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# Ten Propositions Regarding Spacepower

M. V. Smith
Maj, USAF

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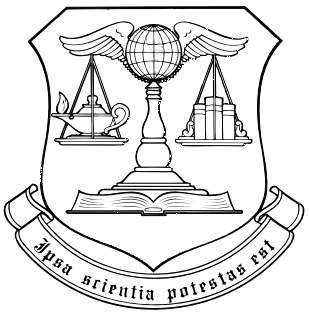


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*This work*
*is dedicated to those who*
*dare fight for spacepower.*

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# Foreword

Major M. V. Smith's *Ten Propositions Regarding Spacepower* is an important contribution to the spacepower literature. Within weeks of being written, an early draft found its way into the various colleges around Air University's Academic Circle. Within months it reached colleges and universities across the United States and even the international academic community.

Major Smith's work begins to quench the growing thirst among those seeking to understand elements contributing to spacepower. More importantly, it offers a view of what spacepower will mean for the United States in the coming decades.

I believe *Ten Propositions Regarding Spacepower* will live up to its aim: assisting political leaders, military professionals, and interested citizens to understand better the nature of space as a source of national and military power. It is a "must read" that belongs at the very top of your reading list.

LANCE W. LORD
General, USAF
Commander, Air Force Space Command

# About the Author

Maj M. V. Smith

Maj M. V. Smith was born in North Conway, New Hampshire, on 3 July 1964. He graduated with honors from Kennett High School in 1982 and cum laude from Saint Michael's College, Burlington, Vermont, in 1986, with a Bachelor of Arts degree in psychology. A distinguished graduate of the Air Force Reserve Officer Training Corps, he received a regular commission upon graduation. In 1987, Major Smith was a distinguished graduate of Undergraduate Missile Training and, in 1994, a distinguished graduate of Undergraduate Space Training. He has served in various missile and space positions, including missile combat crew commander, instructor and evaluator, wing executive officer, and missile maintenance officer. He has served as space crew commander, trainer, and evaluator of several systems.

A distinguished graduate of the US Air Force Weapons School—Space Division in 1996, Major Smith later served as an instructor there, teaching the employment of national and Department of Defense space systems into strategic, operational, and tactical war planning and execution. During Operation Allied Force, he served in the Combined Air Operations Center at Dal Molin Air Base, Vicenza, Italy, in the air component Strategy Cell and on the Guidance, Apportionment, and Targeting team, helping to shape the air campaign and the subsequent peacekeeping operation. In July 2001, Major Smith became a strategist assigned to the Air and Space Operations Directorate at Headquarters Air Force, the Pentagon.

Following the events of 11 September, Major Smith deployed to US Central Command Headquarters where he served as a strategic planner in the Space and Information Operations Element and other campaign planning cells affecting operations in Afghanistan and throughout the Middle East.

Major Smith holds the Master of Arts degree in political science from the University of South Dakota, the Master of Military Operational Arts and Science degree from Air Command and Staff College, and the Master of Airpower Arts and Science degree from the School of Advanced Airpower Studies. He returned to the Pentagon in 2002, serving as chief of the Doctrine Branch in the Strategy, Concepts, and Doctrine Division, also known as the "Skunk Works."

# Acknowledgments

Special thanks go to my thesis advisor, Lt Col Peter Hays, and to my reader, Lt Col Forrest Morgan. The conversations we had not only helped me get my arms around this project but also furthered my appreciation for spacepower's evolution. Col Phillip S. Meilinger, author of *Ten Propositions Regarding Air Power*, provided sage advice at the outset of this study. Considerable help also came from other School of Advanced Airpower Studies faculty, especially Dr. Karl Mueller, Dr. David R. Mets, Dr. Harold Winton, Prof Dennis Drew, and Maj John Terino. Interviews, lectures, and seminar sessions with several general officers helped me understand the organizational, political, and bureaucratic constraints imposed upon our national power in space as the Air Force wrestles with its future and the concept of "aerospace." Among them were Gen Charles "Chuck" Horner, Gen Ralph "Ed" Eberhart, Gen John Jumper, Gen Howell M. Estes III, Gen Joseph Ashy, and Gen Richard Myers. Lt Gen Glen "Wally" Moorhead, Lt Gen Roger DeKok, and Lt Gen Lance Lord were helpful, as were Maj Gen Lance Smith, Maj Gen Howard Mitchell, Maj Gen John Barry, and Brig Gen William Shelton.

My brother space weapons officers also deserve considerable credit for helping me frame the propositions over the past three years. Lt Col "Mr. Bill" Billman, and Maj "Scout" Kinnan remain my constant mentors and stand out as significant contributors. Lt Col Greg "Chappy" Chapman provided valued comments from the Space Division at the USAF Weapons School. Lt Col Michael "Mik" Beno and Maj James Cashin from the Air Command and Staff College provided enthusiastic encouragement for this project and much needed reviews of early drafts. Over the past year, Maj Fred "Zelder" Gaudlip, a true spacepower advocate, and Maj Rob "Snort" Givens, a believer in the "vertical flank," helped me hammer out many of the arguments presented here. Maj Scott Cook, from the USAF Doctrine Center, spent several hours engaged in very productive discussions with me. Welcomed commentary came from Dale "Boots" Hill of Science Applications International Corporation, Dr. Rob Mullins of RAND, and Dr. Larry Weaver of Synergy. My

wife Alice also deserves considerable credit. She not only endured many lonely hours while I worked; she tolerated me while I bounced ideas off her . . . over and over.

Most of the credit, however, goes to Nate—a little boy who is still too young to understand why Daddy closes his door. He paid the greatest price for this work. We are both looking forward to spending more time together.

## Abstract

As political and military leaders ponder the future of space operations, the time has come to frame propositions regarding spacepower. Specifically, this study seeks to answer the question, "What is the nature of spacepower?" It also tests the aerospace integration school's hypothesis that spacepower is simply a continuation or extension of airpower. Two points come immediately to the forefront of this work. First, spacepower is different from airpower even though both share the vertical dimension of warfare. Second, space operations have matured to a point wherein valid and unique propositions regarding spacepower are identifiable. The method used to derive these propositions involved literary research that resulted in a long list. The list evolved over three years during numerous brainstorming sessions with several space experts—most of them space weapons officers with theater and, often, combat experience—until the list was carefully refined into the 10 most salient propositions. The author deferred to Col Phillip S. Meilinger's approach, in *Ten Propositions Regarding Air Power,* of citing each proposition as a thesis statement, with supporting material immediately following. The objective of this work is to stimulate discussions and encourage those who do not yet understand or appreciate the nature of spacepower in modern warfare.

# Chapter 1

# Introduction

*Space, to a large extent, is an unknown to many throughout our country and to many leaders in our government who are being asked to make critical decisions that will chart the course of space for the United States—both inside and outside the military.*

—Gen Howell M. Estes III

*One should bear in mind that there is nothing more difficult to execute, nor more dubious of success than to introduce a new system of things: for he who introduces it has all those who profit from the old system as his enemies, and he has only lukewarm allies in all those who might profit from the new system.*

—Machiavelli

*Either you are a separatist or a conformist. The separatists will often be killed by the party faithful; the conformists will kill the very organization they seek to defend.*

—Gen Charles A. Horner

The objective of this work is to promote discussions and encourage those who do not yet understand or appreciate the nature of spacepower. Its aim is to help political leaders, military leaders, practitioners of war, and interested citizens to better understand the nature of space in order to fully exploit its use as a source of national and military power. American airmen in particular will benefit from pondering the discussions contained herein as they wrestle with their evolving role in space operations. At the heart of this study lies the question, "What is the nature of spacepower?" The propositions presented in this study—along with supporting arguments—provide an answer to this question.

At the turn of the twenty-first century, American spacepower is on unsure theoretical and doctrinal footing. Despite more than 40 years of spacefaring experience, there is still no great book about spacepower—no Clausewitz, Mahan, or Douhet.[1] Consequently, the United States Air Force (USAF) has yet to arrive at a definitive way to conceptualize space. It vacillates between the terms *aerospace* and *air and space* within its lexicon to describe the operating environments beyond the surface of Earth. Indeed, this distinction gives rise to a heated and ongoing debate between members of two schools of thought within the Air Force.[2] It boils down to a political and organizational debate regarding whether or not space operations should remain in the Air Force or evolve into a separate service. The *aerospace* advocates view space as the manifest destiny of airmen, whereas many *air and space* advocates believe space is the manifest destiny of an independent space force.

This study will help train the judgment of military practitioners by pointing out the unique considerations of spacepower. At the same time, it will help readers to assess the strengths and weaknesses of the two competing schools and decide which side of the debate they favor. Readers are free to consider spacepower as a stand-alone concept or as one of the three pillars of "aerospace power," which also includes airpower and information power.[3] Regardless of how the Department of Defense (DOD) organizes, trains, and equips to provide military spacepower for the nation, there are fundamental propositions regarding spacepower that persist in the face of bureaucratic, organizational, and political wrangling. This study identifies 10 of these propositions and argues their case. These propositions may also serve as a foundation beyond the classical theories of statecraft and warfare upon which to base spacepower theory, doctrine, and strategy.

This study unabashedly rides the coattails of Col Phillip S. Meilinger's *Ten Propositions Regarding Air Power*. While Meilinger's propositions are controversial, his book is nonetheless widely read. It stimulates healthy debates about airpower. Spacepower deserves the same attention, particularly as America pits its desire to preserve space as a peaceful

sanctuary against its fears of foreign aggression that may ultimately lead to the weaponization of space.

## Definitions

Words mean things. This is especially true when one is framing propositions. Unfortunately, there is no fixed and time-honored definition for many of the terms used regarding spacepower. In all fairness, however, most military terminology is also in a dynamic state of flux. Authors tend to use specific terminology differently. This places a burden on the reader, who must exert some effort to fully grasp the meanings used by each author. Therefore, it is necessary to provide definitions to help guide the reader during the discussions that follow.

### Proposition

Before defining a proposition, it is helpful to explain what a proposition is *not*. First, a proposition is *not* a principle of war. The principles of war apply to all forms of military power, not just spacepower.[4] Second, a proposition is *not* a tenet. A tenet is an enduring belief about how to employ a particular form of power that rises to the level of institutionalized doctrine.[5] This is similar to a proposition, but a proposition neither focuses on employment nor meets the criteria for doctrine. Third, a proposition is *not* a core competency. Core competencies are basic areas of expertise for practitioners within a form of power.[6]

For the purpose of this study, *a proposition is a statement suggested for acceptance*. This is consistent with the definition used by Meilinger.[7] The reader is free to accept or reject any proposition based on its own merits. It is possible that political or technical changes over time will supersede these propositions or their supporting arguments.

### Power

The term *power* has many meanings. A precise definition depends on who is using it. For the purpose of arriving at a suitable definition of spacepower, *power is the ability of a state*

*or nonstate actor to achieve its goals and objectives in the presence of other actors on the world stage.*[8] This definition does not require the actors to be states, nor does it require a precondition of competition between actors for power to exist in the global system.

## Space

There is no approved definition of space, and a formal definition is probably not forthcoming. From the genesis of space flight, neither the United States nor the Soviet Union wished to define space for fear of constraining their activities in this new environment.[9] Instead, both nations elected to use a functional definition: *whatever is in orbit is in space*.[10] Nevertheless, many people develop their own definitions of space for the purpose of clarification. For example, Air Force officers entering the equivalent of today's undergraduate space training in the early 1990s read the following in their basic text:

> If trying to define where space begins for biological reasons, one might choose 9 miles above the Earth since above this point a pressure suit is required. If concerned with propulsion, 28 miles is important since this is the limit of air-breathing engines. For administrative purposes, one might find it important that US astronaut wings [are] earned above 50 miles. An aeronautical engineer might define space as starting at 62 miles above the Earth's surface since this is where aerodynamic controls become ineffective. Conventional and customary law defines the lower boundary of space as the lowest perigee of orbiting space vehicles, about 93 miles.[11]

The conventional and customary definition is preferred for the purpose of this study: *space begins at the lowest perigee of an orbiting satellite, about 93 miles beyond Earth's surface, and extending out to infinity*. This is essentially the functional definition, which all concede: if it is in orbit, it is in space. It includes objects that are not in orbit but that achieve altitudes that may interfere with objects in orbit—such as ballistic missiles in transit. However, this definition is at odds with the official USAF position, which claims that it is impossible to divide air from space because there is no distinguishable barrier between the two since the atmosphere trails off so gradually. Still, the Air Force concedes that if an object is in orbit, it is in space.

## Spacepower

For the purpose of this study, spacepower is defined as *the ability of a state or nonstate actor to achieve its goals and objectives in the presence of other actors on the world stage through . . . exploitation of the space environment.*[12] More simply, spacepower is doing something in space in support of policy. This definition is remarkably similar to a definition for any other form of power, be it air, land, sea, or information. In the broadest sense, spacepower includes all activities performed by an actor—or exploited by an actor—in the space environment for civil, military, commercial, or other reasons.

## Air

Air requires definition because many of the arguments used in this study refer to the air medium. *Air is the area extending upward from Earth's surface to an altitude at which air-breathing engines can no longer operate, approximately 28 miles*. This definition is also at odds with the official USAF policy, which recognizes no upper limit to the air medium for the same reason it does not recognize a lower boundary for space. Ironically, the highest-flying aircraft in the Air Force's operational inventory, the U-2, only soars to an altitude approximately 16 miles above the surface.

Notice that the definition of air offered here is also a functional definition. When functional definitions of air and space are used, it becomes apparent that air and space do not meet. Airmen claim that air and space are a seamless continuum because it is impossible to identify a discrete altitude where air suddenly ends and space begins. While it is true that no discrete altitude divides air from space, it is really quite irrelevant. Between the ceiling of aviation and the floor of astronautics, there is a region nearly 65 miles wide that divides air and space. This is the transverse region, wherein neither aerodynamic flight nor orbital rotation is possible. Despite rhetoric to the contrary, the transverse region divides air operations from space operations and removes the practicality of an "aerospace continuum."

Operations inside the transverse region are not practical because the energy expenditures required to maneuver there are too great. Vehicles can exploit neither Bernoulli's aerodynamic principles nor Kepler's astrodynamic principles to maneuver or conserve energy. Consequently, the transverse region lives up to its name as a boundary across which vehicles travel but in which they can do little else. The cost of space operations hinges on spacelift vehicles—large, fiendishly expensive rockets that generate the huge amounts of energy required to lift payloads through the transverse region and into orbital speed and altitude.

## Aerospace

The term *aerospace* arrived on the scene in 1958 when Gen Thomas D. White first argued that air and space are indivisible and thus claimed space as the natural realm of the Air Force.[13] The Air Force has used the term in various doctrine and other types of publications. The other services viewed this as a bureaucratic attempt by the Air Force to lay claim over a greater share of the future defense budget pie. As Hays and Mueller point out, "the other Services and the Office of the Secretary of Defense have never accepted the Air Force's definition of aerospace and have certainly not ceded all operations in this realm to the Air Force."[14] Not surprisingly, the term is missing from the *Report of the Commission to Assess United States National Security Space Management and Organization* (hereinafter cited as Space Commission), submitted to Congress on 11 January 2001, except in a reference to industry.[15] Nevertheless, the term was never more "in vogue" inside the Air Force than at the turn of the millennium—and never was it more controversial.

The term is evolving. Traditionally used as a noun, it is synonymous with "air and space," as if they are one and the same. In 1959, the Air Force defined aerospace as "an operationally indivisible medium consisting of the total expanse beyond the Earth's surface."[16] Even doctrinaires find this form of the word confusing because it ignores the obvious differences between air and space, often resulting in gross generalizations of the characteristics of one to the other.[17] Increasingly, aerospace is used

by the Air Force to indicate "of or pertaining to the total expanse beyond the Earth's surface."[18] Although a matter of semantics, this definition allows separate treatment of air and space under the umbrella concept of aerospace. It becomes a term much like *maritime,* which the Navy uses in referring to operations by ships at sea and/or Marines ashore—a term that accommodates both separate services and joint operations.[19]

The October 1999 USAF Doctrine Center publication, *50 Questions Every Airman Can Answer,* describes aerospace power, airpower, and spacepower.

### Aerospace Power

Aerospace power is essentially the ability to create political and military effects using aircraft, spacecraft, and information. Aerospace power involves the effective use of the full range of the nation's resources to allow us to use the physical environments of air and space and our information resources to our national advantage. Air Force Doctrine Document 1, *Air Force Basic Doctrine,* defines the combination of air and space power as the synergistic application of air, space, and information systems to project strategic military power.[20]

### Airpower

Airpower is the fundamental ability to use aircraft to create military and political effects. Another way of defining it is "military power that maneuvers through the air while performing its mission." Airpower is a subset of aerospace power.[21]

### Spacepower

Much like airpower, spacepower is, in essence, the ability to use spacecraft to create military and political effects. Another way of saying it is "military power that comes from, resides in, or moves through space while performing its mission." Spacepower, like airpower, can place an adversary in a position of disadvantage. Spacepower is a subset of aerospace power.[22]

## The Evidentiary Base

Two criteria are required of the evidence used to construct and argue propositions regarding spacepower. First, the evidence for propositions must be rooted in experience to the extent possible. Second, the evidence must be stripped of bureaucratic and organizational prejudice. Given these criteria, it is clear that more recent source materials are preferred since the modern experience base is broader. However, the majority of recent works are advocacy pieces that all but ignore spacepower while arguing—sometimes quite passionately—for a preferred organizational model in an attempt to manage space systems more effectively. While this limits their contribution to framing a spacepower proposition per se, such works are nonetheless valuable because they provide excellent arguments used to support or attack certain propositions presented in this study.

The origins of American spacepower are unique when compared to other forms of military power. Whereas land power, sea power, and airpower evolved out of private and commercial endeavors, spacepower did not. Moreover, the other forms of military power expressed themselves fully in the First and Second World Wars—arguably total wars fought without much restraint. Spacepower did not because it had not yet arrived on the scene. This difference affects the evidentiary base for any study regarding spacepower.

The story of US military spacepower begins in the mid-1940s with notes from Gen Henry H. “Hap” Arnold to Dr. Theodore von Kármán inquiring about the untapped potential of space. This was in the wake of the Second World War, after the atomic bomb, in the fledgling days of the United Nations, and on the eve of the Cold War. Consequently, space systems developed as large governmental endeavors under the strictest military secrecy and with considerable presidential oversight. For these reasons, some of the most basic space-based capabilities remained a mystery to the public and much of the military until recently. This stands in stark contrast to the developments of air, land, and sea power. Perhaps this explains why no great spacepower theory has been forthcoming despite more than 55 years of contemplation. In its place, civilian authors created an entire literary genre

of space-related science fiction and science fantasy. Television shows and movies such as *Star Trek*, *2001: A Space Odyssey*, *Star Wars*, *Battlestar Gallactica*, *Alien*, and *Starship Troopers*—to name just a few—have permeated the popular culture and planted fantastic and quite unrealistic ideas about space. Part of the struggle to make America and its military members more aware of the true nature of spacepower requires undoing what the media has done.

While there is no great book about spacepower, recent years have witnessed an exponential growth in the body of papers, articles, speeches, and other documentation focused on spacepower. Military members fulfilling requirements for professional military education courses generate many of these works. Private think tanks such as the RAND Corporation, congressional studies, and a handful of interested civilian authors also contribute to the body of literature with growing frequency.

Three occurrences in the last 20 years prompted this explosion of critical thought and writing regarding spacepower. The first was President Ronald W. Reagan's national missile defense (NMD) or "Star Wars" proposal, which generated international debate but failed to materialize. The second is the ever-increasing military and commercial reliance on space systems, which now form a significant national infrastructure requiring protection. Finally, the ongoing effort to transform the American military in the post-Cold War era places emphasis on exploiting new technical capabilities such as those offered by space systems—along with a revised proposal for a missile defense system by President George W. Bush.

America has pursued space operations for several decades, but the nation at large is only now realizing the great potential of space. While the evidence on propositions regarding spacepower is still ripening, it nonetheless provides a sufficient base from which to draw reasonable propositions regarding the fundamental nature of spacepower.

## Methodology

The method used to derive the propositions presented here involved three years of literary research and extensive personal

interviews that resulted in a long list of statements regarding spacepower. The list evolved during numerous brainstorming sessions with several space experts—most of them space weapons officers with combat experience.[23] During more than 36 months of debate, the list was carefully refined into the 10 most salient propositions regarding spacepower. In sifting through the evidence, arguments supporting and refuting each proposition emerged. The arguments on both sides are presented with each corresponding proposition in chapter 3.

At the turn of the twenty-first century, we do not have war-fighting experience in, from, and through space, in the classic sense. Therefore, many people view military space activities as merely an avenue to support the information needs of terrestrial forces. While this is certainly important, the propositions presented here argue that spacepower is much more than support. While the propositions are rooted in our space experience to date, it is proper to use analogies to predict, within reason, certain ways spacepower is likely to evolve. A case in point is the proposition that the weaponization of space is inevitable. Support for this proposition comes from historical evidence, which shows that humans have always weaponized the different media. Therefore, it is reasonable to predict that space will also be weaponized.

## Analytical Criteria

To answer the central question of this study, "What is the nature of spacepower?" the evidence must culminate in propositions that describe various aspects of spacepower. In turn, each proposition must serve as a logical answer to the central question. Each proposition must also serve as a premise for arguments supporting and/or refuting the hypothesis being tested in this study (described below).

A proposition regarding spacepower may be very similar to a valid proposition regarding some other form of military power. Such similarity does not, however, invalidate a claim that spacepower is different. In fact, similarities should occur for the same reasons that the principles of warfare are common to all forms of military power. As Clausewitz described

war, “Its grammar, indeed, may be its own, but not its logic.”[24] If military spacepower is truly a form of power, then it should fall in line with a common logic guiding the reasoning of other forms of warfare. As such, similarities to propositions that apply to other forms of military power are expected.

## Hypothesis

The hypothesis tested in this study is the assertion of the aerospace integration school that spacepower is simply a continuation or extension of airpower; that is, it is not an independent form of power. The test of this hypothesis occurs in the presentation of evidence supporting and refuting each proposition presented. Finally, this hypothesis is evaluated in the concluding chapter of this study after all the evidence has been presented and debated.

## Limitations of This Study

When Meilinger framed his propositions regarding airpower, he had more than 80 years of airpower history to draw from. His overwhelming evidentiary base included two world wars and hundreds of other air campaigns among dozens of nations. In the wake of Operations Desert Storm and Allied Force, and in the midst of Enduring Freedom, many now claim that airpower has become the force that “can do most of the work” in modern combat.[25] Most nations maintain separate air forces, and many have academic institutions dedicated to the study of airpower as a distinct discipline. Spacepower advocates can make no such claims, although Russia recently established an independent space force. It remains unclear whether Russia’s initiative is a sign of support for an independent role for spacepower or is indicative of some systemic organizational weakness.[26]

The discussion of the evidentiary base of this study points to a stark limitation: The evidentiary base for spacepower is meager in comparison to that available to air, land, and sea power advocates. Spacepower’s development is different from the development of other military power forms because it came

into being after World War II and evolved under a shroud of secrecy during a highly politicized era of limited warfare. It is unreasonable to expect our national concept of spacepower to match that of air, land, or sea power since it has yet to be pushed to its extreme by total warfare. It also lacks the romantic heraldry of battle-proven war fighters passing the torch to succeeding generations. The lack of glamour undoubtedly dissuaded some potential authors from contributing to serious spacepower literature.

When one is conducting personal interviews, a strange dichotomy arises. The more senior in rank the interviewee (colonels and higher), the less likely he or she is to have had any operational experience with space systems and the more likely he or she is to be involved in the making of bureaucratic and organizational policy that affects military-related space operations. Conversely, the more junior the interviewee (captain to lieutenant colonel), the more likely he or she is to have had extensive experience in space system operations and the less likely he or she is to have any meaningful insight into the jungle of politics surrounding their senior decision makers. This dichotomy exists because space operators have not progressed to the senior ranks inside the Air Force within their operational career field. To meet the standards established for the evidentiary base (experientially based, and stripped of bureaucratic and organizational politics), one must exercise special care when evaluating the information provided by the interviewee.

Another limitation of the evidentiary base is the lack of extensive human experience in the space environment itself. Other forms of military power are much more tactile in nature, since humans physically operate their equipment in the other media. One can easily imagine bygone days when some dashing aviator climbed out of his Sopwith Camel on some misty French aerodrome and manually tightened the guy wire supporting one of his wings. This image is literally lost in space. Military spacepower predominantly employs unmanned robots in the space environment. The thought of invisible data streams carrying ones and zeros between operator and satellite, and from satellite to user, does not conjure a romantic image—nor does it provide a concrete image. Yet, this unique form of military power is

of ever-increasing importance in modern warfare.[27] Between wars, airmen raised the "airmindedness" of the nation by barnstorming and participating in air shows. Space has no such opportunity, although the National Aeronautics and Space Administration has generated some enthusiasm for space exploration by broadcasting images and video from the space shuttle, the international space station, and a number of exploratory probes. Also, various space camps around the country introduce youths into the exciting aspect of manned spacepower but they do not create a general awareness of military spacepower—particularly as regards the use of uninhabited satellites. Space professionals perceive a lack of "spacemindedness" among the populace, and authors of spacepower documents often limit their works to very elementary discussions. This is pervasive across the genre of spacepower literature. In framing the propositions presented here, care is given to keep the language simple while encompassing the range of issues faced by the space professionals themselves.

Some critics will argue that it is premature to suggest propositions regarding spacepower. Their argument has merit only if we trivialize our present operational experience in space. The evidentiary base is comparatively meager, admittedly, but it is no less important than understanding the foundations of any other form of power. There is no attempt to raise these propositions to the level of spacepower tenets, although that may eventually happen. It is vital to the continued growth of America as a spacepower nation, however, that basic propositions regarding spacepower be laid down to promote deeper understanding of this increasingly important medium. Critics must answer the following question, which has been asked repeatedly in several top-level commissions: "If not now, when?"

## Overview

Chapter 2 uses the framework proposed by David E. Lupton in *On Space Warfare* to provide a brief summary of the evolution of American spacepower doctrine. The purpose of this discussion is to familiarize the reader with the political and military environment in which spacepower evolved and operates.

It exposes shifts in the geopolitical landscape that may cause America to dramatically alter its spacepower doctrine, making it more important than ever for policy makers to understand the fundamentals of spacepower.

Chapter 3 is the core of this work. Presentation and argument of the 10 propositions regarding spacepower occurs here. The purpose of this chapter is to deliver the evidence addressing the central question of this study: "What is the nature of spacepower?" This evidence also supports the testing of the hypothesis that spacepower is merely a continuation or extension of airpower—that it is not an independent form of power.

Chapter 4 answers the central question of this study by describing the nature of spacepower as revealed in the evidence for the 10 propositions. It is here that the hypothesis is specifically accepted or rejected. Finally, this study concludes with a brief spacepower theory.

The appendixes provide a brief look at the attempts of other authors to frame statements that capture the essence of spacepower. In a sense, these are their propositions regarding spacepower although this was not the focus of their work. The purpose of reviewing the work of other authors is to provide readers with additional information from which to judge the propositions that are central to the work at hand. In some cases, presumably because an inherent truth is apparent, the propositions presented here overlap the work of other authors. In other cases, because of differing intents, methodologies, analytical criteria, and focus of their works, the propositions are dissimilar to the work of other authors. The recommendations of the Space Commission also appear in an appendix because this landmark document will likely influence future spacepower debates and space policy.

## Notes

1. Perhaps no great book about spacepower is possible in the classic sense. Contemporary authors must meet higher academic standards than the great theorists. Their works would likely be doomed by modern editors for failing to cite their sources and for resting their arguments on untested theory—often without using historical analogies as proofs.

2. To witness the ongoing debate, refer to *Aerospace Power Journal* (*Air Power Journal* prior to Winter 1999), particularly the following editions: Spring 1999, Summer 2000, and Spring 2001.

3. Frederick L. Baier, *Fifty Questions Every Airman Can Answer* (Maxwell Air Force Base [AFB], Ala.: Air Force Doctrine Center, October 1999), 3.

4. Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine,* 1 September 1997, 11–21.

5. Ibid., 21–27.

6. Ibid., 27–34.

7. Col Phillip S. Meilinger, Naval War College, interviewed by author, 20 July 2000.

8. James L. Hyatt III et al., "Space Power 2010," Research Report no. 95-05 (Maxwell AFB, Ala.: Air Command and Staff College, May 1995), 5.

9. Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), 180, 259.

10. John F. Graham, *Space Exploration: From Talisman of the Past to Gateway for the Future,* n.d., n.p., on-line, Internet, n.d., available from http://www.space.edu/projects/.

11. Capt Carol Laymance, "Science of Space," in Space and Missile Orientation Course (Vandenberg AFB, Calif.: 30th Operations Support Squadron, 1993), 1–3, cited in "Space Power 2010," 93.

12. Hyatt et al., 5.

13. Gen Thomas D. White, "Air and Space Are Indivisible," *Air Force,* March 1958, 40–41. For an in-depth discussion of the roots of aerospace, see Maj Stephen M. Rothstein, *Dead on Arrival? The Development of the Aerospace Concept, 1944–58* (Maxwell AFB, Ala.: Air University Press, November 2000), 44–58.

14. Lt Col Peter Hays and Dr. Karl Mueller, "Going Boldly—Where? Aerospace Integration, the Space Commission, and the Air Force's Vision for Space," *Aerospace Power Journal,* Spring 2001, 36.

15. This commission was chaired by now Secretary of Defense Donald H. Rumsfeld.

16. Air Force Pamphlet (AFPAM) 11-1-4, *Interim Aerospace Technology Reference,* 30 October 1959.

17. Maj Shawn Rife, "Does Aerospace Mean 'Air and Space?' " n.d., n.p., on-line, Internet, 12 February 2001, available from http://sac/saic.com/space/docs/does.htm.

18. AFDD 2, *Organization and Employment of Aerospace Power,* 17 February 2000, 133.

19. The maritime environment is defined as "the oceans, seas, bays, estuaries, islands, coastal areas, and the airspace above these, including amphibious objective areas." Found in Joint Publication 1-02, *Definitions Related to Command and Control,* 14 June 2000, 280.

20. Baier, 3.

21. Ibid., 6.

22. Ibid., 7.

23. A space weapons officer is a space operations officer (13SXX) graduate of the Space Weapons Instructor Course at the USAF Weapons School at Nellis AFB, Nevada. This is the USAF's graduate-level training program for the tactical and operational employment of American space systems in combat.

24. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1984), 605.

25. Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, N.Y.: Cornell University Press, 1996), 326; and Benjamin S. Lambeth, *The Transformation of American Airpower* (Ithaca, N.Y.: Cornell University Press, 2000), 7.

26. Nikolai Novichkov, "Russia Gives a Boost to Space Effort," *Jane's Defence Weekly*, 7 February 2001.

27. Maj Gen John L. Barry, lecture, School of Advanced Airpower Studies, Maxwell AFB, Ala., 3 April 2001.

# Chapter 2

# Schools of Thought on American Spacepower

> *History, by apprizing [men] of the past, will enable them to judge of the future; it will avail them of the experience of other times and other nations; it will qualify them as judges of the actions and designs of men; it will enable them to know ambition under every disguise it may assume; and knowing it, to defeat its views.*
>
> —Thomas Jefferson

> *Contemporary critics of spacepower have too little sense of history. Whatever wonders "the stars" hold for our future, there is a vastly nearer-term strategic logic of spacepower that is all but entirely comprehensible in principle today.*
>
> —Dr. Colin S. Gray

"Because it's there" was the reason Sir George Leigh Mallory gave for wanting to climb Mount Everest. Some may argue this is why America went to the moon (if they dismiss the perceived race against the Soviets and the international prestige associated with being first). The reasons for exploiting the space medium for military advantage are far more practical than the simple quest for adventure, knowledge, or glory.

The reasons for pursuing spacepower are perhaps best summarized by Thucydides, who explained more than 2,000 years ago that "fear, honor, and interest" serve as the three strongest motives for taking action.[1] These three motives help to explain much of the underpinnings of America's military space effort. This chapter uses David Lupton's framework to survey how these motives have driven the evolution of American spacepower.[2]

## Lupton's Four Doctrines

In his 1988 work *On Space Warfare: A Space Power Doctrine*, author David E. Lupton provides a comprehensive framework

for analyzing the rationale for various military activities in space. He describes four main schools of thought (doctrines) associated with military spacepower: Sanctuary, Survivability, Control, and High Ground. These schools of thought represent an escalating spectrum of commitment to military spacepower as a source of national and military power.

## The Sanctuary School

This school holds that the primary value of space forces is their capability to "see" within the boundaries of sovereign states. This value stems from the space vehicle's overflight capability. Proponents of sanctuary doctrine argue that past arms limitations treaties could not have been consummated without space systems that serve as a "national technical means of treaty verification." Moreover, the prospects for any future treaties would be extremely dim without the ability of space systems to fulfill President Dwight D. Eisenhower's dream of treaty verification through open skies. Thus, space systems have had a tremendous stabilizing influence on relations between states. Finally, these advocates caution that overflight is a granted right that nations have not attempted to deny and that any proposed military use of space must be weighed against the possible loss of peaceful overflight. This train of thought leads to the conclusion that the only way to maintain overflight legality is to designate space as a war-free sanctuary.[3]

The basic tenet of the sanctuary school is that satellite reconnaissance systems make nuclear war less likely and foster stability in the superpower relationship.[4] From a realist's perspective, exploiting overflight rights for satellite reconnaissance of potential adversaries reduces potential security dilemmas brought about by fear of the unknown. In one sense, it is a vaccine against a surprise attack. With the knowledge gained from space, policy makers are better able to assess their national security situation and scale their defense expenditures appropriately. At the dawn of the space age, satellites were a symbol of great national achievement. This built an aura of prestige associated with space programs—which the superpowers used to attract third world nations to their

causes, thereby gaining power. Sanctuary school advocates seek to preserve space as a weapons-free zone to prevent threatening other states and triggering security dilemmas. Space weaponization might not only diminish the honor of the offending state; it might entice other nations to contest the right of overflight—an action that could close reconnaissance access to many parts of the world and return the space powers to security dilemmas rooted in fear of the unknown.

## The Survivability School

The basic tenet of this school is that space systems are inherently less survivable than terrestrial forces. Weapons have long-range effects in the space environment, and proponents of this school believe nations are more likely to use nuclear weapons in the remoteness of space. They also argue that space forces cannot rely on maneuverability or terrestrial barriers to increase their survivability. Survivability school proponents believe the political insensitivity of space forces creates uncertainty about the implications of an attack; for example, would we go to war if a satellite were destroyed? Finally, survivability school advocates have serious reservations as to the military value of space forces. Advocates of the survivability school concede that space is an excellent place to base many military systems, especially those that augment or enhance terrestrial forces. They also agree that space forces can do certain military functions (communication and weather data gathering) more economically and more efficiently than other forces in peacetime. They believe, however, that space forces must not be depended on for these functions in wartime because they will not survive.[5]

Realists point out that it is in a state's *interest* to exploit space to gain an advantage in military power over other states. Triggering a security dilemma by developing space-based force enhancement capabilities is not particularly worrisome to them. Survivability school proponents argue, however, that exposing vulnerabilities to an enemy by relying on "fragile" space systems is a constant source of fear for the state that uses space assets for military and economic purposes.

## The Control School

The control school declines to place an exact value on space forces but suggests their value by using analogies. For example, Gen Thomas D. White argues that whoever controls space can exert control over the surface of Earth. Others argue that there are space lanes of communications that, like sea lanes of communication, must be controlled if a war is to be won in the terrestrial theaters. Control school advocates argue that the capability to deter war is enhanced by the ability to control space and that, in future wars, space control will be coequal with air and sea control.[6]

Control school advocates believe space is just another medium analogous to air, land, and sea. As such, they advocate controlling this medium vigorously with both offensive and defensive operations. They believe space control is essential to securing victory in any terrestrial conflict. A realist would point out that it is in a state's interest to control space because it is a route of commerce comparable to terrestrial lines of communication. Fear of triggering security dilemmas in other states is not a dominant concern in this school of thought.

## The High-Ground School

This school harkens back to the old military axiom that domination of the high ground ensures domination of the lower lying areas. Disciples of this "high ground" school advocate a space-based ballistic missile defense (BMD). They argue that the global presence of space forces combined with either directed-energy or high-velocity-impact space weapons provide opportunities for radical new national strategies. In their view, space-based defensive forces can reverse the current stalemate caused by the preeminence of the offense and create either an offensive-defensive balance or a preferred defensive stalemate. This rebalancing would allow replacement of the flawed strategy of assured destruction with one of assured survival. The high-ground school believes space forces will have a dominant influence.[7]

"Lupton's final doctrine, high-ground, argues that space is the dominant theater of military operations and is capable of

affecting terrestrial conflict in decisive ways."[8] This is analogous to Douhet's implicit contention that aircraft are the solution to strategic and tactical stalemates and that all future wars can be won from the air.[9] High-ground advocates favor full weaponization of space, including missile defense systems. Space control is essentially a prerequisite. A realist would contend that the high-ground school is the ultimate exploitation of space to secure the *interests* of the state and to avert *fear* of another state exploiting space against those interests. Like so many airpower theorists in the early days of aviation, high-ground advocates rest their case regarding the decisive nature of space upon optimistic speculation with little empirical support. Table 1 summarizes Lupton's four military space doctrines.

## The Historical Evidence

Since the dawn of the space age, there have been advocates for each school of thought. In general, it is fair to say that America followed the sanctuary doctrine during the Cold War. After the Cold War drew to a close, America began focusing on the force enhancement opportunities offered by space-based systems, signaling a move towards a survivability doctrine. Gen Ralph E. Eberhart, commander in chief of US Space Command (USCINCSPACE), began leading the charge in the year 2000, advocating that America pursue a new doctrine: "space control."[10] The remainder of this chapter will use Lupton's model to survey the evolution of spacepower doctrine, and will look at the current conditions that may lead to a shift in that doctrine. It is necessary to ask what has changed and whether a move towards a space control strategy is feasible in the current political and military context. It is important to answer these questions because adopting a space-control strategy would be a significant departure from long-standing space policy.

### Sanctuary Doctrine (Cold War to Desert Storm)

Just as military fixed-wing aviation was born in the First World War as a method of conducting reconnaissance over enemy territory, military satellites were born during the Cold

## Table 1

## Military Space Doctrines

| Doctrine | Primary Purpose of Space Forces | Employment Strategy | Wartime Mission of Space Forces | Preferred Organization |
|---|---|---|---|---|
| Sanctuary: | Strategic Stability<br>Arms Control | Optimize for NTMV*<br>Vulnerable Orbits<br>Limited Numbers<br>Fragile Systems | Limited | |
| Survivability: | Above Functions Plus:<br>Force Enhancement | Hardening Crosslinks, Less Vulnerable Orbits<br>On-orbit Spares<br>Reconstitution Capability<br>Defense Convoy<br>Maneuver<br>Stealth<br>Redundancy | Force Enhancement<br>Degrade Gracefully | Unified Command or Major Command |
| Control: | Space Control Significant Force Enhancement | | Space Control Counterspace Capability<br>Surveillance<br>Significant Force Enhancement | Space Force or Unified Command |
| High Gound: | Above Functions Plus:<br>Ballistic Missile Defense<br>Decisive Impact on Terrestrial Conflict | | Above Functions Plus:<br>Ballistic Missile Defense<br>Decisive Space-to-Space and Space-to-Earth Force Application | Space Force |

*NTMV—national technical means of verification

War to conduct reconnaissance over enemy territory. Arguably, the greatest security dilemma facing the United States in the 1950s was the fear of a nuclear showdown with the Soviet Union. This drove the need for gathering intelligence about the Soviet Union. Accordingly, in May 1955 the Eisenhower administration established its intent to launch a satellite "to establish a legal regime to legitimize overflight and thereby open up the closed Soviet state to satellite reconnaissance by the secret WS-117L spysat system." This policy, along with Eisenhower's concern over the growing power of the military-industrial complex, "also led to the creation of the National Reconnaissance Office (NRO), America's secret and independent military space agency."[11] Establishing the NRO also provided a convenient civilian cover story for the building and launching of reconnaissance satellites.

Eisenhower succeeded in making unimpeded satellite overflight acceptable to the international community—a task made easier by the Soviets, who were the first to establish the precedent with the launching of *Sputnik I* on 4 October 1957. Subsequent administrations would formally hammer out treaties in the United Nations that set aside space for peaceful purposes and prevented any nation from claiming sovereignty over any part of space.[12] In effect, these efforts established space as a "sanctuary" for peaceful operations. These principles, now a matter of accepted international law, continue to influence US national space policy and military space strategy in very fundamental ways.

Until Operation Desert Storm in 1991, space systems were essentially an adjunct to other political and military operations. At that time, the Air Force mission statement read, "To defend the United States through the control and exploitation of the air."[13] Any reference to space was missing because despite more than 30 years of Air Force space activity, the capabilities of space systems were unknown to the Air Force at large, and what existed was limited to a supporting role. This was mostly because space systems evolved to support the extremely sensitive nuclear mission of the Strategic Air Command (SAC), which dominated the Air Force during the Cold War. Consequently, the Air Force space program focused on

providing missile attack warning, global weather, global positioning, and global command and control communications to support the president and SAC. Likewise, reconnaissance support from the NRO was limited to the National Security Council (NSC), SAC, and very few others.

The sanctuary doctrine was highly effective in this era for a number of reasons. First, the national space policy and military space strategy were perfectly aligned. Both gave top priority to supporting the nuclear mission. Second, the only peer competitor the United States had—the Soviet Union—was also interested in establishing its own spysat network. This made it easy for diplomats to secure the principles discussed above. Third, although the Soviets and the Americans pursued some space control capabilities, such as antisatellite (ASAT) technologies, none matured to the point of presenting significant threats to space capabilities. Ultimately, the United States canceled all of its ASAT programs because of technical difficulties and a lack of political will to commit strained budgetary resources in the face of marginal threats. Cancellation also alleviated concerns about the weaponization of space. Finally, given the limitations of satellites themselves, the limitations of computing power, and the extremely high classification of space products during this period, integrating space capabilities into operations at levels lower than the NCA and strategic planning centers was rare—and difficult at best. In reality, technical limitations may have constrained America to follow the sanctuary doctrine.

### Survivability Doctrine (Desert Storm to 2001)

Desert Storm was a watershed event for spacepower.[14] The Cold War was over, and the fear of a surprise nuclear attack withered along with the emphasis on nuclear deterrence. This allowed space operators to strengthen their emphasis on providing force enhancements to conventional warfare, in a manner consistent with Lupton's survivability doctrine. Desert Storm gave them an opportunity to showcase their capabilities. During the war, missile warning satellites and the Global Positioning System (GPS) became the sweethearts of the USAF space program. Unfortunately, the war fighters typically lacked the appropriate se-

curity clearance, the proper ground exploitation tools, and the necessary training to use other types of intelligence-related space support that was available to senior political and military leaders. In the aftermath of the war, many generals complained bitterly about these shortcomings.[15] However, most agreed that spacepower was a significant contributor to the war effort and that much more was possible.

In June 1992, Gen Merrill A. McPeak, Air Force chief of staff, announced a change to the Air Force mission statement. He added the words "and space."[16] This represented an overt institutional shift toward policies inherent in Lupton's survivability doctrine. It essentially entails the Air Force and other services working to provide force enhancements by pushing space products down to the operational and tactical users by removing security barriers, providing training, and acquiring newly available computers powerful enough to exploit space-derived data.[17] It is essentially the integration of space capabilities with terrestrial forces to enhance terrestrial operations.

The shift toward the survivability doctrine was consistent with White House policy as evidenced by President George H. W. Bush's decision to declassify the existence of the NRO in 1992, making access to space-derived data much easier. Space integration also made sense from a fiscal perspective, since it created opportunities to eliminate unnecessary duplication of effort—for example, replacing some aircraft reconnaissance platforms with satellites and replacing ground radio navigation aids with GPS. At the same time, it brought new capabilities to the campaign planners and war fighters. More important, adopting the force enhancement elements of the survivability doctrine did not cross the imaginary line of space weaponization and did not set off significant security dilemmas amongst other states.

Space Command's General Eberhart believes the effort to integrate space-derived force enhancements into terrestrial operations is succeeding: "The fact we heard so much about [the need for integration] after Desert Storm, and didn't after Kosovo, tells me we're on the right track."[18] Regardless of what other spacepower doctrines the United States might pursue, it appears that force enhancement will continue as more and

more systems plug into space-derived information sources. In fact, the tendency to exploit commercial space assets to support military operations is growing at the dawn of the twenty-first century.

## Control Doctrine (Beyond 2001?)

In November 2000, General Eberhart went beyond the need for integrating space-derived assets: "I don't think we would be good stewards of space capabilities if we only thought about 'integration.' We also need to be spending resources and intellectual capacity on space control."[19] In essence, the general joins the control doctrine advocates, who favor developing the capability to use force, if it should become necessary, to secure American access to space and to deny the same to an adversary. Many of these same advocates also support President George W. Bush's call for a missile defense system. This represents a significant departure from the doctrinal philosophy of either the sanctuary or the survivability schools, as it may entail negating adversary satellites on orbit and crossing the threshold of putting weapons in space—in line with the high-ground school of thought.

What has changed? First, the continuing force enhancement effort makes all of America's armed forces increasingly reliant on space support. Thus, the vulnerabilities predicted by the survivability doctrine are created and require protection. Second, commerce in the Western world has also become increasingly reliant on satellites for the collection and routing of essential information. The international banking community, the global telecommunications industry, and the stock markets became heavy users of space services in the 1990s. Whether the commercial sector understands the threat, or wants protection, is unclear.[20] Third, other nations, many of which are potential adversaries who may employ their space capabilities against the United States, are also increasing their use of space. Finally, several countries, including Russia and China, have already developed counterforce weapons that directly threaten US space operations.[21] Other states are likely to proliferate these or similar weapons in the coming decades. In sum, since US military forces are increasingly relying upon space assets, it is

in their interest to protect them from enemy attack. At the same time, the United States has an interest in denying adversaries the ability to exploit their own space assets to gain an advantage. In light of these changes, General Eberhart's assertion that America needs to focus more on space control may be warranted from a military strategist's point of view—but is it prudent from a national policy perspective?

The *National Space Policy* of 19 September 1996 is contradictory and confusing regarding space control. It asserts, on the one hand, "The US is committed to the . . . use of outer space by all nations for peaceful purposes," and "considers the space systems of any nation [to have] the right of passage through and operations in space without interference."[22] This assertion is consistent with the sanctuary doctrine. On the other hand, the document later asserts that the "DoD shall maintain the capability to execute the mission areas of space support, force enhancement, *space control,* and force application" (emphasis added).[23] *National Space Policy* therefore attempts to advocate two mutually exclusive doctrines: sanctuary and control. The result is a policy set adrift in a sea of confusion.

Actions speak louder than words, however, and DOD currently has little or no space control capability. Despite the initiation of various space control programs by the Kennedy, Ford, and Reagan administrations, subsequent administrations cut these programs in favor of abiding by the sanctuary doctrine. For example, the Clinton administration cut, canceled, or delayed several initiatives related to space control, including *Clementine II,* the Space Plane, and the Kinetic Energy Anti-Satellite Weapon. President Clinton also deferred the approval for NMD component construction (mainly radars) to his successor—a system Lupton describes as part of the high-ground school of thought.

The sanctuary doctrine's appeal to political leaders is rooted in four basic assumptions. First, since the United States is the nation most dependent on space support for its economic and military interests, it has the most to lose by abandoning the sanctuary doctrine. Second, pursuing a space control doctrine might destabilize the worldwide balance of power since other nations might see it as threatening their own space assets,

thereby causing security dilemmas of an unpredictable nature.[24] Third, several intelligence agencies argued during the Clinton administration that, since there were no operational threats to American space systems, there was no need to make the heavy financial investments to fulfill a space control strategy. To the contrary, however, Russia has a long-standing ASAT program, and China has openly declared that they have an operational ground-based ASAT laser.[25] Furthermore, the Chinese are developing "parasitic satellites" for use as ASATs.[26] Finally, and perhaps most important, the United States may lose diplomatic power by abandoning the sanctuary doctrine. NATO allies have repeatedly voiced concerns regarding America's propensity to push technology beyond their ability to integrate as equal partners and fearing the destabilization of the global power structure. Moreover, UN Secretary General Kofi Annan is a strong advocate of the sanctuary doctrine and believes that "the advantages of space technologies should be shared amongst everyone, and military conflict in space threatens this prospect."[27] Shifting towards a space control doctrine appears to have been impossible during the Clinton administration for political reasons.

General Eberhart, despite his position as USCINCSPACE, was unable to significantly influence national space policy toward a space control doctrine during the Clinton administration. He was, after all, only one voice in the larger strategic culture of space policy decision making. When Gen Charles A. Horner was USCINCSPACE in the mid-1990s, the chairman of the Senate Armed Services Committee, Sen. Sam Nunn (D-Ga.), asked him if he was in charge of space. General Horner replied that he could not exercise unitary control over his own command. In addition to the president and USCINCSPACE, a number of other agencies and organizations share responsibility for making military space policy. Among them are Management and Budget, Science and Technology, National Security Council, Central Intelligence Agency, National Aeronautics and Space Administration, and the Departments of Defense, State, Commerce, and Transportation.[28]

These agencies and organizations intrude on the USSPACECOM budget, resources, and decision-making authority. "In

addition to the governmental intrusion into his joint command, USCINCSPACE must also deal with service infighting over who should have the dominant role in space."[29] The Air Force believes it should play the dominant role since it dedicates more resources to space missions than the other services. It is important to note that the Air Force embraced the survivability doctrine, pressing the space community to provide greater force enhancement capabilities to airmen. In its *Global Engagement* vision of November 1996, during Gen Ronald R. Fogleman's tenure as chief of staff, the Air Force issued what is probably the most strident position it has ever issued regarding the importance of space to the Air Force's future: "We are now transitioning from an *air* force into an *air and space* force on an evolutionary path to a *space and air* force" (emphasis in original).[30] The enthusiasm was toned down considerably in 1998 by the subsequent chief of staff, Gen Michael E. Ryan, who insisted that air and space form a single aerospace medium. This is the basis for the Air Force's "aerospace integration" effort, which attempts to blend the air and space communities into a single body of like-minded professionals.

From a bureaucratic politics perspective, all outward appearances of this effort suggest it is merely an attempt by the Air Force to secure future missions and resources for itself over its sister services.[31] Only the Air Force views space as part of an "aerospace continuum." This represents a major departure from the current national space policy and DOD space policy, not to mention the 2000 Annual Report to the president and the Congress by the secretary of defense. All of these documents refer to space as a separate medium, with spacepower being of equal importance to the nation as air, land, and sea power.[32] The disparity between the Air Force's position and that of its political and joint leadership is striking. Unfortunately, as General Horner pointed out, there is no single leader of the military space effort. Consequently, space strategy evolves from a highly politicized, bureaucratic process. This is likely to change soon.

Two events that occurred in January 2001 will likely move American space strategy toward the control doctrine. The first event was the Space Commission Report, released on 11 Jan-

uary.[33] It identifies several known threats to American use of space systems, including Russian GPS jammers, and it formally recommends that "the US must develop the means to both deter and to defend against hostile acts in and from space."[34] Furthermore, the report states, "The Commissioners believe the US Government should vigorously pursue the capabilities called for in the National Space Policy to ensure that the President will have the option to deploy weapons in space to deter threats to and, if necessary, defend against attacks on US interests."[35] These capabilities will include the ability to negate hostile satellite threats.[36] Although the Space Commission refers to this as part of a larger deterrence policy, it nonetheless has a space control doctrine at its core.

The second event was the inauguration on 20 January of President George W. Bush. President Bush is likely to abandon formally the sanctuary doctrine in favor of a space control doctrine with some elements of a high-ground doctrine. In the opening weeks of his administration, he immediately began strongly advocating the development and fielding of a missile defense system, which some members of the media and Congress believe implies basing weapons in space.[37] He also appointed Donald H. Rumsfeld, former chairman of the Space Commission, to the position of secretary of defense, increasing the likelihood that DOD will implement the Space Commission's recommendations. Right away, Secretary Rumsfeld indicated his desire for the United States to renegotiate with the Russians or withdraw from the Anti-Ballistic Missile Treaty, which he called "ancient history," to facilitate the missile defense program.[38] It now appears, given the findings of the Space Commission and a more realist-centered Bush administration, that the United States will likely pursue the space control doctrine—and possibly elements of the high-ground school as well.

## Alternative Strategies

The alternatives to adopting a space control or high-ground doctrine must be given consideration by policy makers. One alternative would be to regress back to the sanctuary doctrine

by weaning military and commercial users from the space support to which they have grown accustomed. This will close the vulnerabilities that space dependence breeds, and will reduce the storm that will invariably occur should the United States trigger security dilemmas while pursuing a more aggressive space policy. As appealing as this might sound, it rests on the assumption that the United States will have uncontested space superiority for at least the next 10 to 15 years and that the military services will be willing to fall back to terrestrial technologies.

A second alternative would be to covertly adopt a space control doctrine and secretly field the necessary systems while preserving the appearance of abiding by the sanctuary or survivability doctrines. If the secrecy should endure, it would prevent security dilemmas. Such an approach risks great diplomatic repercussions, however, and would hamper the ongoing force integration efforts. Secrecy would likely prevent space control systems from integrating effectively into real-world operations in much the same way that secrecy prevented integration in Desert Storm and earlier operations.

A third alternative would be for the United States to improve the durability of its satellites, allowing them to withstand attacks in a continuation of the survivability doctrine. This is by no means a perfect solution, but it does add a degree of assurance that friendly space support would be present when needed.

As a fourth alternative, the United States could add a space denial strategy to its survivability doctrine. Space denial would involve traditional air, land, and sea power; special operations; and information attacks in an effort to destroy an enemy's space launch and ground control infrastructure. It may also include striking whatever ground-based antisatellite weapons the enemy might possess. Space denial is analogous to a blockade and is entirely possible through use of current force structures, but it suffers from the same weakness as blockades at sea; that is, the adversary can break down or circumvent the blockade or receive support from third parties.[39] Finally, the United States could pursue a combination of these approaches.

## Conclusions

During the Cold War, the United States pursued the sanctuary doctrine, securing overflight rights of spysats to provide an element of stability in the midst of an anarchic international system. However, the end of the Cold War and advancements in technology allowed the United States to migrate quickly toward the survivability doctrine—focusing on space-derived force enhancement capabilities. However, the increased national reliance on space systems opened new vulnerabilities to potential adversaries who are now fielding credible space threats. Accordingly, General Eberhart called for a move towards a space control doctrine, which was contrary to the policies of the Clinton administration. His call has likely fallen on more fertile soil in the new Bush administration, which appears to embrace a new role for spacepower in America. With the former chairman of the Space Commission sitting as the secretary of defense and several congressionally sponsored studies citing America's growing reliance upon its increasingly vulnerable space assets, changes in space policy and doctrine are more likely now than at any time in recent years.

The turn of the twenty-first century finds America at a crossroads in space. What course America ultimately pursues will likely have far-reaching effects that will resonate for many years. In these defining moments, it is essential for the people of a spacefaring nation to contemplate some basic propositions regarding spacepower.

### Notes

1. Thucydides, "The Peloponnesian War," in *A Comprehensive Guide to the Peloponnesian War,* ed. Robert B. Strassler (New York: Free Press, 1996), 43. Thucydides is recognized as the spiritual father of realism. The realist perspective focuses on the state as a unitary actor in an anarchic international system. Realists argue that states pursue security, autonomy, and power relative to one another and that conflict is caused by security dilemmas wherein a state fears an unacceptable loss of power forcing that state (or states) to act. Discussed in Barry B. Hughes, *Continuity and Change in World Politics,* 3d ed. (Upper Saddle River, N.J.: Prentice Hall, 1996), 46–53.

2. David E. Lupton, *On Space Warfare: A Space Power Doctrine* (Maxwell Air Force Base [AFB], Ala.: Air University Press, June 1988).

3. Ibid., 35.

4. Peter L. Hays et al., eds., *Spacepower for a New Millennium: Space and US National Security* (New York: McGraw-Hill, 2000), 3.

5. Lupton, 36.

6. Ibid., 37.

7. Ibid., 36–37.

8. Hays et al., 3–4.

9. Giulio Douhet, *The Command of the Air*, trans. Dino Ferrari (1942; new imprint, Washington, D.C.: Office of Air Force History, 1983), 15–29.

10. Space control refers to the use of force to gain access to space while denying the same to an adversary. It is a relative term and does not imply absolute control. It may include using weapons placed in space such as missile defenses.

11. Lt Col Peter Hays and Dr. Karl Mueller, "Boldly Going—Where? Aerospace Integration, the Space Commission, and the Air Force's Vision for Space," *Aerospace Power Journal*, Spring 2001, 36.

12. These principles are laid out in the Outer Space Treaty of 1967.

13. R. Cargill Hall and Jacob Neufeld, *The US Air Force in Space: 1945 to the Twenty-First Century* (Washington, D.C.: USAF History and Museums Program, 1998), 174.

14. 57th Training Support Squadron, "Global Positioning System Overview," USAF Space Weapons Instructor Course, MSN574Z, 2 February 1999. Desert Storm is often cited as "the first space war." This is only true if you discount its contributions to the Cold War and the Vietnam War. One can argue that Desert Storm was the first time that space operations affected every American in the battle space. My favorite quote comes from a young Marine who told a CNN reporter, "Space didn't have anything to do with Desert Storm. All I needed was my M-16 and this little box that tells me where I am (pointing to his Global Positioning System [GPS] receiver)!"

15. This was Gen H. Norman Schwarzkopf's number one complaint. Gen Charles A. "Chuck" Horner was the joint forces air component commander during the war. He later became USCINCSPACE and frequently related his frustration at trying to integrate space into the fight only to be thwarted by security barriers.

16. Hall and Neufeld, 174.

17. Ibid.

18. William B. Scott, "CINCSPACE: Focus More on Space Control," *Aviation Week and Space Technology*, 13 November 2000, 80–81.

19. Ibid., 80.

20. Maj Gen Lance L. Smith, Maxwell AFB, Alabama, interviewed by author, 9 March 2001. Commercial satellite operators typically do not want to add protection to their satellites because doing so would increase weight; therefore, their launch costs would go up. During the Schriever 2000 war games in Colorado Springs, Colorado, one corporate leader of a satellite company told General Smith, "Protection? That's what insurance is for."

21. Gen Richard B. Meyers, "Space Superiority is Fleeting," *Aviation Week and Space Technology*, 1 January 2000, 54.

22. The White House, *National Space Policy*, 19 September 1996, 1.

23. Ibid., 4.

24. John B. Sheldon, "Space as the Fourth Environment: For Warfare or a Supporting Role?" *RUSI Journal*, London, October 1999, 2.

25. "China Develops Anti-Satellite Laser System," *Jane's Defence Weekly*, 2 December 1998, 18. The Russian and Chinese antisatellite programs are further elaborated on by Vice Adm Thomas R. Wilson, "Global Threats and Challenges Through 2015" Statement for the Record, Senate Select Committee on Intelligence, 7 February 2001, 14, on-line, Internet, 12 April 2001, available from http://www.dialumni.org/images/dr_testimony.pdf.

26. Cheng Ho, "China Eyes Anti-Satellite System," *Space Daily*, 8 January 2000, n.p., on-line, Internet, 8 January 2001, available from http://www.spacer.com/news/china-01c.html.

27. Kofi Annan, "Keep Space Peaceful," *Space News*, 23 August 1999, 4.

28. Frank G. Klotz, *Space, Commerce, and National Security* (New York: Council on Foreign Relations Press, 1998).

29. Bruce M. DeBlois, *Beyond the Paths of Heaven: The Emergence of Space Power Thought* (Maxwell AFB, Ala.: Air University Press, September 1999), xiii.

30. Gen Ronald R. Fogleman and Hon. Sheila E. Widnall, *Global Engagement: A Vision for the 21st Century Air Force* (Washington, D.C.: Department of the Air Force, November 1996), 8.

31. House, *Missile Development and Space Sciences: Hearings before the Committee on Science and Astronautics*, 86th Cong., 1st sess., February and March 1959, 76–77. This was asserted during the hearings on "Missile Development and Space Sciences" in 1959 during the testimony of the Air Force chief of staff, Gen Thomas D. White. The criticism has endured ever since.

32. *National Space Policy*, 1–12; Department of Defense, *Space Policy*, 9 July 1999, 2; and Department of Defense, *Annual Report to the President and to the Congress, 2000* (Washington, D.C.: Government Printing Office), 84.

33. The report is formally titled "The Report of the Commission to Assess United States National Security Space Management and Organization."

34. Ibid., 100.

35. Ibid., xii.

36. Ibid., 29.

37. James Dao, "Rumsfeld Plan Skirts Call for Stationing Arms in Space," *New York Times*, 9 May 2001, n.p., on-line, Internet, 15 May 2001, available from http://ca.dtic.mil/cgi-bin/ebird?doc_url=May2001/e20010509rumsfeld.htm.

38. Steven Lee Myers, "Bush's Choice for Defense Sees Immediate Bid to Raise Spending," *The New York Times*, 12 January 2001.

39. Sheldon, 4.

# Chapter 3

# The Ten Propositions

*If you develop rules, never have more than ten.*

—Secretary of Defense Donald Rumsfeld
19th Rule of "Rumsfeld's Rules"

The objective of these propositions is to help train the judgments of political and military practitioners regardless of their organizational affiliations. Strategists and operational planners will find these propositions particularly helpful in developing their understanding of spacepower. Largely, these propositions are 10 things to keep in mind when building spacepower for the nation or when employing spacepower in a strategic or operational sense to secure national or military objectives. The particulars of tactical employment are left for others to ponder.

Nearly 50 years of spacefaring experience has delivered many lessons regarding spacepower. Unfortunately, these lessons frequently disappear from view because of organizational interests. This is not to say that evil people are plotting to keep spacepower from rising to its full potential out of organizational self-interest. The fact remains, however, that access to space is relatively new. Until Desert Storm, those who were thinking about spacepower as an element of military and national power were often marginalized or considered to be entranced by the fantasy of space evidenced in science fiction movies, television programs, novels, and magazines. This has changed somewhat; but space operations remain very expensive, complex, and mysterious to all but a relatively small group of operators, a smaller group of general and flag officers, and even fewer political leaders. The organizations in which spacepower is currently vested have their own long-standing priorities and a bureaucratic inertia that changes slowly over time. Assessing these issues was the mission of the Space Commission, whose findings and recommendations appear in appendix E of this study. The propositions listed and discussed

below simply provide a coherent way of thinking about spacepower for the nation.

- Space Is a Distinct Operational Medium
- The Essence of Spacepower Is Global Access and Global Presence
- Spacepower Is Composed of a State's Total Space Activity
- Spacepower Must Be Centrally Controlled by a Space Professional
- Spacepower Is a Coercive Force
- Commercial Space Assets Make All Actors Space Powers
- Spacepower Assets Form a National Center of Gravity
- Space Control Is Not Optional
- Space Professionals Require Career-Long Specialization
- Space Weaponization Is Inevitable

## Proposition No. 1
## Space Is a Distinct Operational Medium

*To land, sea and air may now be added infinite empty space as an area of future intercontinental traffic, thereby acquiring political importance. This third day of October 1942 is the first of a new era of transportation—that of space travel.*

—Maj Gen Walter Dornberger
V-2 Project Director

*We airmen who fought to assure that the United States has the capability to control the air are determined that the United States must win the capability to control space. . . . There is no division . . . between air and space. Air and space are an indivisible field of operations.*

—Gen Thomas D. White
USAF Chief of Staff, 1957

*Space is a medium like the land, sea, and air within which military activities shall be conducted to achieve U.S. national security objectives.*

—DOD Space Policy, 9 July 1999

*Space is a medium like the land, sea, and air where military activities are conducted.*

—William S. Cohen
Secretary of Defense

*Space is not simply a place from which information is acquired and transmitted or through which objects pass. It is a medium much the same as air, land or sea.*

—*Space Commission Report*
11 January 2001

A significant milestone in human achievement occurred on 2 November 2000. On that date, astronauts took up permanent residence aboard *Alpha*, the International Space Station. In that sense, space is much more like the land upon which people live than the oceans or the air through which people traverse. In another sense, *Alpha* is like a ship at sea that never returns to port but swaps out its crew at regular intervals. The astronauts aboard *Alpha* will serve four-month tours of duty, similar to the duration of routine overseas deployments served by American airmen.[1] The bottom line is that "space is a place, not a program."[2] It is quite literally a place that is "out of this world."

The proposition that space is a distinct operational medium may seem intuitively obvious, but the assertion that space is somehow operationally different from the air is anathema to many American airmen who believe that air and space form a "seamless medium unconstrained by arbitrary divisions of the vertical dimension."[3] This is the central argument of the aerospace integration school of thought.[4] The divisions between air and space are not arbitrary, however. There are distinguishable physical, operational, and political divisions between air and space that neither rhetoric nor technology can resolve. Failure to appreciate the differences between these two distinct media not only prevents both airpower and spacepower from developing their full potential but, more important, may lead to serious political and military consequences if spacepower is applied as if it were merely an extension of airpower.

Air Force doctrine recognizes the physical differences between the air and space environments, but it denies any separation between them.[5] A separation becomes apparent, however, when we consider the limitations that physics imposes on practical applications in the two media. In doing so, we realize that the upper boundary of the air medium is 28 miles, the highest altitude attainable by an air-breathing aircraft.[6] Conversely, the lower boundary of space is approximately 93 miles, the lowest possible perigee for a satellite. These functional limitations make it obvious that air and space do not meet. A region nearly 65 miles wide separates air from space. This is the transverse region, wherein neither aerodynamic flight nor orbital rotation is possible. Despite claims of an "aerospace continuum," the transverse region forms an invisible barrier 65 miles thick that divides air operations from space operations.[7]

Operating inside the transverse region is not practical because the energy expenditures required to maneuver or loiter there are too great—by orders of magnitude. Vehicles can exploit neither Bernoulli's aerodynamic principles nor Kepler's astrodynamic principles to conserve energy. Consequently, the transverse region lives up to its name as a boundary across which vehicles transit but do little else. The cost of space operations hinges on space-lift vehicles—large rockets—that generate the huge amounts of energy required to lift payloads through the transverse region and accelerate them to orbital speed and altitude.[8]

Claims that technology will eventually overcome the limitations imposed by the transverse region, thereby enabling vehicles to operate with agility in both media, rest on optimistic speculation. To date, the wings mounted on space vehicles, such as the space shuttle, space maneuvering vehicle, and other experimental craft currently in development, are merely recovery systems analogous to parachutes. One wonders how much extra time, money, and payload trade-off went into designing winged recovery systems and their ground and airspace support infrastructures when a parachute system would weigh less and provide a similar effect—safe return to Earth. A cultural bias is the likely explanation for efforts to force space

systems into the mold of aircraft, in much the same way the original "saddles" on bicycles resembled horse saddles.

One of the primary reasons the Air Force resists recognizing space as something separate from the air is to avoid creating "arbitrary lines on a map" that create command and control problems similar to the Army/Air Force controversy surrounding the fire support coordination line (FSCL).[9] The fear is that command and control issues will somehow hinder the freedom of air and space assets to maneuver and employ weapons if space is established as a geographic area of responsibility (AOR) and as a distinct theater of operations.[10] This seems unlikely to pose a major problem, however, given the great separation between air and space imposed by the transverse region. In fact, to a large degree, the Air Force has already lost this argument because separate coordination with space forces is already required. "Any Department of Defense agency wanting to fire a laser [or any other weapon] above the horizon [into space] must first get permission from US Space Command's Laser Clearing House, which uses the center's information on satellite vulnerabilities to help determine if there are any satellites in the [weapon's] path that should be avoided."[11] It therefore appears that an FSCL is already in place, whether or not DOD ever recognizes space as an AOR or theater.

Lt Gen David L. Vesely, vice chairman of the Joint Chiefs of Staff, expressed another core belief of the aerospace integration school when he stated, "Whatever differences there are between air and space are not important to the theater commander (strategic level) or the war fighter (tactical level). What is important is the effect on the battlefield. Whether it's weapons, communications, or information, the warriors out there don't care where it came from as long as it has the desired impact on the battlefield."[12] Other generals insist, "At the operational level of warfare, air and space are absolutely identical."[13] Are they claiming that air and space are essentially the same at all levels of warfare? There seems to be some confusion in the minds of aerospace integrationists about exactly where the art and science of airpower and spacepower converge within the seamless medium they have constructed.

While it is certainly true that tactical-level war fighters do not care where support *comes* from, they *are* particular about the type of support they receive. Some aircraft and spacecraft perform similar missions (reconnaissance, surveillance, communications), but the type of support each can deliver is different. This is because aircraft and spacecraft operate in different media with vastly different ranges and speeds relative to targets—and they are constrained differently by the physical laws of motion. This means the differences between airpower and spacepower *are* important to theater commanders, component commanders, and operational planning staffs—at least they ought to be! These people are involved with creating the plans that connect the ends with the means in warfare. If the means are different, so must be the plan.

Airpower and spacepower present war planners with different means to accomplish the ends they seek. At the tactical level of warfare, airmen and space professionals practice entirely different sets of war-fighting skills—flying an aircraft in a theater of operations is dramatically different from operating a global network of satellites from a remote site in the continental United States (CONUS). At the operational level of warfare, air operations centers (AOC) around the globe focus almost exclusively on the air situation in their respective theaters. Conversely, the one and only Air Force Space Operations Center at Vandenberg Air Force Base (AFB), California, maintains a global perspective and tasks its assets to support users worldwide.[14] At the strategic level of warfare, combined/joint force commanders obtain their space support via a supported/supporting relationship from USCINCSPACE. At the grand strategic level of national policy, the president and several agencies frequently task space assets independently of other forces in the DOD to achieve political ends.[15]

The physical remoteness and the laws of orbital motion in space create several defining operational characteristics of spacepower that separate it from other forms of power. In *Modern Strategy*, Colin S. Gray points out several of the inherent advantages associated with operating above the transverse region in the space environment.

First, space is but the latest variant of the "high ground" that doctrine often advises military commanders to seize and hold. As with forces on all kinds of high ground, space systems look down on friend and foe and are relatively difficult to reach and grasp. To attack uphill had never been easy; to attack up the Earth's gravity well would continue that military condition. Second, the high ground of space is both global and of all but infinite military depth. The country or coalition which can operate at will in space is able thereby to operate from the highest vantage points. And finally, space power, obedient to Keplarian laws of orbital motion, translates as satellites that can be available globally as either a regularly repeating or a constant overhead presence.[16]

Gray also points out some of the operational limitations imposed by the space environment:

> Spacepower has several limitations. The high cost of transportation into orbit (i.e., launch costs) limits the pace of advance of military, scientific, and commercial space systems. . . . Next, the laws of orbital motion that govern celestial bodies are a permanent constraint upon the flexibility with which spacepower can be employed; those laws can be overridden to a degree, but only with a virtual attrition in payload imposed by the fuel necessary to achieve some anti-Keplarian agility. . . . Predictability "on orbital station," or predictable orbital passage, is both a blessing and a vulnerability. The orbital task calculated by us to provide the necessary terrestrial support is also calculable by the anti-satellite weapon systems of the foe. [Finally,] it is in the nature of spacepower to be distant from terrestrial events. Although it is the distance overhead that is militarily beneficial, still distance from Earth is an important limitation.[17]

The issues that Gray raises about operating in space are similar to those faced by practitioners in the other media. Operators in all media are concerned about the high ground, presence, cost, maneuver, defensibility, and range. Gray argues that these similarities exist because "spacepower . . . is not governed by a distinctive strategic logic," rather it follows the same strategic logic that applies to any independent medium of operations.[18] A listing of Gray's other insightful observations regarding space as it relates to its nature as an operational medium can be found in appendixes B and C of this study.

The advantages and limitations of spacepower that Gray identifies are no surprise. Space professionals understood these enduring characteristics of space operations at the outset

of the space age. Many authors have addressed these characteristics as a way to appreciate the differences between air and space operations. Lt Col Michael R. Mantz is one such author.

Air and space are operationally different. Aircraft have maximum maneuverability, while spacecraft have greater altitude and speed, but can't maneuver [with even a fraction of an aircraft's agility and flexibility]. The principles of war of mass and maneuver certainly do not apply in the same way. Aircraft can mass repeatedly through maneuver over a target, while spacecraft can mass for short periods after great effort, but will disperse almost immediately with a repeat manning unlikely. Aircraft operations are "on demand," while spacecraft operations are "as scheduled" or "when available."[19]

The space medium therefore requires its own concept of operations—integrated with all other forms of national and military power but fully accommodating the unique physical and operational attributes of spacepower.

Perhaps the most important distinction between space and the other media is found in the political arena. Numerous space-specific treaties, agreements, and arrangements of customary law separate space from the terrestrial media. If air and space are truly a seamlessly integrated medium of operations, then why do spacecraft have unrestricted overflight rights whereas aircraft do not? Why is an aircraft carrying bombs aloft not considered the weaponization of space? Why did the UN pass a nonbinding resolution in November 1999 calling upon governments to "contribute actively to the prevention of an arms race in outer space and to refrain from actions contrary to that objective?"[20] The answers to these questions are rooted in the fact that the international community understands space as a separate and distinct operational medium. Different political rules apply to space, as demonstrated by the following space-specific treaties the United States has agreed to abide by:

- The 1963 Limited Test Ban Treaty, which prohibits any nuclear weapon test, or any other nuclear explosion in outer space.

- The 1967 Outer Space Treaty, which proscribes placing weapons of mass destruction in space or on the moon or other celestial bodies for any military purposes.
- The 1972 Anti-Ballistic Missile (ABM) Treaty, which prohibits the development, testing, or deployment of space-based components of an antiballistic missile system.
- A number of arms control treaties that are intended to prohibit the United States and Russia from interfering with the other's use of satellites for monitoring treaty compliance.
- The 1980 Environmental Modification Convention, which prohibits all hostile actions that might cause long-lasting, severe, or widespread environmental effects in space.[21]

The political implications of military spacepower are quite apparent, in that a powerful international lobby wants to preserve space as a peaceful sanctuary. Many fear that conducting offensive operations in, from, or through space has the potential to destabilize the global power structure and cause unpredictable security dilemmas. Several nations voice this concern regularly through the UN Secretariat of the Conference on Disarmament.[22]

If Clausewitz is correct that war is an extension of politics, and if space has a unique set of political considerations associated with its use, then military planners at all levels of warfare must be very careful to employ spacepower consistent with the political aims of the war.[23] In most cases, this will be in a manner quite different from the employment of airpower. Operations in the space medium will likely require their own rules of engagement apart from those guiding other forms of military power because of the unique set of political constraints regarding space.

The physical, operational, and political nature of space set it apart from the terrestrial media. These factors are especially important to military planners at all levels of warfare because spacepower has several unique planning considerations that must be taken into account when designing the means to achieve the desired effects (objectives) in the battle space. This makes space a distinct operational medium.

# Proposition No. 2
# The Essence of Spacepower Is Global Access and Global Presence

*This is Friendship 7 . . . Zero "G" and I feel fine . . . Oh, that view is tremendous!*

—Mercury Astronaut John Glenn

Like most Americans, President Eisenhower could never forget Pearl Harbor. His scientific advisor, James Killian, remarked that Eisenhower "remained 'haunted' . . . throughout his presidency by the threat of surprise nuclear attack on the United States."[24] Indeed, a survey conducted in the mid-1950s indicated that more than half of all Americans believed they were more likely to die in a nuclear attack than from old age.[25] Feeding this sense of paranoia was the closed nature of the Soviet Union, which, as Eisenhower noted, gave them an advantage in planning a secret attack when compared to the open American society.[26] The problem facing the administration was how to gain access to the Soviet Union in order to assess their military capabilities and intentions.

Ultimately, the Eisenhower administration tried four methods of peeking behind the Iron Curtain. First, at the July 1955 Geneva Four Power Summit Conference, the president proposed an initiative called "Open Skies," wherein US and Soviet reconnaissance aircraft would freely overfly each other's country.[27] The Soviets rejected this initiative. Second, in January 1956, Eisenhower authorized the release of reconnaissance balloons to overfly the Soviet Union under the guise that they were merely weather balloons. This practice ended a few days later amidst serious Soviet protests and very few useful photographs recovered.[28] Third, in July 1956, the president authorized overflights by the newly operational U-2 reconnaissance aircraft. This was a great success until May 1960, when the Soviets shot down Francis Gary Powers in a U-2 over their homeland. In the political aftermath, the United States terminated all overflights of the Soviet Union. Shortly thereafter, Soviet space law theorist Georgi Zhukov warned that, since the USSR had proved it could shoot down American spy planes,

the United States would "rush development of a new method via satellites in space."[29] How right he was! Satellite reconnaissance was the fourth method the Eisenhower administration pursued in order to gain intelligence about the Soviet Union, but the effort to build a spysat had begun some years earlier.

Since 1946, scientists seriously contemplated reconnaissance satellites. In that year, the RAND Corporation published a study titled "Preliminary Design of an Experimental World-Circling Spaceship." A satellite offers "an observation aircraft which cannot be brought down by an enemy . . .," the report observed. Other military roles included the "spotting of points of impact of bombs launched by us, and the observation of weather conditions over enemy territory."[30] Over the next decade, politicians and scientists alike would come to appreciate the idea of satellites as a means to access denied geographic regions, such as the Soviet Union. This prompted the Eisenhower administration to seek a way to establish freedom of international overflight rights for satellites (a logical extension of their "Open Skies" policy). While the administration intended to establish the precedence of overflight rights by launching satellites as part of the International Geophysical Year, planned for late 1957–early 1958, the Soviets beat them to the punch and shocked the world by launching *Sputnik I* on 4 October 1957. Freedom of passage in space became customary law and, later, international law.[31] In August 1960, just three months after the U-2 overflights ended, satellites began returning images from inside the Soviet Union. This information allowed political and military leaders to shape their diplomatic and military efforts more effectively to address the real threat and not some perceived threat based on guesswork. Space was no longer merely a science project, but an instrument of policy in the Clausewitzian sense. True spacepower had arrived.

The driving reason for America's initial voyage into space was to exploit the unique element of global access, an inherent attribute of most satellites in low earth orbit (LEO).[32] Jim Oberg, author of *Space Power Theory*, discussed this issue.

> The primary attribute of [Earth-focused] space systems lies in their extensive view of the Earth. Ability to service large areas from a distance of less than a thousand kilometers for most low Earth systems is the key ingredient for stationing the vast majority of systems in space. It is

> this extended area—virtually global in nature—that not only represents spacepower's most valuable asset, but also sets it apart from all other forms of power. While all other forms of power are effectively regional, spacepower allows worldwide access in time spans measured in minutes as opposed to hours and days.[33]

Closely related to the attribute of global access is the attribute of global presence. By placing several satellites of a particular type into orbit at certain altitudes and distribution, we create a "constellation" of satellites. The more satellites added to the constellation, the more coverage of Earth's surface. Another factor, however, is the constellation's altitude above Earth's surface. For example, the Iridium Satellite Company operates 66 satellites in a low Earth orbit (485 miles) that provide telecommunications worldwide.[34] Still higher, at a medium Earth orbit (11,000 miles), USAF's GPS employs 24 satellites to maintain global coverage while ensuring all points on Earth are in view to at least four satellites. Finally, at a much higher geostationary orbit (22,300 miles), only three satellites are required to provide missile warning surveillance or communications over most of the globe. At this altitude, a single satellite views nearly 40 percent of Earth's surface.[35] However, for the sake of redundancy and the security of overlapping coverage areas, more than three satellites are typically used.

When selecting an orbital altitude for a particular satellite or constellation of satellites, there is a trade-off between sensor range to the surface of Earth and the total number of satellites needed to provide global coverage. Traditionally, reconnaissance and other Earth-sensing satellites are placed in low Earth orbits in order to take advantage of the relatively close range to the surface. In order to provide global presence with these types of satellites, constellations of several hundred satellites would be required—at an enormous expense. As a result, nations have not fielded reconnaissance satellites in sufficient numbers to yield global omnipresence; instead, they find it adequate to accept frequent revisits by these satellites to all areas of interest.

For missions that require global coverage (navigation, communications, and missile warning), economic factors typically drive the purchase of a few satellites placed in higher orbits to achieve global coverage. There is another reason to place satel-

lites on the geostationary belt, at 22,300 miles above the equator. Only on the geostationary belt can satellites remain in one spot relative to the surface of Earth. This is particularly useful for large communications systems because users on the surface of Earth can keep their antenna fixed in one position instead of having to track the movements of particular satellites while perpetually moving their antenna. Customers of telecommunications systems that employ several satellites in low Earth orbit, such as Iridium, get around the problem of tracking satellites and adjusting antennas by using very low-power handsets that use omnidirectional antennas to reach any one of the satellites in the constellation.

The essence of spacepower is global access and global presence. These attributes are often the answer to the question, "Why do we go to space?" They are the reasons for performing most military, civil, and commercial missions that are performed in space. This point was widely recognized only a few years ago. In the former Air Force Doctrine Document 2-2, *Space Operations*, dated 23 August 1998, a section titled "Global Coverage" provides the following explanation:

> Space-based systems in appropriate orbital deployments provide worldwide coverage and frequent access to specific Earth locations, including those denied to terrestrial-based forces, on a recurring basis. Unconstrained by political boundaries, satellites deployed in specific orbits and in sufficient numbers maintain a continuous presence over enemy [and friendly] territory....Space systems provide an instantaneous presence not available from terrestrial-based forces, permitting the United States to leverage information to influence, deter, or compel an adversary or affect a situation. The use of multiple space platforms allows warfighters to exploit the various sensors, resulting in a synergistic battlespace perspective that reduces the fog of war. Although space systems provide global coverage, some can be focused to provide information on specific areas of interest, which can improve situational awareness and planning tempo and can enable information dominance for all friendly military forces. By exploiting comprehensive space capabilities, space forces can focus on and provide detailed services for a specific geographic area and support regional planning requirements. The attribute of global coverage offers significant advantage to Air Force battle management. Properly positioned in sufficient numbers, space-based systems could provide a global capability for much of the information currently provided by airborne platforms such as the joint surveillance, target attack radar system (JSTARS) and the Airborne Warning and Control System (AWACS).[36]

There is a great risk that the Air Force is losing sight of the essence of spacepower in its fervor to advance aerospace integration. The latest version of this document, dated 27 November 2001, fails to articulate the unique global access and global presence of spacepower that set it apart from all other forms of power.[37] Doing so would undercut the aerospace argument that air and space are a seamless operational continuum.

In reality, the different attributes of airpower and spacepower mean they do different things, and whatever they do that is similar is nevertheless done differently. For example, aircraft do not routinely overfly politically denied areas. Spacecraft do. Airpower does not provide a global presence. Spacepower does. Airpower is much closer to the fight than spacepower, but several capabilities provided by spacepower are always present during war and peace, whether or not terrestrial forces are present.

When airmen speak of the global nature of airpower, they mean something very different from what space professionals mean when they speak of the global nature of spacepower. An airman means that airpower has global *reach*. Global reach is the ability of an aircraft to take off from point A and travel to point B anywhere on the globe to achieve an objective. In contrast, a space professional means that some spacepower assets provide nearly ubiquitous presence around the entire globe with some capabilities while other spacepower assets provide frequent revisits of all areas of the globe with other capabilities. Spacepower provides its effects across the globe all the time. This is because global access and global presence comprise the essence of spacepower.

## Proposition No. 3
## Spacepower Is Composed of a State's Total Space Activity

> *Air power is not composed alone of the war-making components of aviation. It is the total aviation activity; civilian and military, commercial and private, potential as well as existing.*
>
> —Gen Henry H. "Hap" Arnold

> *Space power is not composed alone of the war-making components of space. It is the total space activity; civil, commercial, defense, and intelligence, potential as well as existing.*
>
> —M. V. Smith's Space Corollary to Arnold's Air Power

Going to space is hard. If it were easy, mankind would likely have gone there long before *Sputnik I* circled the globe in 1957.[38] Taking the initial steps into space was possible because the competing superpowers, reacting to security dilemmas during the Cold War, were willing to support huge government programs to get there. This makes space unique because government interest in both sea and air grew only after civilian curiosity and private enterprise opened these terrestrial media. With more than four decades of spacefaring experience behind us, going to space is still difficult and expensive, even though we have answered most of the fundamental questions and resolved many of the technical problems.

In *Space Power Theory*, author Jim Oberg identifies several attributes of a spacefaring nation. "Several basic traits are shared by most spacefaring nations: geographical size and location, national wealth, an extensive and well-educated population, existing national power, a popular appetite for technology, and political will."[39] It is difficult to tell which of these attributes is most important, but he claims that "spacepower can be conceived as a combination of all the quantitative factors multiplied by the qualitative factor of will."[40] It is immediately obvious that a state must have a great deal of intellectual, industrial, and capital capacity if it is to build a successful space program. In addition, the internal political environment must tolerate such expenditures. A government that must spend every available penny on social programs is not likely to develop or sustain a space program.

In short, many things must be going right inside a state for it to afford the investment in a start-to-finish space program. The Russian space program, possibly the leader in the late 1950s and early 1960s, faltered in the wake of the Soviet breakup in the early 1990s. Russia's social needs outweighed

the continued investment required to reconstitute their satellite constellations and meet their fiduciary commitments to the International Space Station. Nearly 10 years after the breakup, it appears they have resolved many of their earlier problems and may be ready for resurgence in space. Other nations, most notably China (and perhaps India), have finally developed a national infrastructure wherein they can realistically set the goal of conducting manned space missions.[41]

Spacepower in the United States migrated quickly from its defense-related origin and evolved into four distinct sectors of space activity: civil, commercial, defense (also referred to as military), and intelligence. When considered together, activities in these four sectors describe US national spacepower and become a useful template to describe the national spacepower of other states. Peter Hays described the four sectors in *Spacepower for a New Millennium*.

The US Government conducts *civil* space activities in order to explore the universe and advance human knowledge. The National Aeronautics and Space Administration (NASA) performs these missions, and they are funded by the government. Examples include human spaceflight missions conducted under the Apollo, Skylab, and International Space Station programs; robotic exploration performed by programs such as Viking, Voyager, Galileo, and Mars Pathfinder; and scientific missions of the Earth Observation System or Landsat programs. These types of civil space missions are probably the first space activities to come to mind for most people, but they are only the tip of the iceberg of all space activities.[42]

*Commercial* space activities are performed by the private sector to make money. Communications satellites and telecommunications services form the oldest and most profitable segment of the commercial space sector. Other commercial space services that are or soon may become profitable include: navigation and positioning, launch, and remote sensing. Many commercial space sector activities are highly volatile economically and are governed by a complex set of international and domestic legal regimes such as those established by the 1967 Outer Space Treaty and the Commercial Space Act of 1998. These legal regimes are enforced by international and domes-

tic regulatory agencies such as the International Telecommunications Union (ITU) and the Federal Aviation Administration.[43]

The *intelligence* space sector consists of surveillance and reconnaissance missions designed to collect information for use by the US government [and its allies]. Throughout the Cold War, space-based intelligence gathering activities, such as the Keyhole (KH) photo reconnaissance satellites, and the organizations involved in procuring and operating these systems, such as the National Reconnaissance Office (NRO), were highly classified or "black" due to the political sensitivities and cutting-edge technologies involved in this sector. Spy satellites are often given great credit for helping to stabilize the superpower relationship during the Cold War. They were the most important national technical means of verification (NTMV) for arms control agreements prior to the advent of on-site inspections (OSI) that were first allowed as part of the Intermediate-Range Nuclear Forces (INF) Treaty of 1987 and, today, are critical for a wide range of increasingly complex missions beyond verification.[44]

The *military* space sector contains all the remaining national security missions. These are directed by the Department of Defense (DOD), commanded by USSPACECOM, operated primarily by Air Force Space Command (AFSPC), and provide data streams to enhance the effectiveness of US and allied forces worldwide. The vast majority of military sector systems and missions are now declassified, but some aspects remain black. Military sector missions cover a wide variety of actual and potential activities that range from supporting space operations to applying force to, in, and from space.[45]

Hays points out that there is substantial overlap between these four sectors,[46] which creates opportunities for the sectors to leverage off one another to yield a synergistic effect. They often combine research dollars and readily adapt technologies from other sectors to their own. They share facilities and resources such as the eastern and western ranges and the Air Force Satellite Control Network (AFSCN). More important, they provide redundancy in satellite commanding, commercial asset leasing to cover requirements, debris avoidance

warning, and space object tracking (space surveillance). This not only builds a more robust national spacepower, but also creates a new dynamic that complicates the policy-making process for space.

Military use of civil and commercial systems will pose many questions as yet unanswered. For example, is a commercial satellite system a valid target if it is providing information to an adversary? Is it legitimate to strike an adversary's satellite control network if it provides support services to international consortia? While these questions and many others remain unanswered, the mixing of commercial, civil, and military assets in other arenas raises the same types of challenging questions.

The most important development in national spacepower has been the rise of the commercial sector. In the late 1990s, international commercial investment in space finally exceeded the combined spending of all governments in space. This marks a clear turning point. In the words of the Space Commission Report, "Unlike the earlier era, in which governments drove activity in space, in this new era certain space applications, such as communications, are being driven by the commercial sector. An international space industry has developed, with revenues exceeding $80 billion in 2000. Industry forecasts project revenues will more than triple in the next decade."[47] Space is now a place for business, capital investment, and profit.

It seems likely that market forces will now dictate the cost of space programs, regardless of the sector. Although the military and intelligence sectors will undoubtedly have somewhat unique requirements, it is likely that most of their systems or subsystems will be compatible with commercially available systems. The advantage of using commercial off-the-shelf systems is in the tremendous cost savings over having to develop entirely new systems, as was the case only a few years ago.

The rise of the commercial space sector also brings space much closer to every human on the planet. We do not know how deeply spacepower will touch the fabric of our lives, but we are confident that the effects will be significant.

Space-based technology is revolutionizing major aspects of commercial and social activity and will continue to do so as

the capacity and capabilities of satellites increase through emerging technologies. Space enters homes, businesses, schools, hospitals and government offices through its applications for transportation, health, the environment, telecommunications, education, commerce, agriculture, and energy. Space-based technologies and services permit people to communicate, companies to do business, civic groups to serve the public, and scientists to conduct research. Much like highways and airways, water lines and electric grids, services supplied from space are already an important part of the US and global infrastructures.[48]

However, unlike aviation pioneers who made the public more air-minded by providing very exciting and tangible examples of airpower, such as air transportation, barnstorming (air shows), and air races, spacepower remains relatively hidden. Spacefaring states must therefore keep the imaginations of their citizens sparked to the idea and potential of spacepower because only states of high science and energized industry can sustain a space program. A permanent commitment to the hard sciences and the strategic arts will be required to make it all possible. In other words, "No bucks, no Buck Rogers." The bucks begin with building a space-minded nation because spacepower is ultimately composed of a state's total space activity.

## Proposition No. 4
## Spacepower Must Be Centrally Controlled by a Space Professional

> *[Space] warfare cannot be separated into little packets; it knows no boundaries on land and sea [or air] other than those imposed by the radius of action of the [space]craft; it is a unity and demands unity of command.*
>
> —Air Marshal Arthur Tedder
> ("space" substituted for "air")

Did we not learn anything in North Africa? When Operation Torch began in November 1942, airpower was neither independent nor centralized because senior army officers, both

British and American, insisted on controlling their own airpower to provide *local* protection and deal with *local* problems.[49] The results were disastrous. Many historians assert that the early failures of Torch, especially the Battle of Kasserine Pass, can be blamed on ground leaders who failed to listen to their airmen's advice on controlling air resources.[50] The solution to the problem was to give airmen what they had clamored for since the First World War: centralized control of airpower at the *theater* level by an airman with close liaison to Army headquarters.[51] With this change, airmen went from following orders to filling requests—with the freedom to manage airpower in the most efficient manner their expertise made possible.[52] With centralized control and close coordination with ground forces, the Allied air forces quickly turned the tide on the Luftwaffe and hastened the defeat of Germany's *Afrika Korps*.[53]

Nearly 60 years later, the Air Force is making the same mistake with spacepower by promulgating in its basic doctrine that "*Air and space power must be controlled by an airman who maintains a broad strategic and/or theater perspective in prioritizing the use of limited air and space assets to attain the objectives of all US forces in any contingency across the range of operations*."[54] The idea that an airman with a *theater* perspective should ever control space assets, which are properly "tasked and assigned from a *global* perspective," should send shivers up the backs of military leaders.[55] Think North Africa! Here rises a conflict in the aerospace integration argument. Physical differences aside, air and space do *not* form a seamlessly integrated operational medium because airpower is best managed from a theater perspective while spacepower is best managed from a global perspective.[56] Airpower focuses on providing effects that support a combined or joint force commander; spacepower focuses on providing effects that support *all* joint war fighters and civil users around the globe.[57]

Airpower is a theater-focused form of military power, which is why independent air components exist in every theater. So-called "global airpower" assets such as B-2 Stealth bombers support only one theater at a time. Airpower has essentially achieved global reach with theater assets. Conversely, space

assets must be controlled apart from the many pockets of airpower to allow space professionals to properly prioritize and optimize support for multiple users around the globe. These factors culminate in the need for space professionals to centrally control spacepower from a global perspective to achieve the greatest economy of force while supporting the highest priority needs of all users—especially the joint war fighters.

Space assets must not be broken into "penny packets" by allowing airmen (or anyone else) in various theaters of operation to control whatever space assets are present or in view of their theater.[58] Doing so would result in friction caused by the lack of a centralized mechanism to eliminate duplication or to prioritize limited resources as war fighters in adjacent theaters compete for the same space assets. Also, allowing theater control of satellites in low, medium, or highly elliptical orbits would likely degrade the readiness of those satellites to perform their missions on the opposite side of the globe.[59] Such a situation would bring a "déjà vu" of North Africa and Kasserine Pass.

Conflict occurs over the issue of who will exercise operational control of space forces.[60] Current doctrine is a victim of editors who have simply replaced the word *air* with *aerospace* or *air and space* in an honest attempt to be inclusive.[61] Unfortunately, doing so "force fits" the attributes of airpower to spacepower and the theater mind-set of airmen to space professionals, creating an endless source of confusion.[62]

In its zest for aerospace integration, the Air Force now refers to its various theater AOCs as "aerospace" or "air and space" operations centers. This signals an increasing effort by the Air Force to coordinate and control space support and counterspace operations for the entire theater, a job arguably best left to the combined or joint staff because it involves coordinating space support for all theater components from a CONUS-based unified command (USSPACECOM).[63] The role of the handful of space professionals inside each AOC is to advise the air component commander on space operations and spend the rest of their time coordinating with unified commands and space centers in the CONUS. It is questionable whether an airman (or anyone) can readily switch between a theater per-

spective when employing airpower and a global perspective when employing spacepower—the example of Army leaders not listening to their airmen advisors in North Africa arises yet again.

In considering where to centralize the control of space forces, the importance of the operator's perspective or mind-set cannot be overemphasized. Gen Wilbur L. Creech, former commander of Tactical Air Command, credits the success of the AirLand Battle doctrine to Gen Donn A. Starry, commander of the US Army's Training and Doctrine Center in the 1980s. Creech claims that Starry "saw combat in a much broader perspective than the traditional Army."[64] It was the first time the Army recognized a theater perspective beyond the corps area, and it acknowledged the legitimacy of the airman's mind-set.[65] Creech asserts that this mutual understanding laid the foundation for modern joint operations, which were proven in Desert Storm.[66]

This lesson of mutual understanding and joint partnership appears lost on airmen who cannot appreciate the necessary differences between the theater mind-set of airmen and the global mind-set of space professionals. The insistence that air and space form a single operational medium called aerospace is a roadblock, as is the denial that the effects spacepower shares with land power and sea power are just as great as those shared with airpower.

Just as the expanded mind-set of airmen drove their need for centralized theater-level control of airpower by an airman, so too, the further expanded mind-set of space professionals drives their insistence that spacepower must be centrally controlled by a space professional.

## Proposition No. 5
## Spacepower Is a Coercive Force

> *The photoreconnaissance satellite is one of the most important military technological developments of this century, along with radar and the atomic bomb. Without it, the history of this century would be very different. Indeed, without it history might well have ceased.*
>
> —Jeffrey Richelson, 1990

> *We are entering an era—if we have not already entered it—when the use of space will exert such influence on human affairs that no nation can be regarded as a world power or remain a world power unless it possesses significant space capabilities.*
>
> —Gen Robert T. Herres

On 11 May 1998, India surprised the world by detonating nuclear devices. The international diplomatic response was immediate and quite negative, including such headlines as "Pakistan Feels Let Down by US Spy Satellites" and "India Tricks US Satellites."[67] The Pakistanis were counting on the United States to provide advance warning, presumably so their government could take whatever actions deemed necessary for state security.[68] Indian officials later revealed that they managed to conceal the tests from US satellites by conducting nuclear tests "when sandstorms normally swept across the Thar Desert and intense heat could disrupt surveillance sensors. Activity was also timed around the flights of spy satellites."[69]

American spacepower clearly failed to deter India from conducting nuclear testing, but the presence of surveillance and reconnaissance satellites did force India to work around the gaps in satellite coverage. This begs the question of whether persistent coverage of India by spy satellites would have deterred India from detonating a nuclear device. Unfortunately, there is no way to answer this question. According to Maj Christopher J. Kinnan, however, round-the-clock satellite coverage does not necessarily bring about the desired behavior: "Coercive spacepower is not a foolproof means of bringing about a desired change in adversary behavior, no more so than coercive air, land, and seapower."[70]

In *Arms and Influence*, Thomas C. Shelling describes coercion as "finding a bargain, arranging for [an adversary] to be better off doing what we want—worse off not doing what we want—when he takes the threatened penalty into account."[71] Robert Pape simplifies this idea somewhat when he describes coercion as "efforts to change the behavior of a state by manipulating costs and benefits."[72] Coercion can take two basic forms. The first is deterrence, which seeks to preserve the sta-

tus quo by discouraging an opponent from changing his behavior. The second is compellence, which comprises a wide range of strategies that may include any combination of national instruments of power to force an opponent into accepting the terms of the coercer.[73]

Traditionally, spacepower's claim as a coercive force rests on the deterrent value of surveillance and reconnaissance satellites. Surveillance satellites that detect missile launch are an integrated part of America's nuclear deterrent architecture. The early detection capability they provide makes it possible for the United States to formulate retaliation strategies that may include launching its intercontinental ballistic missile (ICBM) force on warning instead of absorbing an adversary's first strike. This may negate the value of a first strike designed to eliminate America's ICBM force in their silos. This form of coercion raises the cost and risk for any adversary who would attack the United States.

Another deterrent value of spacepower is its ability to serve as a national technical means of verification (NTMV) for arms control agreements. The Strategic Arms Reduction Treaty (START) prescribes the method of demolishing bombers and missile silos in ways that facilitate satellite verification. Frequent satellite inspection of the demolished equipment deters either state from attempting to break the treaty and raises the cost for any adversary who would fail to comply with arms control agreements.

Some may argue that the reaction of politicians and diplomats armed with the information gleaned from satellites is the real deterrent force, not spacepower itself. And it is true that deterrence is based on the presumption that undesirable actions will meet with undesirable consequences. It nevertheless remains that the presence of surveillance and reconnaissance satellites themselves shapes a potential adversary's behavior. India's having worked around spacepower's operating limitations to build a nuclear weapon is evidence of this fact. Indian officials had no way of knowing whether the reconnaissance satellites passing overhead were operational. Still, they reacted as though they were operational.

In the past, spacepower's coercive force rested upon its deterrent value. However, spacepower is increasingly contributing to compellence efforts as well. The decade of the 1990s ushered with it an evolution of the spacepower mission. GPS, only a budding technology during Operation Desert Storm, enabled the US Army to maneuver flawlessly through the desert of the Middle East. However, with the advent of technologies such as Joint Direct Attack Munitions, spacepower began to play a more direct role in the force application mission.[74] In this sense, spacepower is moving from an information role to being an integral part of the "sensor to shooter kill chains."[75] This reality is beginning to gray the lines between force enhancement and force application, and between deterrence and compellence, though the tide is still probably closer to enhancement and deterrence.[76]

Looking ahead, it appears that spacepower will continue to grow as a coercive force. Improved intelligence, surveillance, and reconnaissance (ISR) satellite networks will improve spacepower's deterrence potential and close the gaps in our coverage that India found and exploited. Space will eventually be weaponized, and space weaponization will bolster both deterrence and compellence capabilities. Obviously, both of these developments will have far-reaching geopolitical and strategic impacts. US strategists are carefully assessing these potentialities.

Maj Gen Lance L. Smith, commander of the Air Force Doctrine Center, was the senior leader in the Schriever 2001 space war game held at Colorado's Schriever AFB in January 2001.[77] In the scenario, he played the commander of a bolstered US Space Force that had at its disposal a wide variety of potential space-based improvements that may become reality by the 2017 time frame in which the war game was set. In a press interview during the war game, he explained that spacepower is a coercive force that may offer the ability to suppress a potential adversary without resorting to actual force. "Today, we use lethal options when we want to demonstrate resolve, such as bombing nonessential targets," Smith said. "Space could allow us to demonstrate to an adversary how we can hurt him militarily and economically without actually carrying it out and force him to

negotiate. It may allow a face-saving dimension for the enemy which we hadn't thought about before."[78]

William Scott, a writer for *Aviation Week and Space Technology*, commented on these same war games: "Having a robust space force could actually promote global stability, effectively deter a potential aggressor, and avoid armed conflict. Simply being able to constantly monitor the buildup of an adversary's forces, then publicly display imagery of them, can be a major deterrent."[79] The United States demonstrated this at the UN when it revealed U-2 imagery of Soviet missiles in Cuba at the outset of the Cuban missile crisis.

The purpose of spacepower is to achieve goals and objectives through control and exploitation of the space environment. This is possible because space assets collect and disseminate information that decision makers can exploit. On another level, the presence of space sensors deters some actors from certain forms of behavior. Increasingly, spacepower is inside the closed sensor-to-shooter loop—and weapons will eventually migrate to space. All of these factors indicate that spacepower is a coercive force.

## Proposition No. 6
## Commercial Space Assets
## Make All Actors Space Powers

*Mercenaries are worth three men; one in our army, one who is not in our enemy's army, and one of our citizens that can remain at work and pay taxes.*

—Frederick the Great

*Commercial satellites are worth three military satellites; one in our service, one that is not in our enemy's service, and one less satellite program to pay for.*

—M. V. Smith's Space Corollary to Frederick's Mercenaries

*Mercenaries and auxiliaries are useless and dangerous. And if a prince holds on to his state by means of mercenary*

> *armies, he will never be stable or secure; for they are disunited, ambitious, without discipline, disloyal; they are brave among friends, among enemies they are cowards.*
>
> —Machiavelli

If you have a credit card and access to a telephone or the Internet, you can build your own spacepower.[80] Like the condottieri of the Italian renaissance, several companies are ready to sell commercial space products to anyone who can meet their price.[81] The types of services for sale include photographic imagery down to 1.0-meter resolution (soon to be 0.5-meter resolution), infrared detection, radar scanning, communications, GPS receivers, and access to refined weather data.[82] Just a few years ago, these capabilities were the exclusive privilege of the superpowers; today, they can be yours if the price is right.

This is becoming a major issue in modern competition between actors. Among the findings of the Space Commission was that "small nations, groups or even individuals can acquire from commercial sources imagery of targets on Earth and in space. They can acquire accurate timing and navigation data and critical weather information generated by government-owned satellites. Improved command and control capabilities are available through commercial communications capabilities. Even launch capabilities can be contracted for with legitimate companies."[83] The report goes on to note, "Commercial satellite ground communications equipment has electronic jamming capabilities that can easily be used to disrupt the functions of space satellites."[84] Perhaps an even greater concern is the fact that the Aviaconversia Company in Russia "is [openly] marketing a handheld GPS jamming system."[85] A four-watt version of the device was displayed at the Moscow Airshow in September 1997, with a price tag of less than $4,000.[86] Such a device threatens to jam, at ranges over 100 miles, GPS signals used to aid the navigation of aircraft and several other weapons systems. It may also deny access to the GPS timing signal that modern military and commercial digital networks increasingly rely upon to integrate and synchronize communications and information.

Commercial satellite service vendors are becoming modern-day mercenaries, and the United States is helping to make them so. During Desert Storm, more than 90 percent of all the long-distance communications used by American forces went through space.[87] Commercial satellites provided nearly 25 percent of that service.[88] At the same time, USAF purchased more than 100 SPOT images of downtown Baghdad.[89] The American trend of using commercially derived space products to augment its own space capabilities continues to grow as the nation seeks greater cost savings by leveraging against capabilities available in the marketplace. For example, following Allied Force, USSPACECOM estimated that 80 percent of the spaceborne communications used in the operation traveled on commercial satellites.[90] As Lt Cmdr J. Todd Black stated in a *Naval War College Review* article, "Commercial satellite systems are quickly becoming indispensable to the US military, and they are almost certainly growing more useful to potential enemy military, paramilitary, terrorist, and other unconventional forces."[91]

The consequences of facing an adversary armed with the types of information derived from commercial space systems would be profound. If, for example, Iraq had had access to imagery and navigational data, the coalition's victory would not have been as easy. They might have unmasked preparations for the ground forces' "left hook" into Iraq.[92] They certainly weren't expecting an attack out of their uncharted desert because the enemy knew, as Gen H. Norman Schwarzkopf points out, "whenever his own forces went out there, they always got lost."[93] GPS changes all of that, and modern adversaries will use GPS to their own advantage.

There is a unique dilemma brought about by the sale of commercial space products. It is likely that *both* parties in a dispute will purchase satellite services not only from the same company, but also derived from the same satellite. This actually happened during Operation Allied Force, wherein the Serbians leased communications bandwidth from the EUTELSAT Corporation, a corporation that operates a fleet of communications satellites. Ironically, NATO nations were sharing a particular satellite with the Serbs. Eventually, diplomats raised

this issue with the corporation's Assembly of Parties, who voted to suspend service to the Serbians until a later date.[94] This raises serious legal and military issues. How should the parties in a conflict treat a common service provider? What legal obligations does the service provider have to the warring parties? There is nothing in space law to establish a suitable precedent.

In 2001, a military exercise at Schriever AFB, Colorado, examined the problems of using commercial space products in warfare. The war game was hypothetically set in the year 2017 with country "Red" massing forces on its border for possible attack against its smaller neighbor, "Brown." Brown asked "Blue" (presumably the United States) for help. On Day 3 of the game, privately owned foreign satellites became a key issue. The Blue side asked the foreign firms not to provide services to Red. In response, Red tried to buy up all available services to constrain the US military, which relies heavily on commercial space satellites for many of its communications [and other capabilities]. Red offered to pay far more than is customary. Blue then said it would top Red's offer. The eight people playing the foreign firms responded that they would honor their contracts, which left Blue worried and unhappy. Robert Hegstrom, the game's director, concluded that "dealing with third party commercial providers is going to be a priority for USCINCSPACE."[95]

There are still no good solutions to the military problems presented by commercial satellites. In "The Opening Skies: Third-Party Imaging Satellites and US Security," author Ann M. Florini states that militaries have three basic options in dealing with commercial imaging satellites, although Black claims these options also apply to other satellite types as well. The first option is to adopt a *free market approach*, simply attempting to outbid one's opponent or beat him to the punch by obtaining contracts early. The second option is to attempt to *negotiate agreed restraints* in the marketplace and international assemblies. The final approach is taking *direct countermeasures* against satellites, their data-gathering assets, or their ground systems.[96] It is likely that some states will attempt a combination of all three approaches, but there is no

telling what courses of action the various actors around the globe will ultimately pursue.

The problems presented by commercial space assets are still so new that no one has yet decided how best to handle them. While advanced nations use commercial satellites to augment their own intrinsic space assets, new actors now have access to information that levels the informational playing field considerably. There is no doubt that various actors will covet commercial satellites that will be available from the new mercenaries. The bottom line is that all actors can become space powers through commercial space assets.

## Proposition No. 7
## Spacepower Assets Form a National Center of Gravity

> *Space is becoming an economic center of gravity for the United States and may well become such for other nations.*
>
> —Gen Howell M. Estes III
> USCINCSPACE, 1997

> *Space . . . is increasingly at the center of our national and economic security . . . [S]pace is not just a military, but also an economic center of gravity, and unarguably, a vital national interest.*
>
> —Gen Richard B. Myers
> USCINCSPACE, 1999

In *On War,* Clausewitz describes a center of gravity as "the hub of all power and movement, on which everything depends."[97] It is therefore a source of strength and at the same time a vulnerability requiring protection. He claims it is "always found where the mass is concentrated most densely."[98] Clausewitz concedes, however, that an enemy may possess several centers of gravity. "It is therefore a major act of strategic judgment to distinguish these centers of gravity in the enemy's forces and to identify their spheres of effectiveness."[99] By identifying where their spheres of effectiveness overlap, it

becomes possible to trace multiple centers of gravity back to a single one.[100] If it is possible to reduce the enemy's centers of gravity to one, "it represents the most effective target for a blow."[101] In essence, Clausewitz is describing the logic behind nodal analysis and effects-based targeting.

Spacepower assets (satellites, ground stations, and data links) are not *the* national center of gravity, but they *are* centers of gravity. They have spheres of effectiveness that overlap in sectors of civil, commercial, military, and intelligence activities. The relative value of spacepower assets depends on how much an actor uses them and for what. For a small state such as Burundi, spacepower assets do not form a significant center of gravity, although they are a potential space power by virtue of access to commercial space products. However, as Barry Watts points out, "American requirements for global power projection suggest that the Unites States is more dependent on space systems than other countries."[102] In effect, spacepower assets are a larger center of gravity for the United States than for other countries at the turn of the twenty-first century. Each space sector—civil, commercial, military, and intelligence—deserves separate consideration as a center of gravity. Each sector also overlaps its sphere of effectiveness with other space and terrestrial interests.

### Civil Space Sector

The civil space sector does much more than manned space flight and space exploration for scientific curiosity. It is a driving engine of scientific research and discovery. Many of the improvements in telecommunications, microelectronics, computing, and machine engineering that we enjoy today have roots in space research sponsored by programs such as Mercury, Gemini, Apollo, and others. Scientific and technological spin-offs from the civil space sector not only fuel high-tech commercial industries, they also generate popular enthusiasm and promote the types of educational programs in math and science that fuel a high-tech society. Centers of research for the civil space sector represent highly attractive espionage targets but, as the *Challenger* disaster in 1986 demonstrated, fatal glitches

in the manned space program can significantly impact progress in this sector.

## Commercial Space Sector

The biggest change in spacefaring activities is the recent emergence and now dominance of the commercial space sector. Whereas governments drove space activity in the early days of space venturing, commercial businesses launched more payloads into space than governments in the late 1990s. Business revenues exceeded $80 billion in 2000 and are projected to more than triple in the next decade.[103] While this is a drop in the bucket of the overall global economy in terms of dollars, it is far more important to consider the type of information collected or moved by the commercial space sector and the capabilities that will be lost if these satellites are negated. Commercial satellites carry banking information, credit card authorization networks, video feeds for cable and broadcast feeds, cellular telephone networks, pager networks, communications networks, and corporate communications systems. All rely heavily on the commercial space sector.[104]

In addition, the armed forces increasingly rely on commercial satellites as gap fillers for their own space systems and as backups if military satellites should fail. In sum, the commercial space sector is not only a profit maker but, more important, it provides an infrastructure for key pieces of governmental, military, and economic information. Of greatest concern are the relatively few commercial satellites that are important to society as a whole and that are poorly protected. They present a highly attractive target set to adversaries.

## Military Space Sector

Political leaders and terrestrial forces rely increasingly on informational support from space in order to find, fix, track, target, and guide munitions against enemy targets. It is an overstatement to claim that terrestrial forces are *dependent* on space support, but it is fair to say that space support facilitates greater situational awareness in the battle space and thereby increases the timing, tempo, and precision of friendly forces.

Without space support, political leaders and terrestrial forces would operate more slowly, using previous generations of technology. There is a growing union between the military services and commercial space sectors. The armed forces increasingly rely on commercial services in lieu of fielding dedicated military systems. This propels the commercial sector forward by providing capital, but it limits the military to generic services instead of highly specialized capabilities. Military systems also assist the commercial and civil sectors. USAF, for example, provides global access to the GPS, allowing the commercial market to profit by selling receivers to the civilian market. US Space Command provides space object tracking to all the space sectors. Still, the satellites operated by the military represent an advantage over adversaries who lack similar capabilities. Any adversary who bases its strategy on leveling the technological playing field must consider targeting military satellites.

### Intelligence Space Sector

It is sometimes difficult to separate the military and intelligence space sectors in terms of operations since they work hand-in-hand to provide capabilities to political leaders for assistance in achieving the goals of policy. The separation came about during the Cold War when the Eisenhower administration established the NRO, a “black” organization shrouded in secrecy until the 1990s, to operate spy satellites that would peer behind the Iron Curtain. Conversely, the military became the repository for openly acknowledged “white” space systems. Although the actual missions and capabilities of many military systems remained classified, they did not intrude on the NRO’s intelligence-gathering mission. Today, the NRO employs its satellites as a NTMV for treaty compliance and to provide critical ISR support to political leaders and military forces. Like the military, the intelligence sector increasingly buys services from the commercial sector to complete its imaging and other sensing and communications requirements. Satellites of the intelligence space sector, in concert with surveillance platforms in the military space sector, act as global sentries. Together, they keep a watch on potential trouble areas

and signal political and military leaders whenever trouble is afoot. These satellites are likely targets early in a conflict with an adversary who seeks to preserve secrecy or gain the element of surprise.

There is tremendous overlap between the sectors. Satellite systems often share the same intellectual and industrial base, the same launch facilities, the same control network, and sometimes the same portions of the electromagnetic spectrum. These overlaps present highly lucrative targets to an adversary. A single asset, such as a communications satellite, may carry signals for hundreds or thousands of users all at once. Any degradation to a satellite supporting multiple users has an immediate global effect that reduces a state's ability to operate abroad. However, access to similar commercial space assets adds capacity to a state's spacepower architecture from a third party, which suggests there may always be some access to space services even in a war that exacts high attrition on a state's proprietary spacepower assets.

The importance of spacepower to the United States is widely recognized by political and military leaders alike. Increasingly, the use of space is viewed not only as an inherent force multiplier, but also as a vulnerability that must be addressed.

Soon after assuming command of the US Space Command, General Estes noted that "we are the world's most successful space-faring nation . . . one of the major reasons the United States holds its current position in today's league of nations. But we are also the world's most space-dependent nation, thereby making us vulnerable to hostile groups or powers seeking to disrupt our access to, and use of, space. For this reason, it is vital to our national security that we protect and safeguard our interests in space. The ability of our potential adversaries to affect our advantage in space is growing. We, in military space, are just now beginning to consider and deal with these threats."[105]

The US armed forces currently use spacepower assets for two primary purposes: (1) to improve the situational awareness of its forces; and (2) as a means of command, control, and communications with its forces. The United States essentially exploits spacepower assets as a permanent informa-

tional infrastructure that is globally available to friendly forces. This allows friendly forces to operate on interior lines of information around the globe.

No claim is made that US military forces are neutered without space support. Terrestrial forces can still fight without space support. However, the absence of space support will inarguably increase the fog, friction, and overall costs of military operations. If friendly forces' access to space is terminated, they will be forced to move information on exterior lines.

An attack that totally neutralizes America's spacepower assets may not, of itself, be decisive. However, if an adversary can increase the fog, friction, and costs of American operations by striking some or all of its spacepower assets, it may turn the tide of battle against US forces and set up the conditions necessary to defeat the United States.

As space products and services become ever more interwoven with American politics, economics, culture, and security, they become increasingly attractive targets for potential adversaries.[106] This is rooted in the basic logic spelled out by Clausewitz. When that logic is extrapolated to the twenty-first century, we understand that spacepower assets form a national center of gravity.

## Proposition No. 8
## Space Control Is Not Optional

> *Whereas those who have the capability to control the air, control the land and sea beneath it, so in the future it is likely that those who have the capability to control space will likewise control the Earth's surface.*
>
> —Gen Thomas D. White

> *Control of space means control of the world, far more certainly, far more totally than any control that has been achieved by weapons or troops of occupation. Space is the ultimate position, the position of total control over Earth.*
>
> —Lyndon Baines Johnson

> *Whoever can seize control of space—that main area of future wars—will be able to change the correlation of forces so decisively that it will be tantamount to establishing world supremacy.*
>
> —G. Sibiryakov and A. Khabarov

> *Unimpeded access to and use of space is and will remain a vital national interest.*
>
> —*Annual Defense Review*, 2001

In the Second World War, sea power held vastly different strategic significance for the Allies than it did for Germany. The Allies depended upon freedom of the sea to logistically connect the alliance and to take the war to their continental foe. Germany, on the other hand, had little need for the sea, other than to deny its use to her enemies.[107] Accordingly, Germany dedicated substantial resources to build submarines, which formed wolf packs to interdict Allied shipping in the Atlantic. Germany's early successes cost the Allies precious time and resources. Prime Minister Winston Churchill later commented, "The only thing that truly scared me during the Second World War was the Battle of the Atlantic."[108] Fortunately for us, Germany was unable to capitalize on the increased fog and friction their U-boats caused. In the end, the Allies gained control of the sea and ultimately defeated the Axis powers.

Today, the strategic significance of spacepower for the United States is vastly different from the significance it holds for other countries. "At the dawn of the 21st century, the preeminent user of near-Earth space for military purposes is the United States . . . [which] is currently far ahead of any other nation in the capability to exploit orbital systems for the enhancement of terrestrial military operations."[109] Friendly forces stationed or deployed worldwide can plug into American space systems to receive services that increase situational awareness, improve precision engagement, and expedite command and control. American spacepower forms a global informational infrastructure that essentially improves the timing, tempo, and precision of US operations beyond the ability of adversaries to respond in kind. This translates into a very

compelling incentive for adversaries to counter American space lines of communications, whether or not they themselves are spacefaring nations.[110]

To date, the United States has enjoyed complete freedom to capitalize on space systems to bolster its national power, at the same time becoming increasingly reliant on space systems for its economic and military success. In fact, the Space Commission Report states, "The US is more dependent on space than any other nation." The ability for US political and military leaders to take for granted unimpeded access to space-based capabilities may be rapidly coming to an end, however, as Gen Richard B. Myers, USCINCSPACE, noted in January 2001.[111]

We can't be deceived by the fact that we enjoyed space dominance in Kosovo and in the Gulf War. We controlled the high ground, not because of superior technologies or strategies, but because our adversaries didn't use space. We gained space superiority by default; this was our bye round, and a key takeaway is that the whole world took notice. Just as Milosevic modified his air defenses to try and deny our air superiority, others will modify their forces to try and deny our space superiority.[112]

Other nations did take notice. In July 2000, a Chinese news agency reported that its military is developing the means to defeat American space-based systems, stating that "for countries that could never win a war by using the method of tanks and planes, attacking the US space systems may be an irresistible and most tempting choice."[113] Subsequently, China revealed that it is developing tiny "parasitic satellites" for use as antisatellite weapons, claiming that this development will "drastically change the Chinese–American military balance so that the United States would not intervene easily in the event of a conflict in the Taiwan Strait."[114] Despite mounting evidence that more nations intend to challenge America's space dominance, American space control efforts have focused heavily on tracking objects on orbit (space surveillance) and not on defending friendly space assets or negating adversary space threats. There is a growing concern that, without a concerted and balanced space control effort, America might be setting itself up for a "Space Pearl Harbor."[115]

There is, however, a new awakening to the space threat among Washington insiders. In the 2000 *Annual Defense Review* (*ADR*), the secretary of defense characterized space control as posing a "significant challenge to U.S. defense strategy."[116] However, in the 2001 *ADR,* the secretary of defense raised the relative importance of space control to a "vital national security interest" and succinctly described space control.

The ability of the United States to access and utilize space is a vital national security interest because many of the activities conducted in space are critical to its national security and economic well-being. Potential adversaries may target and attack US, allied, and commercial space assets during crisis or conflict as an asymmetric means to counter or reduce US military operational effectiveness, intelligence capabilities, economic and societal posture, and national will. Therefore, ensuring the freedom of space and protecting US national security interests in space are priorities for the Department.

The mission of space control is to ensure the freedom of action in space for the United States and its allies and, when directed, deny an adversary freedom of action in space. The space control mission area includes: the surveillance of space; the protection of US and friendly space systems; the prevention of an adversary's ability to use space systems and services, the negation of adversary space systems and services; and supporting battle management, command, control, communications, and intelligence.[117]

What has changed to stimulate this new awareness, other than a change of presidents? The simple answer is congressional interest and new intelligence. In 1999, several congressional commissions were established to assess America's progress in space, all reporting (among their many findings) that the nation is increasingly dependent on spacepower and proportionately vulnerable to space attacks. The *Space Commission Report* cited the following indications of the scope of America's potential vulnerabilities:

- In 1998, the Galaxy IV satellite malfunctioned, shutting down 80 percent of US pagers, as well as video feeds for cable and broadcast transmission, credit card authorization networks, and corporate communications systems.

To restore satellite service, satellites had to be moved and thousands of ground antennas had to be manually repositioned, which took weeks in some cases.

- In early 2000, the United States lost all information from a number of its satellites for three hours when computers in ground stations malfunctioned. Hackers are routinely probing DOD networks and computers. The US Space Command's Joint Task Force for Computer Network Defense reported that detected probes and scans are increasing, access to hacking tools is becoming easier, and hacking techniques are becoming more sophisticated. In 1999, the number of detected probes and scans against DOD systems was just over 22,000; in the first eleven months of 2000, the number had grown to 26,500.
- If the GPS system were to experience widespread failure or disruption, the impact could be serious. Loss of GPS timing could disable police, fire, and ambulance communications around the world; disrupt the global banking and financial system, which depends on GPS timing to keep worldwide financial centers connected; and interrupt the operation of electric power distribution systems.[118]

The specter of space control being contested by an adversary was raised on 7 February 2001, when Vice Adm Thomas R. Wilson, director of the Defense Intelligence Agency, testified before the Senate Intelligence Committee: "A number of countries are interested in or experimenting with a variety of technologies that could be used to develop counterspace capabilities."[119] "China and Russia have across-the-board programs underway, and other smaller states and nonstate entities are pursuing more limited—though potentially effective—approaches."[120] It is often said that "freedom isn't free." Now it appears that freedom in space is not going to be free much longer.

Faced with growing economic and military dependency in space, the United States cannot afford to leave its space assets undefended, or to leave itself open to attacks from space. Just as mankind developed armed navies to protect its investments transiting the sea, so too the United States is compelled to develop more robust space forces to protect its interests in

space. This challenges the notion of "freedom in space," and "space for peaceful purposes." Given the long-standing international body of laws governing "freedom of the seas," and mankind's willing abandonment of such restraints in wartime, the future of space as a permanent peaceful sanctuary appears bleak. Gray and Sheldon summarized the situation in "Spacepower and the Revolution in Military Affairs: A Glass Half Full?"

Space control is not an avoidable issue. It is not an optional extra. If the US armed forces cannot secure and maintain space control then they will be unable to exploit space reliably, or reliably deny such exploitation to others. US ability to prevail in conflict would be severely harmed as a consequence. If you fail to achieve a healthy measure of space control in the larger of the possible wars of the twenty-first century, you will lose.[121]

In future wars, the "Battle for Space" may be analogous to the Battle of the Atlantic. Preserving its space lines of communications is a vital US national interest during war and peace. Simply put, space control is not optional.

## Proposition No. 9
## Space Professionals Require Career-Long Specialization

*We're going to solve our reconnaissance problem once and for all. Get on the horn and tell them to park a [reconnaissance satellite] directly above Baghdad.*

—Unnamed Commander
Joint Task Force-Southwest Asia

*How many "Gs" is that satellite pulling (pointing to sinusoidal peaks made by the ground track of a LEO satellite on a flat map projection)?*

—Unnamed USCINCSPACE
(a fighter pilot) in his first week

*The Department of Defense must create a stronger military space culture, through focused career development, education and training, within which the space leaders of the future can be developed.*

*—Space Commission Report*

Even though the Air Force manages 85 percent of DOD's space-related budget and personnel activity, flying aircraft and operating satellites are as different as night and day.[122] There is no common core competency between aircraft operators and spacecraft operators. One of the most important findings of the Space Commission is that "The Department of Defense is not yet on course to develop the space cadre the nation needs."[123] The Commission noted that few space professionals are in leadership positions in either US Air Force or US Space Commands. Instead, the Air Force and DOD have installed senior officers who typically have no space expertise whatsoever into space leadership roles.

"General Carl Spaatz once commented in exasperation that soldiers and sailors spoke solemnly about the years of experience that went into training a surface commander, thus making it impossible for outsiders to understand their arcane calling. Yet, they all felt perfectly capable of running an air force. That comment, echoed by American airmen for decades, was at the root of their calls for a separate air force."[124] Many space professionals believe that airmen place them in a similar predicament.

In the Air Force pilot and Navy nuclear submarine career fields, military leaders have spent about 90 percent of their careers within their respective fields. In contrast, military leaders with little or no previous experience in space technology or operations often lead space organizations. A review by the Space Commission of over 150 personnel currently serving in key operational leadership positions showed that fewer than 20 percent of the flag officers in key space jobs come from space career backgrounds. The remaining officers, drawn from pilot, air defense artillery, and Intercontinental Ballistic Missile (ICBM) career fields, on average spend 8 percent, or 2.5 years, of their careers in space or space related positions. Of-

ficers commanding space wings, groups, and squadrons fare only slightly better; about one-third of the officers have extensive space experience, while the remaining two-thirds averaged less than 4.5 years in space related positions.[125]

In a paper prepared for the Space Commission titled "Military Space Culture," Lt Col J. Kevin McLaughlin asserts, "This keeps space organizations from reaching their potential. Today, many leaders of space organizations spend most of their assignments learning about space rather than leading."[126] The short tour length of senior officers, averaging less than 18 months, exacerbates this problem.[127] As a result, the lexicon of space discussions seldom rises above the elementary level because the boss will not understand. Furthermore, senior leaders who lack space expertise cannot immediately grasp the contextual elements of problems or issues that may arise. Finally, keeping the boss straight places a heavy burden on the staff.[128]

Part of the problem may be the tendency inside DOD to think of space as a mission instead of a place where various missions are performed. Evidence of this tendency is found in the way the US Air Force Weapons School is organized. The school is comprised of 11 divisions. Each combat aircraft has its own division and allows its operators to develop highly specialized skills, but all space-related things are combined into a single space division, forcing space operators to develop more generalized skills. Another example is Air Force Tactics, Techniques, and Procedures (AFTTP) Manual 3-1. Each aircraft has its own volume, whereas all of the various satellites and space systems are combined into a single volume.[129] In reality, each of the various missions performed in space requires a cadre of highly qualified and relatively specialized personnel. This is significant because the disparity between space systems is at least as large as the disparity between aircraft types.

Currently, the space career field is divided into five major mission areas: (1) Satellite Command and Control, (2) Spacelift Operations, (3) Missile Operations, (4) Space Surveillance, and (5) Space Warning. McLaughlin claims that the career path suggested for Air Force space and missile operators prevents them from developing sufficient "depth," or expertise,

in any particular mission area. Instead, the goal is to have brief assignments in as many mission areas as possible (touch all the bases or fill all the squares). This prevents sufficient maturation or "breadth" of expertise gained by officers working in various jobs within a particular mission area. Next, he notes that "segregation" between research, acquisition, and operations communities—as well as with the NRO—prevents necessary exchanges of ideas. Finally, McLaughlin points out that the sheer size of the Missile Operations mission area, which accounts for two out of every three operational positions in Air Force Space Command, are ICBM positions. This, he argues, makes it almost impossible to create officers with sufficient experience in specific space mission areas.[130] And it is in stark contrast to the career specialization of aircrew members who typically spend several years operating one or at most a handful of aircraft.

To correct the shortfalls identified above and develop a cadre of true space experts that will become future space leaders, McLaughlin makes five recommendations:

1. Specific selection, training, qualification, and assignment criteria for all space-related positions would ensure that the best-qualified personnel would join the space career field.

2. Combining current operations, research, and acquisition career fields would create space operators with greater depth in their profession.

3. Creating separate career paths for each mission area to ensure that leaders gain both depth and breadth within specialized areas would foster expertise. He stresses leadership involvement to ensure a sense of equality among the various mission areas.

4. Recruiting space professionals with the types of technical degrees that fill the needs of the space career field and giving Air Force Space Command centralized management of personnel in the space career field without having to go through the Air Force Personnel Center. Setting space professionals aside from other Air Force personnel would

be significant because it would recognize the fundamental differences between the skills, mind-sets, and operational specialties between airmen and space professionals.

5. Providing science-intensive training and education along the career path of a space professional would build space leaders having the technical competency and intellectual diversity required.

Interestingly, McLaughlin does not address the training needs of the enlisted space professionals who comprise the majority of all space operators and carry the brunt of the workload. Improving the recruiting criteria and training of enlisted space professionals must be included in any plan for accelerating America's spacepower excellence.

However space leaders are grown, the Air Force must remember the unique global role of spacepower. The requirement for space support is not limited to Air Force operations in theaters where combat operations are under way. Instead, Air Force space assets and space professionals must simultaneously support *all* services in *all* theaters *all* of the time in *all* conditions of war and peace. This is fundamentally very different from the roles and missions of airmen. At the same time, space professionals must also take action to ensure relative control of the space medium to preserve friendly access while denying an adversary the ability to exploit space against supported nations.

While it is certainly essential for Air Force space professionals to be active partners in the planning and operations cells of AOCs around the globe, it is equally important for them to be present in the Army's corps-level planning centers and the Navy's fleet-level planning centers. While the Army and Navy have their own space personnel, they need equal access to the special expertise provided by Air Force space professionals as well. Similarly, Army and Navy space personnel would provide valuable expertise regarding their service's space operations in air and space operations centers. As a rule, space professionals need to interact with war fighters in all other media. Such interaction will promote space integration across the board and yield new synergies in warfare.

Going to space is *still* hard and much of spacepower is *still* rocket science. Space is a place where several highly specialized systems perform a wide variety of missions. It is critical for space professionals, with their unique global mind-set, to rapidly evolve into the leaders of military spacepower so they can set the vision for the future. When we recognize all of the dynamics that pertain to space operations, many of them captured in these propositions, we also realize that space professionals require career-long specialization.

## Proposition No. 10
## Space Weaponization Is Inevitable

> *Space for peaceful purposes – what a bunch of !#%!.# bull.!% that was!*
>
> —Gen Bernard A. Schriever

> *It's politically sensitive, but it's going to happen. Some people don't want to hear this, and it sure isn't in vogue . . . but—absolutely—we're going to fight in space. We're going to fight from space and we're going to fight into space.*
>
> —Gen Joseph W. Ashy

> *Weapons in space are inevitable, and the U.S. ought to review existing arms control obligations that get in the way of deploying a space-based deterrent.*
>
> —*Space Commission Report*

Humanity has attempted to prevent or delay the proliferation of weapons for centuries, but history suggests that mankind is driven to develop new weapons.[131] At the Second Lateran Council in 1139, the Church banned the crossbow for being too lethal.[132] Within a millennium, however, humans had built nuclear weapons and used them in war. Competition is part of the human condition, and war is a natural expression of this condition. If this were not so, states would likely have forgone their military establishments and preparations

for war a long time ago. We are not at the end of history—states still vie for power in an anarchic international system and will compete in every medium of human endeavor. Former Secretary of the Air Force Sheila E. Widnall said, "We have a lot of history that tells us that warfare migrates where it can—that nations engaged in a conflict do what they can, wherever they must."[133]

Space is already militarized by virtue of the force enhancements derived from current systems on orbit. The weaponization of space is only a matter of time. Barry Watts believes it may come about in one of two ways. There may be a dramatic trigger event, such as the use of nuclear weapons to attack orbital or terrestrial assets, compelling states to place weapons in space. Or there may be a series of small, seemingly innocuous developments in orbital capabilities over several years that would, in hindsight, be recognized as having crossed the boundary and weaponized space.[134]

There is a growing national debate on the issue of space weaponization, initially sparked by President Reagan's Strategic Defense Initiative and now reinvigorated by President Bush's advocacy for a missile defense system. Although President Bush never mentioned placing weapons in space as part of his plan, his critics, such as Senate Majority Leader Thomas A. Daschle, claim this is implicit in his argument because space is the ideal place to station a small number of assets that can provide a global capability.[135] Pundits from both sides of the debate have forged the pros and cons of weaponizing space over the years. Frank Klotz describes the debate this way:

> On one side are those who argue that the United States needs to develop a military capability to protect its satellites from attack and to deny adversaries access to the benefits of satellite products and services. On the other side are those who contend that weapons should never be employed in space. They urge instead that arms control and other cooperative measures are the best means to protect American equities in space, as well as to prevent space from becoming an arena for armed conflict.[136]

Both sides of the debate have valid concerns. Proponents of weaponization claim the United States will enhance its national power by weaponizing space. They are quick to point out

that "there is no blanket prohibition in international law on placing or using weapons in space, applying force from space to Earth, or conducting military operations in and through space."[137] Hays and Mueller describe this side of the debate:

> If the United States moves expeditiously to take advantage of its existing leadership in space technology and establish an unassailable dominance of orbital space, its position as the preeminent world power will be enhanced and perpetuated; if, on the other hand, it fails to seize the opportunity to establish unassailable superiority in space, its world leadership will be threatened by more visionary rivals . . . [h]e who controls space will control the world—or at least he who doesn't, won't—and, thus the more the United States invests in developing its spacepower, the more powerful and secure it will be.[138]

Conversely, advocates of preserving space as a peaceful sanctuary believe space weaponization will reduce the overall power of the United States as an actor on the world stage. They are concerned about triggering security dilemmas that will lead to an arms race in space.

> [Sanctuary realists] oppose space weaponization . . . because they believe it would reduce rather than enhance US power and security in particular. They argue that the United States, as the leading user of space, has by far the most to lose if space systems become increasingly vulnerable to attack and that as the world's preeminent air and surface power, it has the least to gain from developing such weapons. Sanctuary realists also assert that if the United States takes the lead in developing space weapons, it will be easier for other states to follow suit, thanks to US technological trailblazing. Finally, they tend to be skeptical that the military utility of space weapons, both for power projection and to protect US space assets, will be as great as the weaponization proponents typically claim.[139]

The numerous concerns over space-based weapons include monetary costs, a questionable threat, lack of survivability, lack of political will, incompatibility with democratic values, problems with orbital dynamics and laser physics, treaty infractions, and international opinion—just to name a few.[140] All these concerns are serious and real. The solutions may not arrive for years, but they will come to fruition sooner or later.

Regardless of which side of the argument is correct, the historical relationship between man and his weapons provides insight into the probable future of space-based weapons. Robert L. O'Connell suggests that human nature—not technology—is at the root of weapons development.[141] Covetous motives re-

quired early man to develop new ways to kill an opponent. Today's modern weapons are more lethal than the sticks and stones of ancient days, but their purpose is still to gain an advantage over an adversary.

O'Connell suggests that humans will constantly develop new weapons as long as their imagination discovers and exploits timeless and eternal scientific principles such as quantum mechanics and relativistic physics, which may give them an advantage in war.[142] Therefore, the very idea of weaponizing space becomes a driving force to do so, like the idea of splitting and fusing the atom made doing so inevitable. "Because so much of this is a function of the physical universe and the laws that govern it, the process is, in a very real sense, beyond our control."[143]

Formulating new and creative ideas for weapons may be inevitable, but man always has a choice whether to develop those weapons or not.[144] Dr. Colin S. Gray cautions that the feasibility of deploying weapons in space does not mean that such weapons are strategically required—or prudent.[145] However, we are also warned that once someone begins development, the "technological imperative becomes nearly absolute" and that "Once the initial conditions are set, however, the logic of technology becomes nearly irresistible, at times sweeping us toward destinations never contemplated or desired."[146] This suggests the choice to weaponize space may be beyond rational decision making. If this premise is correct, some actor may weaponize space as a poorly thought out reaction to some unforeseen security dilemma, or may already be on the slippery slope towards weaponizing space as it seeks to protect its space systems—the two conditions that Watts believes will likely lead to the weaponization of space. The momentum is not likely to stop over the long run.

There is another sort of risk that makes weaponizing space much more likely. Without a world system of checks and balances that can ensure nonproliferation of space-based weapons, spacefaring states have the option of developing space-based weapons in a covert manner. Doing so might prevent an adversary from getting the upper hand. At the same time, secrecy would mitigate the risk of triggering a security

dilemma and a subsequent arms race in space. An actor could place weapons on orbit claiming they were something else, or the actor could store the weapons on the ground in a launch-ready configuration. The later option simplifies the problem of maintaining secrecy and gives the opportunity to frequently inspect and upgrade the weapons. Unfortunately, this simple logic makes the secret development of weapons for space highly attractive—and much more likely.

It would be nice to assume that the notion of space-based weapons will just go away with the passage of time, but O'-Connell suggests that time is the enemy. To fall behind and allow an adversary to gain the advantage would be detrimental to any actor's vital interests. Weaponizing space without careful strategic thought is not the answer, and a space-weaponization strategy is certainly not a "panacea" or a "single-point solution."[147]

Sad though it is, war is part of the human condition. Wherever humans go, they bring their cultural baggage with them, and weapons are part of the baggage. The utility of space is increasing in all areas of human activity and discourse. This may be a pessimistic view, but "we know from history that every medium—air, land and sea—has seen conflict. Reality indicates that space will be no different."[148] The political and military pragmatist must assume that space weaponization is inevitable over the long term.

## Notes

1. Todd Halvorson, "Destination: International Space Station," *Space Views*, 30 October 2000, on-line, Internet, 4 March 2001, available from http://www.spaceviews.com/2000/10/30a.html.

2. Herbert F. York, *Making Weapons, Talking Peace: A Physicist's Odyssey from Hiroshima to Geneva* (New York: Basic Books, 1987), 160.

3. Maj Gen John L. Barry and Col Darrell L. Herriges, "Aerospace Integration, Not Separation," *Aerospace Power Journal,* Summer 2000, 42.

4. Ibid., 42–47.

5. Air Force Doctrine Document (AFDD) 2-2, *Space Operations*, 23 August 1998, 1.

6. The X-15 achieved an altitude of 67 miles on 13 September 1968, but this rocket-powered vehicle glided to this altitude after expending all of its rocket fuel at a much lower altitude.

7. The term *aerospace continuum* is used repeatedly by Hon. F. Whitten Peters and Gen Michael E. Ryan in *America's Air Force: Global Vigilance, Reach, and Power* (Washington, D.C.: Department of the Air Force, June 2000) and subsequently throughout Air Force publications.

8. To give an idea of how much energy is required to cross the transverse region, scientists calculate that 90 percent of the total energy required in accomplishing a mission to Mars is spent lifting the payload into a low Earth orbit.

9. Maj Gen Lance L. Smith, Air Force Doctrine Center, Maxwell Air Force Base (AFB), Alabama, interviewed by author, 9 March 2001.

10. Ibid.

11. Rich Garcia, "Lab Evaluates Satellites," United States Air Force News Release, 6 July 2000, n.p., on-line, Internet, 10 March 2001, available from http://www.sor.plk.af.mil/pa/releases/2000/00-50.html.

12. TSgt Ginger Schreitmueller, "Assistant Chief of Staff Talks About AEF Capabilities, Resources," *Air Force News*, 31 July 1998. A very close paraphrase of this quote is attributed to Gen John P. Jumper in a white paper by the Hon. F. Whitten Peters and Gen Michael E. Ryan, *The Aerospace Force: Defending America in the 21st Century* (Washington, D.C.: Department of the Air Force, 2000), 3. This suggests collaboration among the senior leaders of the Air Force to "stay on message" with the chief of staff's policy, or at least collusion between speechwriters.

13. Smith interview.

14. Actually, the terms *air operations center* and *space operations center* are passé. Both are now referred to as "aerospace operations centers." This is arguably more of a superficial change than a change of substance.

15. The National Command Authorities (NCA) frequently request specific space-derived intelligence products from the National Reconnaissance Office. In addition, the NCA also tasks DOD space assets directly to achieve political purpose, as was the case with the decision to terminate selective availability of the Global Positioning System in 2000.

16. Colin S. Gray, *Modern Strategy* (New York: Oxford University Press, 1999), 260–61.

17. Ibid., 263–64.

18. Ibid., 260.

19. Lt Col Michael R. Mantz, *The New Sword: A Theory of Space Combat Power* (Maxwell AFB, Ala.: Air University Press, May 1995), 79–80.

20. United Nations, "Assembly Urges Enrichment of United Nations 'Internet' Presence, Full Use of Emerging Information Technologies," United Nations Press Release GA/9677, 6 December 1999.

21. *Report of the Commission to Assess United States National Security Space Management and Organization* (hereinafter *Space Commission Report*) (Washington, D.C.: The [Space] Commission, 11 January 2001), 37.

22. Pericles Gasparini Alves, *Prevention of an Arms Race in Outer Space: A Guide to the Discussions in the Conference on Disarmament*,

UNDIR/91/79, Annex A (New York: United Nations Institute for Disarmament Research, 1991), 2.

23. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1984), 605. More precisely, Clausewitz stated that "war is simply a continuation of political intercourse, with the addition of other means."

24. James R. Killian Jr., *Sputnik, Scientists, and Eisenhower: A Memoir of the First Assistant to the President for Science and Technology* (Cambridge, Mass.: MIT Press, 1977), 68. Quoted in David N. Spires, *Beyond Horizons* (Washington, D.C.: Government Printing Office [GPO], 1997), 30.

25. Curtis Peebles, *High Frontier: The US Air Force and the Military Space Program* (Washington, D.C.: GPO, 1997), 3.

26. Ibid., 4.

27. Ibid., 4–5.

28. Col Delbert R. Terrill Jr., *The Air Force Role in Developing International Outer Space Law* (Maxwell AFB, Ala.: Air University Press, May 1999), 5.

29. Georgi P. Zhukov, "Space Espionage Plans and International Law," *International Affairs*, October 1960. Quoted in Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore, Md.: Johns Hopkins University Press, 1985), 259.

30. Cited in Peebles, 1.

31. The Outer Space Treaty of 1967, signed by 90 countries, including the United States and USSR, established the idea that space is for peaceful purposes only and that "passage through space . . . must be free from interference."

32. Reconnaissance satellites are typically placed in a sun-synchronous orbit, meaning the satellite is placed in a retrograde orbit relative to Earth's rotation and the satellite's south-to-north pass has a constant angle to the sun. In this type of orbit, satellites typically complete one revolution every 70 to 120 minutes and repeat the same ground track every few days.

33. James E. Oberg, *Space Power Theory* (Washington, D.C.: GPO, March 1999), 124.

34. "How Iridium Works," Iridium Satellite LLC, n.p., on-line, Internet, 8 April 2001, available from http://www.iridium.com/.

35. One might assume that a satellite in a geostationary orbit might see half of Earth's surface, like an astronaut viewing a full Earth rising from the surface of the moon. This would mean only two satellites would be required to provide global coverage. In reality, geostationary satellites have a line of sight limitation around the edges of the Earth sphere that accounts for the 10 percent reduced viewing area. Even when three satellites are employed in geostationary orbits, there is still a loss of coverage at the polar regions; but this can be compensated for by adding satellites in a Molnaya (highly elliptical) orbit that provides extended dwell time over those regions.

36. AFDD 2-2, *Space Operations*, 23 August 1998, 15–16.

37. AFDD 2-2 (draft), *Space Operations*, September 2000.

38. Arguably, the Germans took the initial steps into space with their V-2 rocket program, which accomplished its first successful flight into suborbital space on 3 October 1942.

39. Oberg, 131.

40. Ibid., 27.

41. "The People's Republic of China recently announced its intention to become the third nation to place human beings into orbits and return them safely to Earth." Cited in *Space Commission Report,* 10.

42. Peter L. Hays et al., eds., *Spacepower for a New Millennium: Space and US National Security* (New York: McGraw-Hill, 2000), 2.

43. Ibid.

44. Ibid.

45. Ibid., 2–3.

46. Ibid., 3.

47. *Space Commission Report,* 11.

48. Ibid., 10–12.

49. Vincent Orange, "Getting Together: Tedder, Coningham, and Americans in the Desert and Tunisia, 1940–43," in *Airpower and Ground Armies: Essays on the Evolution of Anglo–American Air Doctrine, 1940–1943,* ed. Daniel R. Mortensen (Maxwell AFB, Ala.: Air University Press, 1998), 25.

50. Daniel R. Mortensen, "The Legend of Laurence Kuter: Agent for Airpower Doctrine," in *Airpower and Ground Armies,* 93.

51. David R. Mets, "A Glider in the Propwash of the Royal Air Force? Gen Carl A. Spaatz, the RAF, and the Foundations of American Tactical Air Doctrine," in *Airpower and Ground Armies,* 50–56.

52. The airland command relationship at the time of Kasserine flowed from Field Manual 31-35, *Aviation in Support of Ground Forces,* adopted in April 1942. An outstanding summary of this failed command structure is found in Bernard C. Nalty's, *Winged Shield, Winged Sword: A History of the United States Air Force,* vol. 1, *1907–1950* (Washington, D.C.: Air Force History and Museums Program, 1997), 271–72.

53. Warren A. Trest, *Air Force Roles and Mission: A History* (Washington, D.C.: Air Force History and Museums Program, 1998), 91.

54. AFDD 1, *Air Force Basic Doctrine,* 1 September 1997, 23.

55. AFDD 2-2, 5.

56. Several recent documents assert the contrary point as part of the Air Force's aerospace integration initiative. See "The Aerospace Force: Defending America in the 21st Century—A White Paper on Aerospace Integration" (Washington, D.C.: Department of the Air Force, 2000), 3. Also see Maj Gen John L. Barry and Col Darrell L. Herriges, "Aerospace Integration, Not Separation," *Aerospace Power Journal,* Summer 2000, 42.

57. The Army, Navy, and Marines in all theaters need space support at least as much as the Air Force.

58. "Penny packets" is a term used by Arthur Coningham to describe the almost worthless value of airpower when divided amongst ground units in

"Development of Tactical Air Forces," *Journal of the Royal United Services Institution,* May 1946, 215.

59. Apparently, the joint chiefs have complained because a new series of spy satellites that form part of the Future Imagery Architecture cannot take collection commands from commanders in the field. To give field commanders this power would be a serious usurping of the centralized control principle. See Jeremy Singer, "Joint Chiefs Dissatisfied With New Series of Spy Satellites," *Space News,* 5 February 2001, 1.

60. AFDD 2-2 (draft), 7–8.

61. Lt Col Peter Hays and Dr. Karl Mueller, "Boldly Going—Where? Aerospace Integration, the Space Commission, and the Air Force's Vision for Space," *Aerospace Power Journal,* Spring 2001, 36–37.

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63. AFDD 2, *Organization and Employment of Aerospace Power,* 17 February 2000, 34.

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70. Maj Christopher J. Kinnan, "Coercive Spacepower: Enabling a 'Virtual Boots on the Ground' National Security Strategy for the 21st Century" (master's thesis, School of Advanced Airpower Studies [SAAS], Maxwell AFB, Ala., 15 November 2000), 2.

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80. Gen Richard B. Myers, "Space Superiority Is Fleeting," *Aviation Week and Space Technology*, 1 January 2000, on-line, Internet, 15 July 2000, available from http://www.peterson.af.mil/usspace/avweek-gen%20myers.htm.

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# Chapter 4

# A Spacepower Theory

*The Air Force has identified itself with the air weapon, and rooted itself in a commitment to technological superiority. The dark side of this commitment is that it becomes transformed into an end in itself when aircraft or systems, rather than missions, become the primary focus. . . . Even though the Air Force is the lead military agency for space, space systems will be competing for aircraft roles and missions, posing difficult tradeoffs in budgets and force structure. . . . [S]pace becomes a competing faction.*

—Carl H. Builder

## The Nature of Spacepower

The central question of this study is, "What is the nature of spacepower?" There is no single answer to this question. Instead, the 10 propositions regarding spacepower answer this question by revealing many of its characteristics. My findings are presented below.

### A Distinct Operational Medium

Space is physically very different from all earthly media. More important, orbital operations are constrained in very unique ways by the laws of physics. Their uniqueness creates a wall of misunderstanding between space professionals and others who do not understand orbital mechanics. These physical differences heavily determine operational methodologies and special planning considerations for space activities. Most important, space was diplomatically set aside as a separate medium during the Eisenhower administration. The international community now recognizes entirely different legal standards in space. Every American administration and the DOD have reaffirmed the US belief that space is a separate and distinct operational

medium. Only USAF officially views air and space as a seamless operational medium.

### Global Access and Global Presence

The fundamental reason for moving earthly capabilities to orbit is to exploit the global nature of spacepower. Access to denied areas was the initial reason for putting up a satellite in order to conduct reconnaissance. This is still a compelling reason. However, the ability to conduct various missions globally with just a few assets is extremely compelling not only to the military and civil sectors but especially to the commercial sector. In space vernacular, "global" means more than access to all locations on Earth's surface; it may also mean access to all locations on Earth's surface at the same time, as is the case with navigation and communications services.

### Total Space Activity

Space activities have pushed beyond their intelligence and defense roots as states developed civil and commercial sectors. Going to space is difficult, and a substantial infrastructure is required to generate a space program. Spacefaring is most likely among wealthy nations that have a solid educational system that stresses the sciences, abundant natural resources, a stable political environment, and a strong will to commit to a space program over the long term.

### Central Control

Spacepower is different from other forms of military power because its missions are global in scale. Because spacepower assets are global in nature, it would be wrong to manage them from a theater perspective as is the case with most terrestrial forces. Doing so would handicap spacepower in the same way airpower was handicapped at the outbreak of the Second World War when it was broken into penny packets under Army control. A space professional with a global mind-set must centrally control spacepower in order to balance scarce resources across theaters. At the same time, space professionals must take charge of the

battle for space control and not leave this responsibility to other commanders with different priorities and concerns.

### Coercive Force

The mere presence of spacepower assets, such as reconnaissance and surveillance satellites, has already influenced and will increasingly influence the activities of actors wishing to conceal certain activities. This flows from the deterrent potential of collection assets that have long been used as national technical means of treaty verification. It is quite likely that some actors are deterred from certain courses of action in the presence of spysats. Increasingly, spacepower assets are integrating into the sensor-to-shooter loop of active combat operations. This, plus the inevitable emergence of weapons on orbit, signals the expansion of spacepower's coercive force into the role of compellence as well as deterrence.

### Space Powers

The advent of commercial vendors selling military-related space products has created a new form of mercenary. The type of asymmetric advantage the superpowers once enjoyed because of their space prowess is quickly eroding because anyone who is able to pay the price can receive certain kinds of space support. Military and law enforcement planners must take into account the potential for any opponent to exploit these commercial services.

### A National Center of Gravity

More and more segments of society are turning to space-based assets for services. This makes the relatively few satellites on orbit very lucrative targets for an adversary who has the will and means to strike them. While access to satellites is seldom a single point of failure, losing access to the vital information collected and carried by them will increase the fog, friction, and cost of operations. In certain circumstances, this may turn the tide against spacefaring states such as the United States.

### Space Control

The increasing reliance on spacepower assets by governmental agencies and the intelligence, military, and business segments of society makes it essential to secure access to satellite services. At the same time, it is equally important to deny an adversary access to these space systems. Adversaries will likely compete for relative control of the space medium; a state must therefore take measures to secure its national interests in space.

### Space Professionals

Going to space is still hard. Despite more than 40 years of spacefaring experience, we still face numerous technical challenges. Moreover, space operations are so different from any form of terrestrial operations that highly specialized and recurring education, as well as careful career management, is required to develop space experts.

### Space Weaponization

Wherever mankind goes, weapons follow. There are some rock-solid reasons for not weaponizing space, but they fail to take into account the technological imperative that often drives human behavior in ways that are frequently beyond rational thought. When weapons will be placed in space is anybody's guess, but the political and military pragmatist must assume that someone will put weapons in space—and act accordingly.

## The Hypothesis Is Rejected

This study *rejects* the hypothesis that spacepower is merely a continuation or extension of airpower, as advocates of the aerospace integration school claim. An independent form of power, spacepower directly affects all other national instruments of power and increasingly affects the daily lives of ordinary humans. Because it forms a global informational infrastructure that the armed forces of advanced nations increasingly rely upon, spacepower's importance as a form of military power is growing. In the future, spacepower will likely

include counterspace weapons and systems designed to attack terrestrial targets.

Advocates of the aerospace integration school may fairly criticize this study as stacking the deck against their case simply because using the term *spacepower* concedes an independence from other types of power. The logic behind this criticism is just as valid now as it was at the court-martial of Billy Mitchell, who brazenly argued for something called "airpower."

Aerospace integrationists frequently argue that spacepower is not different from airpower because it delivers similar products to users, as if aircraft can do what spacecraft can do. This is simply not the case. Aircraft cannot survey more than 80 percent of Earth with three aircraft, and aircraft cannot freely pass over politically denied airspace as spacecraft can. A handful of satellites can provide persistent capabilities on a global scale. The GPS, for example, employs only 24 satellites in its nominal constellation; yet it is described as "the first global utility." Aircraft simply do not do the types of global-scale missions that spacecraft perform very efficiently. While it is true that some satellites perform photoreconnaissance missions similar to those performed by aircraft, reconnaissance aircraft loiter over theater-specific areas of interest while reconnaissance satellites transit the globe in a matter of minutes—taking photographs in virtually every theater along their route. Not only are air and space assets employed differently, but the fundamental differences between airpower and spacepower create unique mind-sets among operators. Airmen possess a theater-level perspective whereas space professionals possess a global mind-set.

The aviation community has repeatedly attempted to make an aircraft that can do what a spacecraft can do. There have been many attempts to produce a space plane, but none have become operational—in part because of technical problems, but mostly because no one could ever explain why an enormous sum of money should be spent to make an aircraft do what a satellite can do other than serve as a reusable spacelift and recovery vehicle. Currently there are arguments that America needs a combat-capable space plane in order to deliver ordnance more rapidly than aircraft—and to do so without

requiring forward bases in a combat zone. These are compelling ends, but justifying the means will likely be as difficult today as it was at the height of the Cold War.

## Lessons Learned

The highly politicized nature of space doctrine stems from its clandestine roots in the spy versus spy era of the Cold War.[1] There is undeniable tension between those who believe a state's power interests are best served by preserving space as a peaceful sanctuary and those who believe a state's power interests demand the rapid development and fielding of weapons in space.

### Military Space Doctrine Is Highly Controversial

The recent international debate regarding space weaponization as part of President Bush's missile defense program indicates the global sensitivity to military-related space strategies. This indicates that space weaponization will bring about security dilemmas quite unlike the introduction of new weapons into the traditional media of air, land, and sea.

### Decision Making Is Fragmented and Bureaucratic

While spacepower policy ultimately rests with the president, there is no single advocate for spacepower. USCINCSPACE shares his authority with numerous agencies—each having a say in space strategy—and the military space program is a house divided since many voices are advocating different desires. The Space Commission recommended realignment of the many agencies in the military space community to help consolidate authority into a smaller group of decision makers.

### The Air Force Is Out of Step

The aerospace integration effort is at odds with national and DOD policies that identify space as a separate medium coequal with air, land, and sea. Despite more than 40 years of pushing the term *aerospace*, nobody is using it—at least not outside the Air Force where the issue of space being a separate medium is already settled. This hurts the credibility of

airmen who advocate for spacepower and does spacepower a grave disservice since these advocates typically lack any degree of space expertise. The Carl Builder quote that begins this chapter is partly correct—the Air Force is thrashing within itself over a budgetary and philosophical rivalry concerning the nation's spacepower. On a programmatic level, space and air systems do compete for the limited resources in the Air Force's budget; and space systems do not always fare well in this competition. On a doctrinal level, however, Builder is wrong to assume that airpower and spacepower compete with each other for roles and missions. This is simply not the case. Airpower continues to provide theater-focused forces; spacepower provides globally focused forces. The two complement each other as joint partners with land and sea forces.

## American Grand Strategy Hinges on Space Superiority

The successful integration of space forces with terrestrial activities makes all of our instruments of power increasingly reliant on space support. Without space control capabilities to defend friendly access to space while denying the same to an adversary, we rest our case on hope. The Space Commission recommends in unambiguous language that the United States develop and field space control capabilities to safeguard national interests.

## The Space Commission May Be the Deus Ex Machina

One of the basic findings of the Space Commission is that "The US Government—in particular, the Department of Defense and the Intelligence Community—is not yet arranged or focused to meet the national security space needs of the twenty-first century."[2] In one sense, the commissioners concluded that the military space community is broken. The Space Commission made several recommendations that may fix the deficiencies they identified. While it did not specifically address the Air Force's aerospace integration policy (in fact, the term was conspicuously absent), it does recommend moving space experts into leadership positions within the space community from which they will advocate for spacepower. The

reform-minded nature of the Bush administration makes such reforms likely, especially since the chairman of the Space Commission is now serving as the secretary of defense. The specific findings and recommendations of the Space Commission appear in appendix E of this study.

## The Theory

The introduction of this study posited that the 10 propositions regarding spacepower might serve as a foundation to assist in the creation of a spacepower theory. Such a theory would serve political and military practitioners by providing a framework to assess spacepower issues and guide their related decision making. Presented here is an attempt to synthesize the 10 propositions and lessons learned during this study into the rough sketch of a spacepower theory.

### Spacepower, Statecraft, and Warfare

Any theory of spacepower must be firmly rooted in broader theories of statecraft and warfare. Instead of rehashing what the time-honored masters have already done so brilliantly, suffice it to say here that students of spacepower should read Sun Tzu's *The Art of War*.[3] This book crisply describes the nature of statecraft and its nexus with warfare in a world where states are in constant competition with one another. Next, they should read Carl von Clausewitz's *On War*.[4] This book, although difficult to read and easy to misinterpret, captures the central premise of war: "War is nothing but the continuation of policy with other means . . . the political object is the goal, war is the means of reaching it, and the means can never be considered in isolation from their purpose."[5] With these intellectual underpinnings, and an appreciation of the propositions regarding spacepower, students of spacepower are ready for a theoretical discussion.

### Military Spacepower

The purpose of military spacepower is to provide global capabilities to assist in achieving political and military objectives.

It is an independent form of power that can be used alone or in concert with other forms of power to achieve desired ends. Space is a place where humans put systems in place to help them resolve problems. It begins above Earth's surface at the lowest altitude where a satellite can sustain a circular orbit (approximately 93 miles) and extends outward to infinity. Eventually, humanity may extend its interests beyond near-Earth space. Military spacepower will likely protect those interests. Someday, far into the future, populations and their political entities may migrate into space as well. For now, however, humans live on the surface of Earth; and contemporary spacepower in this context refers to the struggles occurring there—but this will evolve over time.

## Near-Earth Space

The reason for going to near-Earth space is to gain access to regions of Earth where terrestrial forces either cannot go or cannot loiter as economically as some satellites. A relatively small number of similar satellites spread out in orbital space can survey the entire Earth's surface, which gives space-based constellations the ability to perform missions on a global scale. In the opening years of the twenty-first century, space missions are primarily informational; for example, providing command and control, communications, and computer support ($C^4$), as well as ISR support, to terrestrial forces. Air, land, and sea forces also perform missions like these; but only space systems (and some terrestrial communications networks) perform them continuously on a global scale. These space networks create a global informational infrastructure that links together expeditionary forces deployed anywhere in the world and connects these forces with their homeland leadership.

Terrestrial forces are predominantly concerned with performing these missions inside relatively small theaters of operation. In the future, humans will not only employ space-based weapons to gain control of space, they will also employ them against targets on the surface of Earth, at sea, and in the air. With sustained national commitment to technological advancement and investments of time, talent, and treasure,

space will continue to provide an excellent vantage point from which to observe, support, and influence human events. Space systems will require a vigorous defense, however.

## Space Control

The first and most enduring mission of space forces is to gain relative space control over adversaries when hostilities occur. This means providing continuous situational awareness about what is happening in space and ensuring friendly access to space while denying the same to any adversary. Space control has both defensive and offensive components.

Defensive space control efforts must ensure that friendly forces and their political leaders can continue to exploit space. Space control is necessary to support theater operations where combat operations are under way and to continue observing activities in all other theaters to assess other potential threats requiring diplomatic or military intervention. Space control will also enable a state to sustain such services from space as communications and GPS data, upon which users in all theaters are increasingly reliant. At the same time, commercial assets in space require some degree of defensive protection. Ideally, all satellites should be hardened from attack; commercial investors, however, are reluctant to spend the money to protect their satellites. This places a burden on defense planners to provide some protection to commercial systems that are important to the business interests of domestic and allied economies.

An adversary's counterspace weapons may be able to destroy space systems very rapidly. It is therefore imperative to acquire the ability to find, fix, track, target, and destroy an adversary's counterspace weapons very quickly. Such systems may reside on land, at sea, in the air, or in space. It is equally imperative to repair or replace lost satellite services on orbit. The goal is to rapidly restore space support before it affects political and combat operations. Activating on-orbit spares, leasing commercial satellite services, launching new satellites to replace those lost through attrition, or gaining access to an ally's satellite services may accomplish this. It is also essential to acquire the ability to repair or replace lost satellite ground

control systems. Methods for doing this may include transferring ground control responsibility to another location (fixed or mobile), leasing commercial support, or obtaining ground support from an allied state.

On the offensive side, space control does not have to be total in order to be effective. For example, the enemy may have satellites that do not especially affect his war-fighting ability or influence the outcome of a conflict. The situation and the strategy will dictate the degree of offensive space control that is required. Factors to consider will be the time and place where space control must be gained, how rapidly it is needed, the number of satellites or ground control targets requiring negation, how long space control must be sustained, and the desired level of negation (destruction, degradation, denial, disruption).

It is important to remember that an adversary's satellites are global assets. It may be politically untenable to permanently damage an adversary's satellite for a number of reasons. For example, while an imagery satellite may threaten to disclose friendly troop movements in one region, that same satellite might perform treaty verification on the opposite side of the globe or perform other missions on behalf of a friendly interest. In many scenarios, offensive space control might best be limited to very localized and temporary effects.

One way to deny an adversary's access to space is to destroy his space launch facilities. We must also be aware, however, that the adversary may contract his space lift with other countries where he may have satellites in storage. Therefore, the best way to deny space support to an adversary is to directly negate the satellites he uses. While some satellite systems may be particularly susceptible to the destruction of their ground stations, other satellite systems may degrade gracefully in the absence of ground control. An adversary may employ mobile ground stations for tactically important space systems that require frequent ground control. This not only makes targeting ground stations more difficult—it highlights the need to negate an adversary's satellites on orbit. It is also possible to attack the users of space support by jamming or spoofing their receivers. This tactic has the benefit of localized and temporary

effects. In many scenarios, it is likely that a combination of attacks on all three segments of a space system (ground stations, satellites on orbit, and user equipment), as well as on their linkages, will be required to achieve the desired effect.

Space control efforts will be complicated if an adversary is using launch facilities, satellites, or ground control systems provided by commercial vendors, international consortia, or an ally. Diplomatic efforts will likely be required to eliminate third-party support to adversaries, but friendly forces must be ready to expand the conflict by striking wherever adversaries receive space support. If diplomatic efforts fail and policy does not allow expansion of the conflict to strike third-party targets, then the adversary has a sanctuary he will likely exploit.

## Situational Awareness

Situational awareness has always been critical in diplomacy and warfare, but in the new era of precision targeting, situational awareness must be equally precise—a bomb is only as accurate as the coordinates used by the planner, the war fighter, and the munition itself. Precision targeting is well understood; but the need for precision intelligence, surveillance, and reconnaissance is not.

Multitudes of ISR sensors in all media characterize the modern battle space. Some collect signal intelligence while others collect photoreconnaissance data. Still others collect radar information. These sensors and their operators not only attempt to identify targets, they also try to determine each target's precise coordinates. The ability of different sensors to determine the precise coordinates of targets varies, but airborne sensors are better at this than space-based sensors. Space systems are typically much farther away from the targets than aircraft, and satellites in the lowest orbits have relatively shorter dwell times on targets than aircraft have. Satellites in higher orbits are much more distant and are generally less able to precisely refine target coordinates. Also, satellite sensors degrade over time and no effort is being made to keep them in prime condition. Finally, given the relatively few ISR satellites in low earth orbit, continuous coverage from space is currently impossible. In sum, aircraft have several distinct advantages over spacecraft

in regards to *theater* ISR collection, but space-derived ISR data is critical to operations.

Space-derived ISR data is critical to diplomatic and military operations because it provides a "first look" at the battle space and assists planners in finding and coarsely locating many targets before terrestrial forces move into the region. As a rule of thumb, today's space-derived ISR is useful in finding 80 percent of the targets and is able to determine their location to roughly 80 percent of the accuracy required for precision strikes. In some cases, space systems do better than 80 percent in finding and fixing targets; in other cases, they do worse. What is important is the tremendous advantage space systems provide politicians and commanders by giving them a first look into the situation they face. With this information, they are able to make decisions about how best to employ their limited terrestrial ISR assets (aircraft, ships, submarines, reconnaissance ground forces) more efficiently. The first look from space may suffice in some cases, but terrestrial ISR assets are usually required. During combat operations, space-based ISR sensors continue to provide data, filling gaps in theater coverage. Space-based ISR sensors also frequently cue terrestrially based sensors, as was the case during the Gulf War when missile warning satellites cued Patriot batteries to intercept Iraq's inbound Scud missiles.

Perhaps most important of all, day in and day out, during war and during peace, spacepower provides an 80 percent first look on a *global* scale. It allows analysts to watch the world and report factors that give political and military leaders the freedom to employ their terrestrial forces more expeditiously and with greater confidence. Spacepower literally watches the backs of terrestrial forces to make sure no threat is sneaking up behind them. Thus, commanders can allow greater concentration of terrestrial forces in theaters of combat operations because space-based ISR assets are sufficient to act as a kind of global sentry. Space systems have unimpeded access around the globe, and relatively few assets are required to sustain ISR missions on a global scale.

Much more is possible. By increasing the number of low earth orbiting sensors, continuously improving sensor quality,

and developing the means to service and repair them, the 80 percent rule of thumb will creep closer toward the 100 percent solution. As space systems become more capable, is it likely that they will replace terrestrial forms of ISR collection? No! Aerial reconnaissance did not eliminate the need for land and sea forces to conduct reconnaissance of their own. There is no reason to believe that space-based reconnaissance will replace any other form of reconnaissance.

## Spacepower and Other Forces

Spacepower does not usurp missions from other forces. Spacepower assets give new capabilities to a military power for its order of battle. The ability to provide continuous coverage on a global scale is a new contribution to warfare. The various $C^4$ISR capabilities—including weather observation, missile warning, and navigation and timing broadcasts—give American forces a distinct informational advantage over adversaries in the opening days of the twenty-first century. This advantage will evaporate over time as other actors on the world stage develop, lease, or borrow similar capabilities.

Despite having to share much of their budget with USAF, American space forces do not compete with terrestrial forces for roles and missions. Airpower, land power, sea power, and spacepower bring different capabilities to modern warfare. The United States trains its military members in highly specialized ways, the objective being to dominate operations within their respective media. Operations in each medium require centralized control by practitioners of that form of power, in close coordination with their sister services, to ensure optimum management of resources.

A great fallacy resulting from the aerospace integration mind-set is the oft-cited statement that “airpower missions will migrate to space when it becomes reasonable to do so.” This presumes that theater commanders are willing to trade highly flexible organic airpower assets for less flexible (and often less capable) space systems that another commander would likely manage as global assets. Economic considerations may force such a compromise; but a more prudent approach is to develop robust spacepower capabilities in addition to

airpower, land power, and sea power assets. Remember, the difference between space systems and terrestrial systems is that space systems provide global access and global presence during both war and peace. Terrestrial systems should be developed as theater assets to fill gaps in space coverage and provide more flexible and precise ISR data and strike capabilities.

When space forces eventually obtain systems that can create physical effects (conventional bombs or other weapons) at any location on the surface of Earth, they will not replace the aircraft that can do the same thing. Space operations are expensive, and economic considerations alone will likely require air delivery of many munitions. Exceptions include times when cost is not a consideration, such as combat in areas where aircraft are denied access, when aircraft cannot respond to a time-critical situation as quickly as spacecraft, when only a specialized weapon delivered from space will have the desired probability of killing a target, or when surprise is of the utmost importance.

Some overlap exists between the capabilities of spacepower and other forms of power, but this is a strength rather than a waste. Just as bombers, submarines, and missiles during the Cold War prevented an adversary from gaining a significant advantage should they successfully counter one leg of the triad, today's redundancy prevents an adversary from gaining a significant advantage should they successfully counter space-based systems or terrestrial forces. There will be some adjustments in force structures as space capabilities become more robust, but *no* mission in *any* service should *ever* move *entirely* to space. Under *no* circumstances should *all* of the eggs *ever* be placed in the space basket. Instead, there should be an integrated combined-arms approach.

## Combined Arms

During times of peace, spacepower assets monitor the globe, helping to identify and characterize potential threats. When a threat emerges, political and military leaders may opt to send terrestrially based ISR sensors into the area of interest to get a closer look. Should hostilities break out, space forces will

gain the degree of space control required and will help friendly forces in terms of ISR and strike capabilities. They still must watch the rest of the world, in every other theater, looking for tip-offs, warnings, and indications of other threats.

Force application from space will take many different forms; but it seems likely that space-based weapons will fill specific niches, ideal for a handful of missions during certain phases of operations. No claim is made that spacepower by itself can be decisive in conventional warfare, but it may help set the conditions for victory by friendly forces in certain circumstances. Conversely, if spacepower forces are defeated, this may turn the tide of the war against friendly forces and contribute to defeat. There may be certain forms of limited warfare wherein information gleaned from space or strikes delivered from space may achieve the political and military aims of an operation. If this defines decision in the battle space, then so be it.

## Unfinished Business

This study identified and argued the case for 10 propositions regarding spacepower. Doing so revealed that air and space—indeed, airpower and spacepower—are different. With a greater understanding of the nature of spacepower, it became possible to construct a spacepower theory. The theory presented above supports the timeless principles of statecraft and warfare, but it is also complementary to—not competitive with—other forms of power. We are left with the unfinished business of building spacepower that matches the vision laid out in this theory.

It is beyond the scope of this study to recommend who should build spacepower for the nation. There are many possibilities. Should it be the Air Force? Should it be a space corps within the Air Force filled with dedicated space professionals whose primary focus is spacepower? Should it be a joint effort under a unified command? Should it be the responsibility of an independent space force? The nation should address these questions in light of the 10 propositions presented here. Readers of this study should be better able to

develop an informed opinion and make decisions concerning spacepower accordingly.

## Notes

1. It is interesting to speculate how spacepower might have evolved if it came of age during a total war such as World War I or II. If the airpower analogy applies, then it is probably safe to presume that space would now be fully weaponized and the global military power structure might be radically different.

2. *Report of the Commission to Assess United States National Security Space Management and Organization* (Washington, D.C.: 11 January 2001), ix.

3. Sun Tzu, *The Art of War*, trans. Ralph D. Sawyer (Boulder, Colo.: Westview Press, 1994).

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

5. Ibid., 69, 87.

Appendix A

# Oberg's 12 Truths and Beliefs about Spacepower

James E. Oberg completed *Space Power Theory* from a draft by Dr. Brian R. Sullivan. Oberg worked for a NASA contractor at the Johnson Space Center as a space engineer from 1975 to 1997. He is the author of several space-related books and articles. He is also a consultant to news organizations, commercial corporations, the US military, and the Congress on space-related subjects.[1]

Gen Howell M. Estes III, who served as USCINCSPACE from 1996 to 1998, commissioned the book. General Estes wanted a book that would stimulate debate on spacepower in the same way the works of Douhet, Trenchard, and Mitchell did for airpower.[2] The book touches a wide range of topics, including the importance of spacepower, legal issues, the nature of the space environment, orbitology, current and future capabilities, and organizational issues.

Oberg's 12 "Truths and Beliefs" about spacepower are listed below.[3]

1. The primary attribute of current space systems lies in their extensive view of the Earth.
2. A corollary to this attribute is that a space vehicle is in sight of vast areas of the Earth's surface.
3. Space exists as a distinct medium.
4. Spacepower, alone, is insufficient to control the outcome of terrestrial conflict or ensure the attainment of terrestrial political objectives.
5. Spacepower has developed, for the most part, without human presence in space, making it unique among other forms of national power.
6. Technology competence is required to become a space power, and conversely, technological benefits are derived from being a space power.

7. As with Earthbound media, the weaponization of space is inevitable, though the manner and timing are not at all predictable.
8. At some time in the future, the physical presence of humans in space will be necessary to provide greater situational awareness.
9. Situational awareness in space is a key to successful application of spacepower.
10. Control of space is the linchpin upon which a nation's spacepower depends.
11. Scientific research and exploration pays off.
12. There will be wild cards.

## Notes

1. James E. Oberg, *Space Power Theory* (Washington, D.C.: Government Printing Office, March 1999), back cover.
2. Ibid., vi.
3. Ibid., 124–31.

## Appendix B

# Gray's Eight "Clausewitzian" Ideas about Spacepower

In *Modern Strategy*, author Colin S. Gray promotes his central thesis that "there is a unity to all strategic experience: nothing essential changes in the nature and function (or purpose)—in sharp contrast to the character—of strategy and war."[1] Formerly a professor of international politics and director of the Centre for Security Studies at the University of Hull, now at Reading College in the United Kingdom, Gray has researched and published numerous books and articles on strategy. His recent interest lies in the impact of evolving technology upon modern warfare. In particular, he has spent much effort contemplating the role of spacepower and the need for a theory upon which to base the particular aspects of spacepower strategy. Particulars aside, he contends that the roots of all strategy can be found in the logic laid down by Clausewitz in *On War*. Gray believes the logical underpinnings for spacepower theory must have their roots planted firmly in the Clausewitzian tradition.

Here are Gray's "Clausewitzian ideas" about spacepower:[2]

1. War has a grammar, but not a policy logic, of its own.[3] War in space has its own distinctive characteristics that policy must know and respect, but such war has meaning only for the purposes of policy.
2. Countries have "centres of gravity" that are key to their functioning.[4] A country's or coalition's ability to wage war successfully can be negated if those centres of gravity are menaced, damaged, or taken. Space forces can greatly enhance the ability of other kinds of military power to locate, threaten, harass, and destroy such centres.
3. War is the realm of chance, uncertainty, and friction; the fog of war blinds the commander.[5] Spacepower assaults

some of the friction that impairs terrestrial military performance, but is itself subject to the workings of friction.

4. War is a unity.[6] Spacepower is an essential team player, probably due to become the team player who adds the greatest value for lethality in combat in the twenty-first century.
5. Policy makers and military commanders need to understand what the military instrument can accomplish under particular conditions.[7] The emergence of spacepower adds to the burden of comprehension by military professionals and civilian laypersons alike.
6. As the Just War tradition maintains, there needs to be a unity of character and intensity of political purpose with the scale and kinds of military means: the principle of proportionality.[8] Contemplation of the military implications of a maturing spacepower has to accommodate appreciation of the value to policy of an unprecedentedly discriminative military instrument, without being captured by techno-military fantasies.
7. Success in battle flows from the achievement of overwhelming strength at the "decisive point."[9] This maxim is as sound for space operations as it is for other kinds of military activity.
8. Defence is the stronger form of waging war (on land).[10] In space, defence is probably the stronger form of waging war in high- and medium-Earth orbit (HEO and MEO), but probably not in low-Earth orbit (LEO). There is some safety in sheer distance (equal to time, provided speed-of-light directed-energy weapons are not relevant).[11]

With its Clausewitzian roots framed, Gray argues that the elements of spacepower theory can be assembled in piecemeal fashion from theories of airpower and seapower because the logic of warfare in one medium applies to warfare in all other media.[12] His list of Clausewitzian ideas implies that space is a distinct medium and potentially a center of gravity. The employment of space assets therefore requires special policy and military considerations in order to exploit it properly—just like the other media.

## Notes

1. Colin S. Gray, *Modern Strategy* (Oxford, U.K.: Oxford University Press, 1999), 256–57.

2. Ibid., ix.

3. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1984), 605.

4. Ibid., 595–97.

5. Ibid., 119–21.

6. Ibid., 607.

7. Ibid.

8. Ibid., 88, 579.

9. Ibid., 204.

10. Ibid., 359.

11. Note that "HEO" is typically used in America as an acronym for "Highly Elliptical Orbit." Gray, however, is British and uses the acronym "HEO" to mean "High Earth Orbit." HEO, in the sense used by Gray, is an orbit that extends beyond 35,000 km in altitude; MEO extends from 800 to 35,000 km; LEO extends from 150 to 800 km.

12. Gray, 257.

## Appendix C

# Gray's Seven Most Vital Assumptions about Spacepower

Having established the Clausewitzian roots as the framework for a spacepower theory, Gray points out that air, land, sea, and space have much in common. This must be so if he is to prove his thesis that there is unity to all strategic experience.

Here are Gray's seven most vital assumptions about spacepower:[1]

1. In all strategic essentials, spacepower is akin to landpower, seapower, and airpower.
2. The strategic history of spacepower is likely to follow the pattern already traced by seapower and airpower.
3. Geographically, space is distinctive, but then so is the land, the sea, the air, and even cyberspace.
4. People have only one natural environment: the land. To function in any other geography, they require technological support. The vacuum of space admittedly is exceptionally hostile to human life, but it does not differ basically in character from sea and air. These three geographies can accommodate humans only when machines provide their life support systems.
5. Because people live only on the land and belong to security communities organized politically within territorial domains, military behaviour, no matter what its tactical form, ultimately can have strategic meaning only for the course of events on land. It follows that seapower, airpower, and spacepower function strategically as enabling factors. The outcome of a war may be decided by action at sea, in the air, or in space, but the war must be concluded on land—and usually with reference to the land.
6. The logic of strategy is geographically universal and temporally eternal. Different strategic cultures may "do it their way," but only if that way is consistent with the

laws of physics, inter alia. (Willpower is only hot air, if the engineering is unsound.)

7. The unique geography of space must find expression in unique technology, operations, and tactics. That unique geography does not point the way to some unique logic of strategy, however, let alone a unique irrelevance of strategy.

## Notes

1. Colin S. Gray, *Modern Strategy* (Oxford, U.K.: Oxford University Press, 1999), 258–59.

Appendix D

# Mantz's 10 Axioms of Space Combat Power

In May 1995, Lt Col Michael R. Mantz published an Airpower Research Institute-sponsored research report titled *The New Sword: A Theory of Space Combat Power*. The purpose of the report was to present an "unconstrained and comprehensive" theory of space combat power.[1] The report is essentially an elaborate "think piece" that draws on Mantz's extensive academic and practical experience. He graduated from the US Air Force Academy in 1976 with a Bachelor of Science degree in electrical engineering. Mantz completed his Master of Science degree in aeronautics and astronautics from the Massachusetts Institute of Technology in 1981 before his selection and subsequent training as a space shuttle payload specialist (astronaut) in 1982.

In an appendix, Mantz included what he called "Axioms of Space Combat Power," a list of 10 statements that are very similar to propositions. He included them because "any theory uses axioms as building blocks."[2] He dealt primarily with the concept of space combat, not spacepower as a whole.

Here is Mantz's list of axioms:

1. Space strike systems can be employed decisively by striking Earth forces, both independently and jointly.
2. Space strike systems can be employed decisively in war when the enemy's essential means for waging war (industry, transportation, and communications) are vulnerable to attack from space.
3. Space strike systems can be employed decisively by striking at the decision-making structure (leadership and command and control) of the enemy.
4. Space strike systems can deter hostile actions by holding forces, decision makers (leadership and command and control), and infrastructure (industry, transportation, and communications) at risk.

5. Space denial systems can be employed decisively by denying enemy access to space-derived data.
6. Space denial systems can be employed decisively by physically denying enemy access to space.
7. Space protection systems can be employed to assure friendly access and use of space.
8. Total space control (the combination of space denial, space protection, and passive space defense measures) is neither achievable nor necessary.
9. Space combat power must be centrally and independently controlled.
10. Spacepower is not intrinsically linked to airpower.[3]

Mantz goes on to provide an excellent discussion that links his axioms to his theory of space combat. It is important to note that Mantz sees space as a distinct medium of operations and believes spacepower has an independent mission, separate from its role of supporting or augmenting surface forces. Interestingly, he also believes that total space control is neither achievable nor necessary.

Mantz remains on active duty in the US Air Force and continues to serve as a space professional.

## Notes

1. Lt Col Michael R. Mantz, *The New Sword: A Theory of Space Combat Power* (Maxwell Air Force Base, Ala: Air University Press, May 1995), xi.
2. Ibid., 74.
3. Ibid.

Appendix E

# Findings and Recommendations of the Commission to Assess United States National Security Space Management and Organization (Space Commission Report)

The Commission has unanimously concluded that organizational and management changes are needed for the following reasons.

First, the present extent of U.S. dependence on space, the rapid pace at which this dependence is increasing and the vulnerabilities it creates, all demand that U.S. national security space interests be recognized as a top national security priority. The only way they will receive this priority is through specific guidance and direction from the very highest government levels. Only the President has the authority, first, to set forth the national space policy, and then to provide the guidance and direction to Senior officials, that together are needed to ensure that the United States remains the world's leading space-faring nation. Only Presidential leadership can ensure the cooperation needed from all space sectors—commercial, civil, defense and intelligence.

Second, the U.S. Government—in particular, the Department of Defense and the Intelligence Community—is not yet arranged or focused to meet the national security space needs of the 21st century. Our growing dependence on space, our vulnerabilities in space and the burgeoning opportunities from space are simply not reflected in the present institutional arrangements. After examining a variety of organizational approaches, the Commission concluded that a number of disparate space activities should promptly be merged, chains of command adjusted, lines of communication opened and policies modified to

achieve greater responsibility and accountability. Only then can the necessary trade-offs be made, the appropriate priorities be established and the opportunities for improving U.S. military and intelligence capabilities be realized. Only with senior-level leadership, when properly managed and with the right priorities will U.S. space programs both deserve and attract the funding that is required.

Third, U.S. national security space programs are vital to peace and stability, and the two officials primarily responsible and accountable for those programs are the Secretary of Defense and the Director of Central Intelligence. Their relationship is critical to the development and deployment of the space capabilities needed to support the President in war, in crisis and also in peace. They must work closely and effectively together, in partnership, both to set and maintain the course for national security space programs and to resolve the differences that arise between their respective bureaucracies. Only if they do so will the armed forces, the Intelligence Community and the National Command Authorities have the information they need to pursue our deterrence and defense objectives successfully in this complex, changing and still dangerous world.

Fourth, we know from history that every medium—air, land and sea—has seen conflict. Reality indicates that space will be no different. Given this virtual certainty, the U.S. must develop the means both to deter and to defend against hostile acts in and from space. This will require superior space capabilities. Thus far, the broad outline of U.S. national space policy is sound, but the U.S. has not yet taken the steps necessary to develop the needed capabilities and to maintain and ensure continuing superiority.

Finally, investment in science and technology resources—not just facilities, but people—is essential if the U.S. is to remain the world's leading space-faring nation. The U.S. Government needs to play an active,

deliberate role in expanding and deepening the pool of military and civilian talent in science, engineering and systems operations that the nation will need. The government also needs to sustain its investment in enabling and breakthrough technologies in order to maintain its leadership in space.[1]

Following are the Commission's unanimous recommendations.

1. Presidential Leadership

*The United States has a vital national interest in space. National security space should be high among the nation's priorities. It deserves the attention of the national leadership, from the President down.*

*The President should consider establishing space as national security priority.*

2. Presidential Space Advisory Group

*The President might find it useful to have access to high-level advice in developing a long-term strategy for sustaining the nation's role as the leading space-faring nation.*

*The President should consider the appointment of a Presidential Space Advisory Group to provide independent advice on developing and employing new space capabilities.*

3. Senior Interagency Group for Space

*The current interagency process is inadequate to address the number, range and complexity of today's space issues, which are expected to increase over time. A standing interagency coordination process is needed to focus on policy formulation and coordination of space activities pertinent to national security and to assure that representation in domestic and international affairs effectively reflects U.S. national security and other space interests.*

*The President should direct that a Senior Interagency Group for Space be established and staffed within the National Security Council structure.*

### 4. SecDef/DCI Relationship

*The issues relating to space between the Department of Defense and the Intelligence Community are sufficiently numerous and complex that their successful resolution and implementation require a close, continuing and effective relationship between the Secretary of Defense and the Director of Central Intelligence.*

*The Secretary of Defense and the Director of Central Intelligence should meet regularly to address national security space policy, objectives and issues.*

### 5. Under Secretary of Defense for Space, Intelligence and Information

*Until space organizations have more fully evolved, the Office of the Secretary of Defense would benefit from having a senior-level official with sufficient standing to serve as the advocate for space within the Department. The Secretary of Defense would assign this official responsibility to oversee the Department's research and development, acquisition, launch and operation of its space, intelligence and information assets; coordinate the military intelligence activities within the Department; and work with the Intelligence Community on long-range intelligence requirements for national security.*

*An Under Secretary of Defense for Space, Intelligence and Information should be established.*

### 6. Commander in Chief of U.S. Space Command and NORAD and Commander, Air Force Space Command

*The Commander in Chief, U.S. Space Command should continue to concentrate on space as it relates to warfare in the mediums of air, land and sea, as well as space. His primary role is to conduct space operations and provide space-related services, to include computer network defense/attack missions in support of the operations of the other CINCs, and national missile defense. This broad and varied set of responsibilities as CINCSPACE will leave less time for his other assigned duties.*

*The Secretary of the Air Force should assign responsibility for the command of Air Force Space*

*Command to a four-star officer other than CINCSPACE/CINCNORAD.*

*The Secretary of Defense should end the practice of assigning only Air Force flight-rated officers to the position of CINCSPACE and CINCNORAD to ensure that an officer from any Service with an understanding of combat and space could be assigned to this position.*

7. Military Services

*The Department of Defense requires space systems that can be employed in independent operations or in support of air, land and sea forces to deter and defend against hostile actions directed at the interests of the United States. In the mid term a Space Corps within the Air Force may be appropriate to meet this requirement; in the longer term it may be met by a military department for space. In the nearer term, a realigned, rechartered Air Force is best suited to organize, train and equip space forces.*

*The Air Force should realign headquarters and field commands to more effectively organize, train and equip for prompt and sustained space operations. Assign Air Force Space Command (AFSPC) responsibility for providing the resources to execute space research, development, acquisition and operations, under the command of a four-star general. The Army and Navy would still establish requirements and develop and deploy space systems unique to each Service.*

*Amend Title 10 U.S.C. to assign the Air Force responsibility to organize, train and equip for prompt and sustained offensive and defensive air and space operations. In addition, the Secretary of Defense should designate the Air Force as Executive Agent for Space within the Department of Defense.*

8. Aligning Air Force and NRO Space Programs

*The Department of Defense and the Intelligence Community would benefit from the appointment of a single official within the Air Force with authority for the acquisition of space systems for the Air Force and the NRO based on the "best practices" of each organization.*

*Assign the Under Secretary of the Air Force as the Director of the National Reconnaissance Office. Designate the Under Secretary as the Air Force Acquisition Executive for Space.*

9. Innovative Research and Development

*The Intelligence Community has a need for revolutionary methods, including but not limited to space systems, for collecting intelligence.*

*The Secretary of Defense and the Director of Central Intelligence should direct the creation of a research, development and demonstration organization to focus on this requirement.*

*Competitive centers of innovation that actively pursue space-related research, development and demonstration programs are desirable.*

*The Secretary of Defense should direct the Defense Advanced Research Projects Agency and the Services' laboratories to undertake development and demonstration of innovative space technologies and systems for dedicated military missions.*

10. Budgeting for Space

*Better visibility into the level and distribution of fiscal and personnel resources would improve management and oversight of space programs.*

*The Secretary of Defense should establish a Major Force Program for Space.*

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The Commission believes that its recommendations, taken as a whole, will enable the U.S. to sustain its position as the world's leading space-faring nation. Presidential leadership

and guidance, coupled with a more effective interagency process and especially with improved coordination between the Department of Defense and the Intelligence Community, are essential if the nation is to promote and protect its interests in space.[2]

## Notes

1. *Report of the Commission to Assess United States National Security Space Management and Organization* (Washington, D.C., 11 January 2001), ix–x.

2. Ibid., xxxi–xxxv.

# Glossary/Definitions

| | |
|---|---|
| ACSC | Air Command and Staff College |
| ADC | active defensive counterspace |
| ADR | Annual Defense Review |
| ASAT | antisatellite |
| AU | Air University |
| BMD | ballistic missile defense |
| COTS | commercial-off-the-shelf |
| DOD | Department of Defense |
| FSCL | fire support coordination line |
| GEO | geostationary Earth orbit |
| GPS | Global Positioning System |
| HEO | highly elliptical orbit |
| ICBM | intercontinental ballistic missile |
| LEO | low earth orbit |
| MEO | medium earth orbit |
| NASA | National Aeronautics and Space Administration |
| NCA | National Command Authorities |
| NMD | national missile defense |
| NTMV | national technical means of verification |
| NORAD | North American Air Defense |
| NRO | National Reconnaissance Office |
| OCS | offensive counterspace |
| PDCS | passive defensive counterspace |
| SAAS | School of Advanced Airpower Studies |
| SAC | Strategic Air Command |
| START | Strategic Arms Reduction Talks |
| US | United States |
| USAF | United States Air Force |
| USCINCSPACE | United States Commander-in-Chief Space |
| USSPACECOM | United States Space Command |
| USSR | Union of Soviet Socialist Republics |

Proposition: "1. A plan or scheme suggested for acceptance . . . 5c. A statement containing only logical constants and having a fixed truth-value." —From the *American Heritage*

*Dictionary*, Second College Edition (Boston, Houghton Mifflin Co., 1995) 994.

Spacepower: The ability of a state or nonstate actor to achieve its goals and objectives in the presence of other actors on the world stage through control and exploitation of the space environment.[1]

## Notes

1. James L. Hyatt III et al., "Space Power 2010," Research Report 95-05 (Maxwell Air Force Base, Ala.: Air Command and Staff College, May 1995), 5.

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