grow as well. Second, space power theories should be fully developed in the lower-tier games before gaining play in the Title X arena. In spite of the educational value gained from the Title X realm, space power risks a loss of credibility if space is not designated as an important aspect of the scenario.[49] In addition, the military does not need another *conceptual* war game. AFSPC should develop a series of independent, unbiased, analytical war games to demonstrate advantages and disadvantages of space-heavy forces. The lack of a balanced assessment environment contributed to the myopia about unescorted strategic bombing prior to World War II.[50] Space (and aerospace) advocates must avoid the same trap today. Eventually, the proposed analytical games could become part of a larger DOD study system designed to compare competing theories of victory. To that end, there should be greater emphasis on trade studies that compare space assets with air, sea, and ground assets in terms of cost, risk, and mission performance.

Finally, the military needs to commit greater resources to prototyping space concepts and tools. There is much in the argument that the current

funding approach to assessment demonstrates that the future is not a priority for the military. Greater money and effort spent now may prevent a crisis later. Once committed to pursuing promising concepts and assets, the emphasis should be on a variety of small-scale projects. The military should heed the lessons of history and the rationale that supports these approaches before long-term uncertainty becomes a near-term threat and, potentially, "a mistake that could cost the nation dearly on future battlefields."[51]

Notes

1. For a discussion of the current civil-military decision-making process, see Christopher P. Gibson and Don M. Snider, "Civil-Military Relations and the Potential to Influence: A Look at the National Security Decision-Making Process," *Armed Forces and Society*, Winter 1999, 193–218.

2. Gen Richard B. Myers, "Achieving the Promise of Space—The Next Step," address to the Air Force Association Warfighting Symposium, Orlando, Fla., 4 February 1999, n.p., on-line, Internet, 21 January 2000, available from http://www.spacecom.af.mil/hqafspc/library/speeches/pos.htm. For a discussion of the origins of the joint emphasis on experimentation and its relationship to space power, see Frank Finnelli, "Transforming Aerospace Power," *Airpower Journal*, Summer 1999, 12–14. For proof of CINCUSACOM emphasis on experimentation, see message, 071030Z DEC 98, CINCUSACOM INTEGRATED PRIORITY LIST (IPL), FY 01-05 (U), paragraph 6, Joint Experimentation (U). (Secret) Information extracted is unclassified.

3. I. B. Holley, quoted in Lt Col Dennis M. Drew, "Of Leaves and Trees: A New View of Doctrine," *Air University Review*, January–February 1982, 41.

4. Ibid., 40–48.

5. For a summary of some of the early studies in the Air Force, see Michael Gorn, *Harnessing the Genie: Science and Technology Forecasting for the Air Force, 1944–1986* (Washington, D.C.: Office of Air Force History, 1988). For specific space impacts of the studies cited here, see David N. Spires et al., *Beyond Horizons: A Half Century of Air Force Space Leadership* (Maxwell AFB, Ala.: Air University Press, 1998), 1, 2–12, 280–81.

6. See, for instance, the discussion of space launch in Department of the Air Force, *New World Vistas: Air and Space Power for the 21st Century, Summary Volume* (Washington, D.C.: USAF Scientific Advisory Board, 1995), 44–45. For a concise summary of the origins, process, and conclusions of *New World Vistas*, see Lt Col Dik Daso, "New World Vistas: Looking Toward the Future, Learning from the Past," *Aerospace Power Journal*, Winter 1999, 67–76.

7. While the modern studies are more comprehensive, there is little new about the concepts. For instance, a 1959 Air Force study listed several aspects of space capability broken down into operations, weapons, and vehicles. Aspects listed included space rays, missiles, mirrors, boost gliders, and rocket ships, to name a few. Report of the Research and Development Flight, "The Space Problem: Will a Military Advantage Accrue to the US and to the Air Force through the Development of a Space Capability?" as published in History, 2562d Air Reserve Center, 1 January–30 June 1959, Alameda, Calif.

8. For an example of an assessment for future space power, see D. Gonzales, *The Changing Role of the U. S. Military in Space*, RAND Report MR-895-AF (Santa Monica, Calif.: RAND, 1999).

9. Air Force Instruction (AFI) 10-230, *Participation in Key Exercises and Wargames*, 1 July 1998, 17.

10. For a complete description of the utility and applications of war games, see Peter P. Perla, *The Art of Wargaming* (Annapolis, Md.: Naval Institute Press, 1990), 1–11, 58, 109.

11. For a short discussion of the type of work conducted by the Joint National Test Facility for national missile defense, see William B. Scott, "Reality Check Boosts Wargame Credibility," *Aviation Week and Space Technology*, 2 November 1998, 63–64.

12. Wiiliam B. Scott, "Wargames Revival Breaks New Ground," *Aviation Week and Space Technology*, 2 November 1998, 56–58.

13. A former assistant defense secretary, who acted as the US president in that war game, wrote a letter to Secretary of Defense William Cohen urging timely action on space control issues. See William B. Scott, "JLASS Wargame Challenges Players' Real-Time Battle Skills," *Aviation Week and Space Technology*, 28 April 1997, 60.

14. Gen Howell M. Estes III, said "In previous games we had not been asked to come out and participate at the level we did in this game." For a summary of the Global Engagement 1997 results, see William B. Scott, "Wargame Shows Impact of Air/Space Action," *Aviation Week and Space Technology*, 8 December 1997, 26–27.

15. Robert P. Haffa Jr. and James H. Patton Jr., "The Need for Joint Wargaming: Combining Theory and Practice," *Parameters*, Autumn 1999, 1, on-line, Internet, 31 March 2000, available from http://carlisle-www.army.mil/usawc/Parameters/99autumn/haffa.htm. See also Perla, xviii. Numerous other military officers and civilians directly associated with wargame execution shared this view but did not wish to be identified here.

16. Perla, 8–12.

17. For a brief synopsis of space participation in war games, see Lt Col Mark P. Jelonek, *Toward an Air and Space Force* (Maxwell AFB, Ala.: Air University Press, 1999), 57–58. Information on the Futures Game is based on James Snead, Lead, AFRL Wargaming Initiative, interviewed by author, 30 March 2000. Information on Space Game: Maj Otis Campbell, AFSPC/DOTG, interviewed by author, 30 March 2000. See also AF Key Exercise/Experiment & Wargame Events, 5 May 2000, n.p., on-line, Internet, available from http://www.xo.hq.af.mil/xoc.

18. The author interviewed numerous members of the war-gaming and experimentation community, and there was general agreement that there was little coordination among various war games. One example of efforts to coordinate exploration activities within the Air Force is the evolution of the Air Force Experimentation Office (AFEO). Originally set up as a task force in 1998 to execute large-scale experiments, the organizational charter now includes responsibility to "coordinate experimentation activities across the Air Force (and) develop the Air Force six-year experimentation campaign plan." See http://afeo.langley.af.mil. At the service level, the Air Force published a new instruction in 1998 designed to coordinate exercise and war-game planning. Air Force Instruction (AFI) 10-230, *Participation in Key Exercises and Wargames*, 1 July 1998, will become AFI 10-230, *Conduct of Key Exercises and Experiments*, and AFI 10-233, *Conduct of Key Wargames*, in June 2000. The AFEO Campaign Plan (still in draft as of May) did not mention the existence of an Air Force Space Game in spite of the fact that aerospace integration was one of the document's transforming concepts. AFEO, *Air Force Experimentation Campaign Plan FY 00-05* (Langley AFB, Va.: AFEO, 31 March 2000), 43–45. (Hereinafter cited as AFEO CPLAN). Members of the AFEO staff claimed that most of the time was spent preparing for the large-scale experiment run by the office—Joint Expeditionary Force Experiment (JEFX). See also AFI 10-230, 12–14, for guidance that contradicts the AFEO coordination mission. More recently the Air Force has begun an effort to pull together various aspects of exploration and provide mutual support between agencies through an Air Force "innovation process."

19. For details on the lack of coordination between interservice and intraservice agencies regarding space experimentation, see Maj Kathy Echiverri, Joint Advanced Warfighting Program, "Joint Space Experimentation," Briefing, AFSPC Headquarters, Peterson AFB, Colo., 30 March 2000, and letter to author, 22 March 2000.

20. Scott, 58.

21. Air Force Association (AFA) Science and Technology Committee, *Shortchanging the Future: Air Force Research and Development Demands Investment*, AFA Special Report (Washington, D.C.: AFA, January 2000).

22. According to the Joint Experimentation Futures Web site, "Based on the direction contained within the House Appropriations Conference Report 106-371, HR 2561, 8 October 1999, concerning the expenditure of fiscal year (FY) 1999 and FY 2000 funds, all FY 2000 USJFCOM Futures activities have been suspended until further notice." Notice available from Joint Forces Command Web site, dated 22 December 1999, on-line, Internet, 7 March 2000, available from http://www.jfcom.mil/J9Futures.nsf/HTML/frontpage?opendocument.

23. In January 1980, Dr. Mark challenged the USAFA personnel to lead the study of doctrine for the military role in space. The result was a prescient set of papers and lectures captured in Peter A. Swan, ed., *The Great Frontier: Military Space Doctrine* (Colorado Springs, Colo.: US Air Force Academy (USAFA), Department of Astronautics and Computer Science, 1981); and Maj Paul Viotti, ed., *Military Space Doctrine: The Great Frontier*, Final

Report of the USAFA Military Space Doctrine Symposium (Colorado Springs, Colo.: USAFA Department of Political Science, 1981).

24. Two examples of this kind of study related to space lift include Michael A. Rampino, "Concepts of Operations for a Reusable Launch Space Vehicle," in *Beyond the Paths of Heaven: The Emergence of Spacepower Thought*, ed. Col Bruce M. DeBlois (Maxwell AFB, Ala.: Air University Press, 1999), 437-506; and Jeffrey L. Caton, *Rapid Space Force Reconstitution*, Research Report no. AU-ARI-94-4 (Maxwell AFB, Ala.: Air University Press, 1994).

25. Perla, 72. There are records of more than 300 war games played during the interwar period at the Naval War College alone.

26. R. D. Specht, "The Nature of Models," in *Systems Analysis and Policy Planning: Applications in Defense*, ed. E. S. Quade (New York, N.Y.: Elsevier Scientific Publishing Co., 1968), 211–12.

27. Two current, classified models specifically associated with space control include the Portable Space Model (PSM) and the National Air and Space Warfare Model (NASM). The System Effectiveness Analysis Simulation (SEAS) is an example of a simulation used to scrutinize space power contributions of various ISR systems to the theater. There are numerous examples of trade studies, based on models and simulations, used to examine system utility. Just one recent example is the National Security Space Architect Launch on Demand (LOD) Study. The PSM is another example of the extensive work done by the NMD community. It is designed to simulate the operation of the Theater Event System to provide theater missile warning to training audiences through operational broadcasts. NASM will (eventually) become the air and space component of the very ambitious Joint Simulations System. Most information on NASM and PSM is classified, but unclassified descriptions are available at http://www.usspace.spacecom.smil.mil/SJ3/SJ37/ models_and_simulation.htm. Information on SEAS from Robert W. Weber, Aerospace Corporation, "Evaluation and Evolution of the System Effectiveness Analysis Simulation (SEAS)," RAND Briefing, 23 March 2000. LOD reference from "Launch On Demand," National Security Space Architect, n.d., n.p., on-line, Internet, available from www.acq.osd.mil/nssa/majoreff/lodi.

28. E. S. Quade, "Pitfalls and Limitations," in *Systems Analysis and Policy Planning: Applications in Defense*, ed. E. S. Quade (New York, N.Y.: Elsevier Scientific Publishing Co., 1968), 345–63.

29. Information on C4ISR utility from Aerospace Corporation, "SBIRS Low Program Definition Utility Analysis Briefing," January 1999; and Oliver Cathey, Air Force Materiel Command, "SBIRS Support of the TMD-GBR Response to Anti-Radiation Missiles (ARMs)," 6 August 1993. Robert W. Weber, Aerospace Corporation, interviewed by author, 23 March 2000.

30. Col Terry S. Thompson, "AFEO Director's Corner," Air Force Experimentation Office Web site, 28 February 2000, n.p., on-line, Internet, 10 March 2000, available from http://afeo.langley.af.mil/afeo_director.htm

31. "A big problem with wargaming is that they always assume unlimited bandwidth and they don't allow space to interfere with that bandwidth. That is not realistic. But many times they do use the 'exercises' to 'prove' that the concept works rather than really testing it." Lt Gen Donald G. Cook, vice commander, AFSPC, interviewed by author during visit to Air Force Doctrine Center, 25 January 2000.

32. Haffa and Patton, 4. See also Perla, xviii–xx, 102–109.

33. AFEO CPLAN, 43–45.

34. Perla, 9, 67–87. M. G. Weiner, "Gaming," in *Systems Analysis and Policy Planning: Applications in Defense*, ed. E. S. Quade (New York, N.Y.: Elsevier Scientific Publishing Company, 1968), 272–73. William B. Scott, "'Title-10' Games Shape Policies," *Aviation Week and Space Technology*, 2 November 1998, 61–62.

35. JEFX 1999 Initiative Summaries, n.d., n.p., on-line, Internet, 10 March 2000, available from http://jefxlink.langley.af.mil/mil/final99/main.htm#Initiative Summaries.

36. Ibid. Initiatives for JEFX 2000 are proprietary, but an interview on 4 April 2000 with a member of the JEFX staff indicated the staffing concept used in JEFX 1999 was not planned for JEFX 2000. "This plan includes senior Air Force leadership determined *Focus Areas*. They will provide the focus for the biennial large-scale Joint Expeditionary Force Experiment (JEFX) and the Advanced Process and Technology Experiment (APTE) conducted by the Air Force Experimentation Office." After the JEFX 1999 "focus" on air and space integration, there is not a space-related focus area until 2003. AFEO CPLAN, 7–15.

37. Defense Science Board Task Force, *Space Superiority* (Washington, D.C.: Office of the Undersecretary of Defense for Acquisition and Technology, February 2000), 21; and National Security and International Affairs Division, *Defense Acquisitions: Improvements Needed in Military Space Systems' Planning and Education*, Report to the Chairman, Subcommittee on Strategic Forces, Committee on Armed Services, and to the Honorable Robert C. Smith, US Senate (Washington, D.C.: General Accounting Office [GAO], May 2000), 24–27.

38. *Defense Acquisitions*, 25.

39. Richard O. Hundley, "Past Revolutions, Future Transformations: What Can the History of Revolutions in Military Affairs Tell Us About Transforming the U.S. Military?" RAND Report MR-1029-DARPA (Santa Monica, Calif.: RAND, 1999), 55.

40. Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991), 228.

41. Curtis Peebles, *High Frontier: The United States Air Force and the Military Space Program* (Washington, D.C.: Air Force History and Museums Program, 1997), 60–61.

42. International Aerospace Division Note (IADN) 94-5, *A Brief History of the DOD Space Test Program (U)*, March 1994, I-3, II-2, (Unclassified/Limited). Information extracted is unclassified.

43. "MightySat Goals," Air Force Research Laboratory, n.d., n.p., on-line, Internet, 22 March 2000, available from http://www.vs.afrl.af.mil/vsd/mightysatII/goals.html; and "Space Maneuver Vehicle," Air Force Research Laboratory, n.d., n.p., on-line, Internet, 22 March 2000, available from http://www.vs.afrl.af.mil/factsheets/smv.html.

44. Some common examples include the Dyna-Soar (X-20), the manned orbiting laboratory and the Strategic Defense Initiative, which was reduced in scale to the Ballistic Missile Defense Organization. For a brief overview of each of these programs, see Peebles, 15–25, 67–69.

45. Ibid.

46. E. S. Quade, "Principles and Procedures of Systems Analysis," in *Systems Analysis and Policy Planning: Applications in Defense*, ed. E. S. Quade (New York, N.Y.: Elsevier Scientific Publishing Co., 1968), 40.

47. Rosen, 244–45.

48. AFA, 21.

49. This was exactly the scenario in Global Engagement 1998 where space was deemphasized but gained wider attention in EFX-99. See Scott, 62.

50. Claire Chennault believed that "the rules in maneuvers involving bombers and pursuit aircraft had been 'rigged' to favor bombers." James P. Tate, *The Army and Its Air Corps: Army Policy toward Aviation, 1919–1941* (Maxwell AFB, Ala.: Air University Press, 1998), 161–62. Recent evidence indicates that there were valid reasons for tailoring the maneuvers, but the reasons were forgotten and then the results considered without regard for the maneuver constraints. Maj Hugh G. Severs, "The Controversy behind the Air Corps Tactical School's Strategic Bombardment Theory: An Analysis of the Bombardment versus Pursuit Aviation Data Between 1930–1939," Research Report no. 97-0126c/97-03 (Maxwell AFB, Ala.: Air Command and Staff College, 1997).

51. AFA, 26.

Chapter 6

Conclusions and Recommendations

An event that is lightly touched upon, instead of being carefully detailed is like an object seen at a great distance: it is impossible to distinguish any detail, and it looks the same from every angle.

—Carl von Clausewitz

This paper set out to answer two fundamental questions. First, is there a historical pattern of transformation? If so, is it a practical tool or an irrelevant intellectual exercise? Second, if such a tool exists, can it be used to answer the following: Is the US military effectively transforming space power in order to significantly enhance national security over the next quarter century? This chapter provides concise answers to both questions.

The validity and value of the model is considered first because it has greater implications for the future. Next, the specific case of space power is discussed with regard to each element of the model and then overall. Finally, some general insights are intended to provide potential catalysts for future investigation.

The Transformation Trinity

The main objective of this portion of analysis was to provide a strong conceptual framework for studying strategic innovation and transformation. This objective is important because, whether one likes it or not, the face of warfare will continue to change. Even accepting the chaotic nature of change, there are some recognizable historical patterns of transformation.

The evidence presented here clearly indicates that American peacetime military transformation depends on three dimensions, each composed of multiple variables, all of which interact to determine success or failure. In addition, the three dimensions are constantly influenced by uncertainty, which demands intuition and insight into the strategic environment from the actors who influence the course of change.

The first aspect of transformation is the importance of a practicable *vision*—a perception for the future identity and mission of an organization. While the concept of vision is overused, it is my defining qualifiers—coherency and congruency—that determine which visions are likely to last. First, military and civilian visions should be congruent, but it is not always the case that the military vision follows civilian policy—in spite of fiscal or lawful pressure. This is less alarming than it sounds because it takes time for the military to shape the civilian vision. Since it takes the military longer to influence the civilian vision than vice versa, it is important

that a given military vision is coherent, or consistent, over time. In addition, a military vision stands a better chance of success if it is congruent with, or at least not contrary to, other service visions.

A respected and innovative *culture* is the second facet of transformation. In the military, an innovative leader seldom accomplishes dramatic change completely on their own—and never overnight. They need disciples that understand and accept the conceptual vision and, eventually, have the authority to implement change. These followers may begin at the entry level or may "convert," just as the visionary leader did, but there is usually a period of resistance from the organization as a whole. During this period of resistance, the supporters of the innovation must develop competing theories of victory while advancing through the ranks and shaping the culture. This process invariably takes time and is disruptive to the organization, but it is vital to successful transformation. If this aspect is ignored, the transformation generally devolves to incremental adaptation. Because of the time required to shift the culture and develop innovative theories of victory, this area often receives less attention than it warrants.

Finally, transformation depends on the willingness of the visionary leader and emerging culture to submit their theories of victory to open, honest *assessment.* Assessment is required for two reasons. First, uncertainty about future threats requires an approach that manages uncertainty through war games and simulations designed to explore the shape of potential wars. Second, the ambiguous costs and benefits of new tools and tactics can only be explored through critical evaluations designed to highlight, and learn from, mistakes. Assessment is heavily dependent on the existing culture, so some aspects may need to be separated from the mainstream. Nevertheless, honest assessment must address the linkage between new theories of victory, vision of the expected environment, and the strategy and operational realities of the time.

Because of uncertainty, the value of the concepts extracted here lies in their use as a conceptual framework within which data from unique situations may be placed and better understood. Instead of debating ad hoc each separate facet of a given situation, senior leaders can view the problem "in full" and thereby refine the elements of the model necessary for success. In this holistic sense, the model is practical.

While the underlying influence of the strategic environment captures many of the potential missing elements, it is only in subsequent examination and application that this model will demonstrate any worth. In this light, the answer to whether or not the framework is practical lies in the hands of its intended audience. Future leaders can choose to make decisions based on their own extensive—but often uncorroborated—experience, or they can apply this model and, hopefully, achieve better insights (and improve upon the model through greater use).

The name "Transformation Trinity" is important for two reasons. First, the model that Clausewitz proposed for his theory captured the chaotic nature of warfare and, by extension, transformation. The reference to a

trinity is invoked to remind readers, once again, that there are no arbitrary or fixed relationships between the three elements described here, other than the requirement for aspects of all three. Put simply, users of the model should avoid sequentially applying the facets of the model like steps in a checklist. Leaders should not assume that a vision appears without some connection to the existing culture or ongoing assessment. On the contrary, visions emerge in response to the background of the leaders and the new information that shapes their perception of the emerging strategic environment.

This point highlights the second rationale for invoking the name of a Prussian theorist. Clausewitz stressed the importance of *detailed* critical analysis when pursuing theoretical truths. Likewise, this model is only as useful as the level of analysis performed by its user. When applied, the model should seek the most precise level of detail possible in each area studied to avoid stopping at "an arbitrary assumption that others may not accept."[1] In this light, the model is most useful as another aid to judgment rather than a means to derive laws and standards. In fact, the detailed application of the model to an issue will better inform the leader of the nature of the strategic environment. This approach intentionally strengthens the intuition and, hopefully, makes the process of transformation easier.

The Status of Space Power Transformation

The case study provided here is instructive on two counts. First, it highlights the importance of each element of the model. While it would be circular to claim that the case of space power proves the model, it is worth noting that all of the model's aspects proved to be consequential in either the long-term (since 1945) or short-term (since 1980) case of space power. Second, the model provided insights into the progress of a potential space power transformation.

One note of caution is in order. This paper chose to investigate the soundness of one particular space power scenario—a desire to maintain US space superiority in the future. A full investigation of space power using this model would approach the case from other potential visions that differ from those contained in the national security strategy, National Defense Panel, and USSPACE *Long Range Plan.*

The Plan

The review of the civil-military space power vision demonstrated the importance of detailed investigation. Upon close inspection, it became clear that in spite of superficial commitment to future space power, current civilian actions demonstrate an entrenched commitment to the Eisenhower-inspired philosophy of freedom of space. Again, the intent is not to decry the civilian approach to space power but to point out the internal discord. Military leadership content to consider merely the policy guidance of

the present administration might, incorrectly, assume a strong civilian commitment to space control and, possibly, force application from space. It will, however, take more than a few outspoken members of Congress to demonstrate a greater emphasis on space power; it will take funding and legislation consistent with published policy.

The military vision for space also suffers from dissension. Joint doctrine and the unified space command *Long Range Plan* paint a clear and consistent picture for the future of space. The Air Force portrayal is more nebulous and fluid. The mercurial changes made to the Air Force vision reflect an uncertainty about the best way to include space in an air-centric Air Force. This uncertainty is apparent in Air Force space doctrine, which is more concerned about organizational structure than operational strategy. For a coherent military space power vision to emerge, the Air Force must make a conscious effort to stabilize its gyrating organizational vision.

If strategic change is desired, there is room for improvement for both the military and the civilian leadership. Until then it seems likely that any change will be incremental rather than dramatic.

The People

The confusion over the space power vision is evident in the military space culture. The Air Force space culture heritage presented earlier demonstrates the length of time required for cultural change and the unintended consequences of social engineering. The rise of the missileer within Space Command highlights the impact of one-way cross flow and should prove instructive to those calling for aerospace integration. The present joint culture is more amenable to continuing the space support era than catalyzing a space warrior era.

If change is desired, whether to an air and space force or an aerospace force, it will require concerted two-way cross flow between the space and air communities for as long as it takes to make the change occur. The space and missile career field merger, while ongoing, took less than a decade to impact the leadership of the command. The rise of the fighter pilots, on the other hand, took almost four decades.[2] In any case, military leaders should recognize that cultural change is possible but always outlasts their tenure. In that sense, social change should not be undertaken without a coherent vision.

In the same vein, doctrinal change should not be taken lightly. The military risks losing the value of doctrine as a potent aid to judgment when it uses it to justify organizational constructs. The Air Force must commit to thoughtful development of *environmental* doctrine regardless of what shape—air and space or aerospace—the future force takes.[3] There are some promising efforts in this regard, but only time will tell if the future Space Warfare Center will develop useful space power doctrine and ultimately fulfill the concept born 20 years ago.[4]

Space separatists should also heed the lessons imbedded in this investigation. Once again, military change takes time, and there is an impressive

record of dramatic change since the watershed event called Desert Storm. Those that call for a separate force should consider fully the dangers of maturing in isolation. The powerful and prescient airpower theories of Sir John Slessor were conceived in the critical world of the Army War College, while the equally powerful—yet fatally flawed—theories of the Air Corps Tactical School were born in relative isolation. Before jumping from the nest, the space warriors should make sure their ideas are mature enough to take flight. To do this, their energy needs to shift from justifying their own organizational vision towards offering robust, competing theories of victory.

The Progress

For a variety of reasons, the assessment of space power theories is also lacking. First, much of the energy that should be devoted towards developing combat strategies is spent on organizational agendas. As a result, there are fewer theories of victory to compare or expand and much of the examination done by the military seems to be stuck in the same pattern traced in the 1950s. Occasionally, new ideas emerge; but they are often relegated to the library shelves. The military needs to invigorate the development of competing theories by encouraging more academic investigation.

In addition, the recent resurgence in war gaming requires better coordination within and across the services. Lower tier games should be played more frequently with more emphasis on trending results from one game to the next. Space war games should also be played more frequently to avoid single-game lessons. In fact, space war games should be more akin to trade studies than conceptual war games to allow a full spectrum of tools with which to make decisions.

To support valid space power trade studies, the military needs to commit greater resources to small-scale prototyping. By buying information on a variety of concepts, the military can minimize its cost while allowing flexibility for the uncertain threats of the future.

The Future

Taken together, there is a compelling picture of the future of space power transformation. While this transformation model does not attempt to predict transformation, it does suggest the conditions that will prevent transformation. Many of those symptoms are present in the case of space power.

First, based on the present opposition of the civilian and military space power visions, transformation is unlikely in the short term. Unless the military can rally around a single vision, it will miss the opportunity to shape subsequent civilian visions. In addition, the lack of consensus within the military about the future of space power may spur traumatic change imposed from outside the organization.[5] While separation of Earth and space may seem appealing to some, such a dramatic move ignores the

long-term cultural issues at play. In short, there is little in the way of a coherent and congruent vision to indicate the United States is poised to transform its approach to space power in order to retain space superiority in the future.

Second, the present space culture lacks detailed, compelling theories of victory; and an organizational split will only divert energy to bureaucratic issues and result in future theories developed in isolation. There is a healthy space culture at present, but it is rooted in a mind-set of aircraft and missile analogies that shade the potential growth of upstart "pure space" seedlings. Leaders who believe in an innovative future for space power should nurture both cultures in order to sow the largest crop of competing theories of victory. Otherwise, the military will carry a space support culture into the twenty-first century and, in spite of all the talk, may leave the space superiority mission unfulfilled.

Third, the present military mechanism for assessment runs the risk of becoming another blunt instrument in the parochial tool kit. The services should mandate an independent, trusted agency with the power to conduct high-level examinations of competing ideas to ensure an honest, open evaluation of competing theories of victory. Until then, the weaknesses in any space superiority theories will await the brutally honest and unforgiving test of war.

Overall, the US military is not effectively transforming space power in order to enhance national security over the next quarter century. There are isolated, sometimes brilliant, efforts toward this end but no concerted, long-term work based on a vision of the future. This point is moot if, as some contend, there is no immediate reason to expect a threat to our uncontested space power dominance. On the other hand, it is more likely that the nature of competition will compel an adversary, as yet unseen, to attack the United States in ways that threaten its present superiority. In any case, the present approach to space power transformation implicitly accepts the former proposition while accepting the risk of the latter.

Closing Thoughts

The nature of warfare is immutable, but the means of war change over time. The unavoidable challenge to future leaders is coping with that change. Since effects in war seldom arise from a single cause but instead emerge from several concurrent causes, the problem of transforming the military in light of the perceived strategic environment is especially vexing. While not a panacea, the transformation trinity provides an orderly way to deal with uncertainty to enlighten the leader of tomorrow.

The United States presently enjoys a substantial lead in the arena of space power; but an early lead in a new way of war, no matter how large, can be lost. History is clear on this one point if no other. The leaders of the United States, both elected and commissioned, would be wise to consider the observations drawn here, lest history teach her favorite lesson yet again.

Notes

1. Carl von Clausewitz, *On War,* ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 157.

2. Col Michael Worden, *Rise of the Fighter Generals: The Problem of Air Force Leadership (1945–1982)* (Maxwell AFB, Ala.: Air University Press, 1998).

3. For an explanation of fundamental, environmental, and organizational doctrine, see Lt Col Dennis M. Drew, "Of Trees and Leaves: A New View of Doctrine," *Air University Review,* January–February 1982, 40–48.

4. While usually associated with the Moorman Panel, the original idea for a unique space organization to develop combat doctrine surfaced at the US Air Force Academy Military Space Doctrine Symposium in 1980. See chap. 4.

5. The best example of ongoing concern about the DOD approach to space power is the space commission established to assess current national security space management and organization. *National Defense Authorization Act for Fiscal Year 2000,* sections 1621–30, Public Law 106-65 (5 October 1999).