



Globalness

Toward a Space Power Theory

BRIAN E. FREDRIKSSON, Lieutenant Colonel, USAF
School of Advanced Air and Space Studies

THESIS PRESENTED TO THE FACULTY OF
THE SCHOOL OF ADVANCED AIR AND SPACE STUDIES,
MAXWELL AIR FORCE BASE, ALABAMA, FOR COMPLETION
OF GRADUATION REQUIREMENTS, ACADEMIC YEAR 2003-4.

Air University Press
Maxwell Air Force Base, Alabama 36112-6615

June 2006

This School of Advanced Air and Space Studies thesis and others in this series are available electronically at the Air University Research Web site <http://research.maxwell.af.mil> and the AU Press Web site <http://aupress.maxwell.af.mil>.

Disclaimer

Opinions, conclusions, and recommendations expressed or implied within are solely those of the author and do not necessarily represent the views of Air University, the United States Air Force, the Department of Defense, or any other US government agency. Cleared for public release: distribution unlimited.

Contents

<i>Chapter</i>		<i>Page</i>
	DISCLAIMER	ii
	ABSTRACT	v
	ABOUT THE AUTHOR	vii
	ACKNOWLEDGMENTS	ix
1	INTRODUCTION	1
2	NATIONAL AND MILITARY POWER	9
3	SPACE AND MILITARY POWER	25
4	SPACE POWER THEORY	41
5	CONCLUSIONS	61
	GLOSSARY	65
	BIBLIOGRAPHY	67

Illustrations

<i>Figure</i>		
1	The power cone	10
2	Purposes of military power	14
3	Forms of military power	16
4	Four functions of military power	19
5	Attributes of military systems	20
6	Space power theory at a glance	56

Tables

1	Characteristics of military power	34
2	Inherent qualities of space power	37

Abstract

The purpose of this thesis is to take the first steps toward a military space power theory. It begins by answering the question: Why does the US military need space power theory? The United States or any military space-faring nation needs theory because space power is more than simply a force enhancer but is a separate and unique form of military power with the capacity to deter and compel. An analysis of the fundamental attributes of military power—identified here as presence, perspective, response, and destructive capability—demonstrates the unique advantages and disadvantages of space vis-à-vis land, sea, and airpower. A unifying principle of “globalness” links the laws, rules, and precepts of a prototype theory based on space power’s unique capabilities. The space power theory provides a common vision that allows a space-faring nation to take full advantage of these unique capabilities.

About the Author

Lt Col Brian E. Fredriksson is a New Hampshire native and a 1988 distinguished graduate of Air Force Reserve Officer Training Corps at Lehigh University in Bethlehem, Pennsylvania. Colonel Fredriksson began his military career as a systems engineer and program manager for the Global Positioning System Joint Program Office in Los Angeles, California. In 1994 he was selected for a broadening experience special tour and subsequently served as a missile operations crew member, flight commander, instructor, and wing executive officer for the 341st Space Wing, Malmstrom AFB, Montana. In 1998 Colonel Fredriksson reported to Peterson AFB, Colorado, where he served as command lead for the Minuteman III Propulsion Replacement Program, command lead for Space Force Applications, executive officer, and chief, director's action group for the directorate of requirements, Headquarters Air Force Space Command.

Colonel Fredriksson is a graduate of Squadron Officer School, Air Command and Staff College, and the Defense Systems Management College Advanced Program Management Course. He holds bachelor of science and master of science degrees in mechanical engineering from Lehigh University and a master of science degree in management from Troy State University. Following graduation from the School of Advanced Air and Space Studies, Colonel Fredriksson will serve as chief of plans for Fourteenth Air Force, Vandenberg AFB, California.

Acknowledgments

Alone one can accomplish little, and I am forever grateful to all who supported and assisted this endeavor. First and foremost, I would like to thank God for blessing me with the opportunity, meager ability, and tenacity to complete this work. I am also very grateful to my advisor, Dr. Everett Dolman, and my reader, Col Thomas Ehrhard, for their unwavering support, clairvoyant direction, and constructive criticism. I would also like to acknowledge the intellectual insights of my classmates, especially Lt Col “Sel” Stanford Kekauoha, and my instructors at the School of Advanced Air and Space Studies. I am especially grateful to my friend, Shannon, who unselfishly served as a proofreader, taskmaster, and understanding supporter. Finally, I must extend my love and thanks to my family, whose love and support has served as my bedrock throughout my life. The trust and support of all these people enabled me to “press on.”

Chapter 1

Introduction

That's one small step for man, one giant leap for mankind.

—Neil Armstrong, 20 July 1969

Echoing in the words of the first human to set foot on a world other than terra firma is the promise that humanity could someday live, work, and play on another world. Today, only a few hardy souls venture into space each year, and most for only a short duration. Still, national space programs continue to expand, and humanity inexorably increases its reliance on space services. Hundreds of satellites operate routinely in earth orbit, and much of the world's modern lifestyle depends on them. America's military relies heavily on space systems to communicate, navigate, observe, track, attack, and defend—virtually every military function.

These military space capabilities are lumped into the category of *space power*. But where does space power fit in the strategist's plans? Are space assets merely force multipliers, valuable but dependent upon terrestrial linkage for their utility, or do they have an independent power that could presage a fundamentally different way of waging war? How is space power different from other forms of military power? The answers to these questions will help provide the foundation for a model of space power that properly places it into strategic and operational context.

The following examination highlights the notion that space power is a unique form of military power that provides advantages over other forms, to include land, sea, and airpower. As the process of identification and examination of the fundamental qualitative advantages and disadvantages of space power unfolds, it will yield the beginnings of a working theory. This is a vital step, as a practical space power theory is a prerequisite for a space-faring nation to take full advantage of these unique capabilities, yet a step that has not been satisfactorily taken.

The military space community has long acknowledged the lack of a definitive space power theory or theorist. To this day no space power Clausewitz or Jomini, Mahan or Corbett, Mitchell or Warden has emerged. While there are numerous proposed space power theories, none have achieved consensus in the military—much less in the larger space community. Noted strategy scholar Colin S. Gray sums it up best, “Spacepower suffers from an unusual malady: an acute shortage of space-focused strategic theory and the lack of a binding organizing concept to aid understanding of what it is all about.”¹ While a number of writers have addressed the issue, to this day no one has elucidated a basic and comprehensive theory of space power. Several, including James E. Oberg and Everett C. Dolman, have made significant contributions to a comprehensive theory, but all fall short, particu-

larly in the practical military application of space power.² This dearth of space power theory begs two related questions: Is a space power theory really needed, and if so, for what? Despite the lack of theory, military exploitation of space has proceeded briskly, even if a bit disorganized. Finding sufficient reasons for the latter question will answer the former.

Ultimately, if no truly unique contributions from space are discernible, then a theory of space power is not necessary, as it is subsumed by the broader or general theory of military power.³ If, on the other hand, space contributes independent and unique capabilities, these would form the basis of a space power theory. While a universal theory is beyond the scope of a master's thesis, the military space community needs a simple, comprehensive, and useful set of theoretical principles that (1) defines the unique contribution of military space power, and (2) advances the development of a true space power theory.

Purpose

Due to the vast nature of this topic, a brief note of intent and ambition is warranted. Carl von Clausewitz, who considered theory a guide to thought, wrote, "Theory will have fulfilled its main task when it is used to analyze the constituent elements of war, to distinguish precisely what at first sight seems fused, to explain in full the properties of the means employed and to show their probable effects, to define clearly the nature of the ends in view, and to illuminate all phases of warfare in a thorough critical inquiry."⁴ The purpose here is to take the first steps in establishing a foundation for further critical inquiry. Clausewitz saw theory as the means to comprehend history, and history as a surrogate for experience. His construct works extremely well here. Humankind has yet to fight in space; as a result, we have little experiential basis for space theory. In the absence of direct historical precedent or experience, the present analysis turns to a higher level for guidance, the employment of military force in general. Applied to the realm of space, these principles are by necessity abstract. The result is not a doctrinal prescription for how to fight, but a speculative conceptualization and optimization of the use of space as a military instrument of power.

The time for such analysis is now, as the United States is poised to assert itself in this potentially dominant form of power. Today airpower is the preeminent form of war, as land and sea power were for great powers in earlier ages. Without question, airpower has served American interests. It dominated the last three major US conflicts—Operations Desert Shield/Desert Storm, Bosnia/Kosovo, and most recently in Afghanistan and Operation Iraqi Freedom. While airpower will be the dominant means of military power for the near future, other forms of military power are far from obsolete or unnecessary. In fact, this analysis shows that each form of military power contributes unique capabilities that, depending on the nature of the conflict, the strategist must employ to accomplish the desired

ends. Yet, just as the United States has chosen airpower as its primary means of waging war, changing political objectives and threats suggest the need for a new way of thinking—space power will increasingly fill that role in the twenty-first century.

As the world's lone superpower, the United States has global interests and responsibilities, but it could be argued that it has neither a comprehensive global strategy nor truly global forces. Indeed, the United States can and does deploy forces worldwide, but those deployments are in response to specific situations or crises and are far from rapid (as the buildup before both Gulf Wars demonstrates). The precise role the United States will assume in world leadership is yet to be determined, but global interests and responsibilities suggest the need for global forces and a global strategy.⁵ This is best accomplished with a strategy of global presence, near-instantaneous response, and near-omniscient perspective. These capacities are best achieved via space power.

Approach

The method for this analysis is straightforward. The first objective is to distinguish military power as a distinct form of national power. Next, an examination of the attributes of military power provides a framework to distinguish the qualitative and quantitative differences between land, sea, air, space, and information power.

Space is shown to be unique in its properties and capabilities, thus a concept of space power separate from but integrated with the other forms under the umbrella of military power is identified. With space power isolated, a strategy or theory of space power can be put forward distinct from a general theory of war. The unique characteristics of space power then form the basis of theoretical propositions regarding military space power described in terms similar to those used by naval theorist Julian S. Corbett in his "Green Pamphlet."⁶ It will be averred that these theoretical propositions have the potential, if developed, to fundamentally change the way states wage war. At the end is a short, admittedly incomplete, outline that could result in identifying space power as the dominant form of military power.

Definitions, Assumptions, and Limitations

Defining space power is a logical first step toward the development of a theory to guide its employment. Unfortunately, there is no clear and widely accepted definition of space power. Numerous definitions have been put forward, and US Air Force doctrine provides several.⁷ Strategist Gray proposed the simplest definition of *space power* as "the ability to use space while denying reliable use to any foe."⁸ Lt Col David E. Lupton presented perhaps the first formal and arguably the most satisfying definition, in his 1988 paper *On Space Warfare: A Space Power Doctrine*. "Space power is the ability of a nation to exploit the space environment in pursuit of national

goals and purposes and includes the entire astronautical capabilities of the nation.”⁹ Lupton based his definition on three characteristics found in the definitions of other forms of military power: elements of national power, military and nonmilitary purposes, and civilian and military systems. The drawback of this definition is that it combines other broad elements of national power under the space rubric. Michael R. Mantz counters with a narrow view in his definition of *space combat* as the “hostile application of destructive or disruptive force into, through, within, or from space.”¹⁰ For the purposes of this paper, the definition must bridge the gap between an all-inclusive characterization that overlaps with other forms of military and national power and a narrow combat-focused definition. Thus, the term *space power* as it is used in this paper refers to military space power and is defined simply as the use of space to achieve military objectives. This definition will be placed in perspective in chapter 2.

Military space power does not necessarily mean space weaponization. Today space is militarized, meaning that space is used for military purposes. Except for early prototype antisatellite (ASAT) capabilities developed by the United States and the Soviet Union through mid-1980, states have for the most part refrained from building and stationing weapons for use in or from space.¹¹ In contrast, space-transiting weapons, in the form of intercontinental ballistic missiles (ICBM), are staples of nuclear deterrence. While not generally considered space weapons, these forces represent the first offensive military use of space. The future utility of space weapons was recognized in a series of treaties from 1967 to 1973 that constitute the current outer space legal regime.¹² Nonetheless, numerous constraints—legal, policy-based, and technical—have stemmed the development of space weapons.¹³ As a result space power today functions almost entirely in a force-enhancement role, meaning that it improves or supports the other forms of military power.¹⁴

Space has become increasingly important to the world, but nowhere does a state take more economic and military advantage of space power than in the United States. Loss of access to space would thus be a far greater setback to this state than to any other. US reliance on space assets makes them a natural target for those who would do the United States harm, and thus it follows that the United States should protect those assets. Some disagreement exists, however, concerning the means of protecting those assets. Should the United States rely primarily on legal or diplomatic means, coercion or threats, weapons in space or dedicated to space, or some combination of these? The combination that works best is not suggested here, but it is pressed that without space weapons, the United States would have to use passive defenses and other forms of power to protect its assets there and to contest or control space.

In this ambitious attempt to divine the rudiments of a space power theory, certain restrictions apply. First, space power here is limited to military activities. Moreover, while it is assumed that space-based weapons are not only possible but may be necessary for the full realization of space power on par with other mediums, detailed technical accounts of specific weapons and

weapon systems are beyond the scope of this paper. Previous writers have delved into this domain sufficiently.¹⁵ Also limited to particularly relevant attributes is a discussion of orbital mechanics. A basic understanding of the physics of space power is relevant for any discussion of space, but space scholars Dolman and Oberg provide satisfying working-level explanations for the issues presented here.¹⁶ Despite these caveats, ruminations are not limited to current technical constraints. Inherent in the following discussion is the assumption that where there is a need, a means will be found. While full implementation of the theoretical construct offered here is not yet practical, there is reason to believe that the requisite technologies will be developed in the near future. More importantly, a working strategy is likely to drive and focus efforts to develop appropriate technologies, further enhancing the ability of planners and decision makers to employ them fruitfully.

Conclusions

Consider for a moment an apparent contradiction. A stealthy B-2 bomber destroying a satellite uplink station in the heart of enemy territory is an example of using airpower to affect space power. If the B-2 uses a Global Positioning System (GPS) guided Joint Direct Attack Munition (JDAM), could this be a use of space power to affect space power? No—it should be recognized as the use of space power to augment airpower that affects space power. This is probably the most that space power can contribute in its own defense. The example underscores the notion that space power without weapons is only a partial realization of its full military potential. It also demonstrates what Gray describes as the “interconnectedness, indeed the interdependence, of the different geographical environments.”¹⁷ Space power without weapons can provide presence, perspective, and to a limited degree, response, but it alone cannot provide destructive potential.

As Operation Iraqi Freedom clearly demonstrated, space power is growing rapidly in its ability to augment American military forces, transforming them into true twenty-first-century fighting forces. While space power is currently a necessary component for this transformation, it will mature into a full-fledged and stand-alone form of military power only with the advent of space weapons. Eventually, space control weapons will demand an independent space strategy. Hence, the intent of this thesis is to work out some of the theoretical obstacles before such a strategy is implemented. The goal is theory, both descriptive and predictive, capturing the essence of space power.

Notes

1. Colin S. Gray, *Modern Strategy* (Oxford: Oxford University Press, 1999), 255.
2. Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age* (London and Portland, OR: Frank Cass Publishers, 2002); and James E. Oberg, *Space Power Theory* (Washington, DC: Government Printing Office, March 1999).

3. The ontological distinction is that either space power (like sea or airpower) can and should have an independent theory and strategy, or it is simply a component of a broader theory or strategy of war.

4. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 141.

5. US intentions aside, there are those who believe the United States is on the verge of achieving global hegemony. Jay Tolson, “The New American Empire?” *US News and World Report*, 13 January 2003, 36–40. Andrew J. Bacevich, in *American Empire* (Cambridge, MA: Harvard University Press, 2003), argues that increasing globalization in the post–Cold War environment has resulted in a consistent US foreign policy he deems a “strategy of openness” that seeks to “preserve and, where feasible and conducive to US interests, to expand an American imperium.” Richard N. Haass, on the other hand, argues that US leadership or primacy (rather than hegemony) as a “reluctant sheriff” is necessary in a world of deregulation. This age of deregulation is characterized by a loosening of international relations—new centers of decision making, diffusion of power, and absence of universally accepted norms; weakening of the nation-state; and the dominance of democratic, free-market societies. Richard N. Haass, *The Reluctant Sheriff* (New York: Council on Foreign Relations, 1997), 1–44.

6. Often described as the Jomini of the Sea, Corbett published two editions of a hand-out, referred to as the “Green Pamphlet,” for his students at the Royal Naval War College. The pamphlets describe in a simple, outline-type form his basic propositions regarding the use of naval power. Julian S. Corbett, *Some Principles of Maritime Strategy* (1911; reprint, Annapolis, MD: Naval Institute Press, 1988), 305.

7. Air Force doctrine defines *space power* as (a) “the capability to exploit space forces to support national security strategy and achieve national security objectives.” Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, September 1997; (b) “the capability to exploit civil, commercial, intelligence, and national security space systems and associated infrastructure to support national security strategy and national objectives from peacetime through combat operations.” AFDD 1-2, *Air Force Glossary*, 9 July 1999; and (c) “the total strength of a nation’s capabilities to conduct and influence activities, to, in, through, and from space to achieve objectives.” AFDD 2-2, *Space Operations*, 27 November 2001, 54.

8. Colin S. Gray, “The Influence of Space Power upon History,” *Comparative Strategy*, October–December 1996, 293. Alternatively, Gray defines *space power* as “the ability in peace, crisis, and war to exert prompt and sustained influence in and from space.” Gray adapted the definition from the definition of *land power* given by William T. Johnsen, “Redefining Land Power for the 21st Century” (unpublished paper, Carlisle Barracks, PA: Army War College, 7 May 1998), 6; and Gray, *Modern Strategy*, 259.

9. David E. Lupton, *On Space Warfare: A Space Power Doctrine* (Maxwell AFB, AL: Air University Press, June 1988), 7.

10. Michael R. Mantz, *The New Sword: A Theory of Space Combat Power* (Maxwell AFB, AL: Air University Press, May 1995), 2.

11. Paul B. Stares, *Space and National Security* (Washington, DC: Brookings Institution, 1987), particularly chap. 4, for details on US and Soviet antisatellite weapons programs.

12. P. K. Menon, *The United Nations’ Efforts to Outlaw the Arms Race In Outer Space: A Brief History with Key Documents* (Lewiston, NY: Edwin Mellen Press, 1988); Peter L. Hays, *United States Military Space: Into the Twenty-First Century* (Maxwell AFB, AL: Air University Press, September 2002); and Dolman, *Astropolitik*, 113–44, for excellent surveys of space-related arms-control treaties and regulations. The most prominent space treaty is the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, usually referenced as simply the Outer Space Treaty (OST). Contrary to popular perception, the treaty regime, to include the OST, does not prohibit weapons other than “weapons of mass destruction” in space. Article IV of the OST declares, “States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass

destruction, install such weapons on celestial bodies or station such weapons in outer space in any other manner.” Other treaties include the now defunct, Antiballistic Missile (ABM) Treaty of 1972, which limited the development, testing, or deploying of land, air, sea, or space-based ABM systems or components, and the Agreement on Activities of States on the Moon and Other Celestial Bodies (United Nations [UN] General Assembly Resolution 34/68, 1979), which declares that the moon be developed “exclusively for peaceful purposes,” and prohibits nuclear weapons, weapons of mass destruction, and military facilities or maneuvers on or in orbit around the moon.

13. In addition to the sources cited above, excellent discussions of treaty/policy implications are provided by Steven Lambakis, *On the Edge of the Earth: The Future of American Space Power* (Lexington, KY: University Press of Kentucky, 2001); and Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945–1984* (Ithaca, NY: Cornell University Press, 1985).

14. Although weapons do not orbit in space, residual capabilities exist that can threaten space assets. Examples include ballistic-missile-launched nuclear weapons, ground-based lasers, electronic countermeasures like GPS jammers, ABM systems like the Russian GALOSH around Moscow (as well as the old SL-11-launched co-orbital ASAT, which may still be operational), and even the American space shuttle. Stares, *Space and National Security*, 111–13, provides a dated but still relevant discussion.

15. See Bob Preston et al., *Space Weapons, Earth Wars* (Santa Monica, CA: RAND, 2002), for an excellent discussion regarding the types and capabilities of space weapons.

16. Dolman, *Astropolitik*, 60–85; and Oberg, *Space Power Theory*, 23–41. For a more detailed engineering explanation of orbital mechanics, see Michael J. Muolo, *Space Handbook*, vol. 2, *An Analyst’s Guide* (Maxwell AFB, AL: Air University Press, December 1993); and Roger R. Bate et al., *The Fundamentals of Astrodynamics* (New York: Dover Publications, Inc., 1971).

17. Gray, *Modern Strategy*, 256.

Chapter 2

National and Military Power

So the nature of War, consisteth [sic] not in actual fighting; but in the known disposition thereto, during all the time there is no assurance to the contrary. All other time is peace.

—Thomas Hobbes
Leviathan, 1660

First, therefore, it is clear that war should never be thought of as something autonomous but always as an instrument of policy.

—Carl von Clausewitz
On War, 1818

This chapter lays the foundation for examining the role of space power within the construct of the national instruments of power. A notional power model demarcates space power as a distinct form of military power employed as an instrument of policy. Additionally, the coercive mechanisms whereby military power accomplishes political objectives are defined and placed in context.

Military power accomplishes four basic functions: presence, perspective, response, and destruction. How space power accomplishes these functions distinguishes it from other types of military power and delineates its fundamental character, thereby providing the basis for a theory of space power. The investigation begins by examining the nature of national power.

National Power

War and peace exist as a continuum. At one extreme is absolute or total war, and on the other, peace. In reality the current state of affairs is situated between the extremes, often with both conditions coexisting.¹ Sixteenth-century philosopher Thomas Hobbes described this situation as the ever-present fear of war, and it is in this realist context that this paper considers the conduct of national and military power.² Realist theory considers the state to be the fundamental unit of international relations, although the import of other national and transnational entities is certainly rising. Those of the realist school fathom that the rule of anarchy defines the balance between war and peace. In an anarchical world, force is the ultimate arbiter, albeit not the only one. The currency of states is national power, which takes three basic forms: economic, diplomatic, and military.³ Though distinct conceptually, the three forms of national power are inherently intertwined and interdependent. The focus here, however, is the role of military power in its myriad forms—land, sea, air, and space.

Figure 1 models the interaction of the various instruments of power along the continuum of peace and war. The power cone depicts a hierarchy but also the interplay of the components from top to bottom. Imagine a flashlight illuminating the diagram from the peak. As the light shines down through the sections, it includes the various components in varying degrees of intensity—altered, magnified, and directed by the prisms at each conical section. Thus, the political objective of the state is articulated in the grand strategy, apportioned to the executive agents of the state who formulate economic, diplomatic, and military strategies for the employment of the instruments of power. The military strategist then employs various means to best accomplish the campaign objectives.

Clausewitz defined *strategy* as the use of engagements (campaigns) for the object of war.⁴ At the operational level of planning, each of the means—land, sea, air, space, and information—will have a strategy to contribute to the campaign objectives. These strategies combine and interact (as depicted by the Venn diagram of circles projected at each level) to accomplish the campaign objectives. At the tactical level, operators—the soldiers, sailors, airmen, marines, and space and information operators—employ assets to achieve mission objectives. Their actions are the tactics of combat where actual battles are fought.

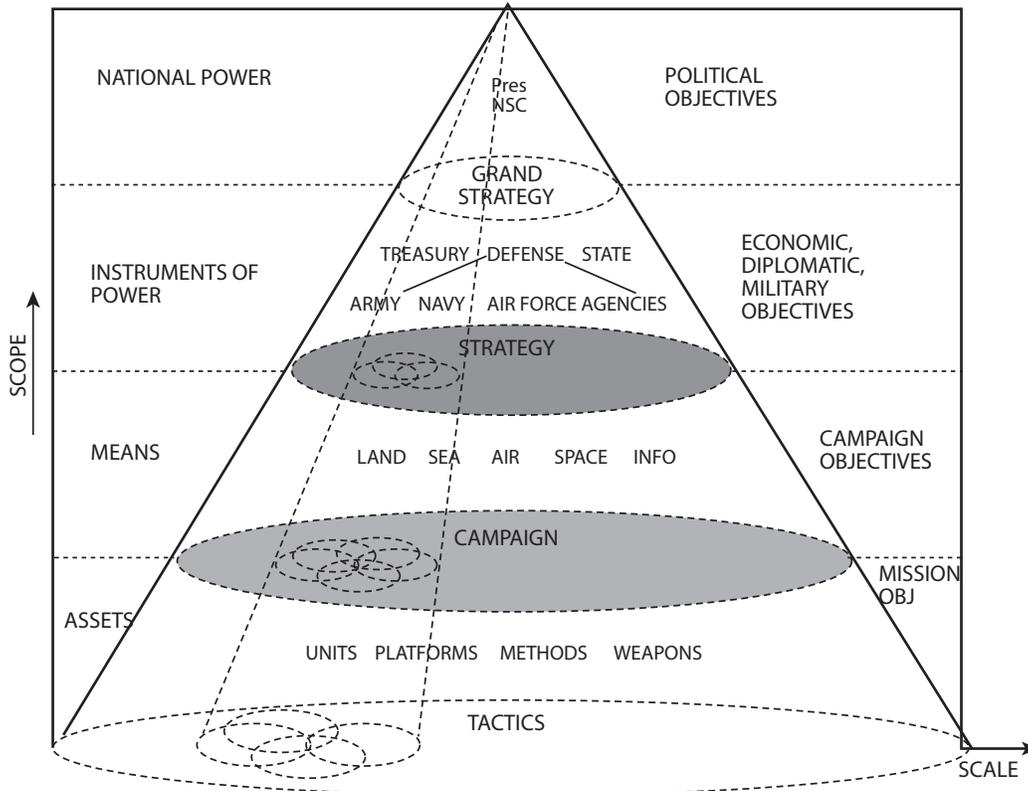


Figure 1. The power cone

At the pinnacle of the power cone, the executives of the state determine the grand strategy with the object of maintaining or achieving a state of peace. For the United States, the president, assisted by the National Security Council, develops a national security strategy utilizing all elements of national power to secure national security objectives that promote the principles, ideals, and indemnity of the state. In times of peace, the objective is to maintain amity or expand influence. During war, the grand strategy's objective is a *better* state of peace. As noted earlier, the conditions of peace and war coexist, for a nation can be at war with one state and have mostly peaceful relations with others. Even in the abstract notion of total war, the state will have allies and alliances that belie an absolute state of war. The important point, however, is that the political objectives determine the grand strategy implemented through economic, diplomatic, and military instruments of national power.

At the strategic level, the executive agents of government employ the instruments of power to achieve the political objectives of the state. For the United States the central agents include, but are by no means limited to, the trade representative and the Departments of State, Commerce, and Treasury for economic strategy; the Department of State for diplomatic strategy; and the Department of Defense for military strategy. Each department or agency sets forth its own objectives to support the grand strategy and national political objectives of the state utilizing the instruments of power—economic, diplomatic, and military—at their disposal. For example, the State Department sets trade policy, employs sanctions, and grants trade status in concert with the national security strategy. Likewise, the Department of Treasury determines monetary policy to satisfy economic goals. Similarly, “the Armed Forces of the United States shape and employ the military instrument [of power] to advance and defend national security interests and objectives” through the national military strategy.⁵

At the operational level, the land, sea, air, space, and information strategies are executed through campaigns. Campaigns may be unique to the means, as a land campaign to conquer territory or a campaign to achieve air or space superiority. They also can be combined in joint efforts to achieve the campaign objectives. For example, on 8 August 1990, six days after Iraq invaded neighboring Kuwait, Pres. George Bush outlined four political objectives for the region: (1) secure the immediate, unconditional, and complete withdrawal of Iraqi forces from Kuwait; (2) restore the legitimate government of Kuwait; (3) secure the security and stability of the region; and (4) protect American lives.⁶ To accomplish these political objectives, Gen H. Norman Schwarzkopf and his central command staff devised a four-phased campaign plan for Desert Storm. Phase I was a strategic air campaign, which evolved from the Air Staff's Instant Thunder plan, against centers of gravity to incapacitate Iraqi leadership and destroy key military capabilities. Phase II was an air supremacy campaign in the Kuwaiti theater of operations. Phase III consisted of battlefield preparation to attrit Iraqi ground forces. Phase IV, the offensive ground campaign, sought to liberate Kuwait, cut lines of communications, and destroy the Republican

Guard.⁷ Here we see an air campaign strategy in phase III that worked in concert with the ground campaign strategy in phase IV, accomplishing the ultimate political objectives.

Finally, at the tactical level, operators employ the tools of war to achieve mission objectives. The tools of war are the assets—the physical and mental entities that apply force in combat. These entities include the units, platforms, weapon systems, tactics, and individual combatants employed to achieve victory in the battle space. These assets employ tactics or doctrine to accomplish missions in support of campaign objectives. Interestingly, the assets used are independent of the campaign strategy, be it air, land, sea, or space. Navies routinely employ carrier aircraft guided by space assets to accomplish campaign strategies. Air forces team with the ground scheme of maneuver by using satellite-guided weapons.

The point is that assets (weapon systems and employment techniques) do not determine the campaign strategy. A theater-level military strategy is made up of overlapping, integrated but distinct operational strategies for each form of military power—except space power. As a whole, these strategies form the campaign plan. Today, space assets augment the other operational strategies—air, land, and sea. If space power eventually includes independent offensive operations, it too will require its own strategy and, therefore, its own theory.

Space factors prominently into all of the instruments of national power—diplomatic, economic, and military. Space expert Stephen Whiting describes how the United States can use space power to exert diplomatic leverage.⁸ His model uses David Baldwin's taxonomy of coercion (prestige, technology partnerships, access to services, legal precedent, objective information, presence, and threat of punishment) across a spectrum of crises from military operations other than war through crisis response to war. Whiting avers that space significantly contributes to all the levels of coercion except the ability to threaten punishment and is applicable across the entire spectrum of conflict. Perhaps the most obvious example of space influencing diplomacy was Secretary of State Colin Powell's use of satellite imagery to demonstrate to the UN Security Council Iraq's failure to comply with UN resolutions prohibiting weapons of mass destruction.

In addition to diplomatic leverage, the economic impact of space is significant, though disagreement exists on whether it is an economic center of gravity. In 1999 commercial space transportation and space-enabled industries generated over \$61.3 billion in economic activity in the US alone, including \$16.4 billion in direct employee earnings and 497,000 jobs.⁹ Optimistic projections of future growth peg cumulative US investments in space as \$500 billion by 2010 and as much as 10–15 percent of the gross domestic product by 2020.¹⁰ However, today, the direct economic impact of space is but a fraction of the world's economic activity. Despite the recent decline in the commercial satellite and launch industry, space remains a center of gravity because of indirect effects.¹¹ For example, the precise timing provided by GPS cesium clocks is used by a number of communications and

financial services. The timing signal synchronizes the electronic switching and transmission of voice, data, and video links. Television, radio, and Internet traffic also require accurate time transfer, as well as automated teller machines, banking systems, and wireless communications. A case in point: An errant command to a GPS satellite on 17 March 1997, resulting in one satellite broadcasting an incorrect timing signal for six seconds, caused 110 of 800 cellular phone sites in the eastern United States to fail, crashing the entire system for a number of hours.¹²

Even if it is not an economic center of gravity, the increasing military investment in space testifies to its growing military significance. The Pentagon's 2004 budget requested \$8.5 billion for unclassified space programs, an increase of about \$600 million over 2003. While increasing, the military space budget represents only about 2.2 percent of the Department of Defense budget request of \$379.9 billion.¹³ Expenditures for classified intelligence satellites, estimated at \$6–7 billion per year, increase the total slightly.¹⁴

As important as space power is to economic and diplomatic stratagems, the purpose herein is to define its role within the context of military strategy. Space—like land, sea, air, and information—has many interdependent means of accomplishing military objectives. Each means, defined by its own grammar, contributes to an overall strategy unified in the logic of political discourse—“a continuation of politics by other means.”

Military Power

While the military is but one means for achieving political ends, it is the ultimate arbiter of national power in an anarchical world. As the ultimate arbiter, states use military power in a destructive capacity to wage war. Yet states not only wield military power forcefully, but also peacefully, to maintain order, keep the peace, provide humanitarian relief, and aggressively without force, to threaten, coerce, or intimidate. As Barry Blechman and Stephen Kaplan aver, “armed forces—by their very existence as well as their general character, deployment, and day-to-day activities—can be used as an instrument of policy in time of peace.”¹⁵

Used in this manner military power becomes integrated with and fungible to the other instruments of statecraft.¹⁶ To understand this supreme mediator, and the role of space power as an element of the military influence, requires an understanding of the functions and attributes of military power in general. These functions and attributes provide a framework to judge the relative merits of the forms of military power, particularly space power.

Purpose of Military Power

Clausewitz said, “War is an act of force to compel an adversary to do our will.”¹⁷ However true in theory, this definition provides insufficient fidelity to distinguish between the types of military power. Like other forms of power, military power seeks to control or coerce the adversary in a given

situation. *Coercion*, in its broadest sense, means to compel an act or choice.¹⁸ Coercion includes deterrence, or preserving the status quo by preventing the adversary from choosing to act in a manner against your will; and compellence, changing the status quo by making an adversary choose or act in the manner you desire.¹⁹ In other words, compellence is getting an adversary to stop doing something or to start doing something he would not otherwise do. Deterrence is making an adversary choose not to do something he would otherwise do. So, military power takes one of two forms: compellence or deterrence. All other purposes fall within these rubrics. This is not to say that other categorizations are not useful, but simply that the other forms are encompassed by these two (see fig. 2).²⁰

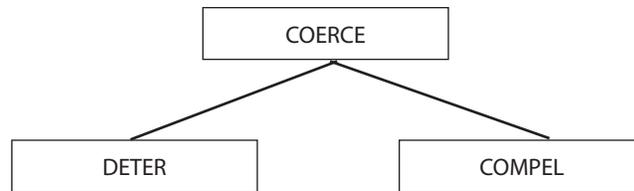


Figure 2. Purposes of military power

Consider, for example, an alternate construct. Robert Art proposes four uses of force “that themselves analytically exhaust the functions forces can serve: defense, deterrence, compellence, and swaggering.”²¹ According to Art, the defensive use of force is the deployment of military power to “ward off an attack or minimize the damage to oneself if attacked.” Certainly, defense is well recognized as an important role for the Department of Defense. Defense can be preemptive or preventative. But in either case, defense amounts to either deterring an attack or compelling the adversary to stop.

Art defines *deterrence* based on the threat of retaliation or punishment, a common definition attributable to Schelling.²² An alternate definition is to inhibit or prevent, which Robert A. Pape construes as denial. Deterrence operates not only through threat of reprisal but also through denial of opportunity or ability to act. In other words, deterrence is making the adversary choose to act in a manner you desire. An enemy can fear retaliation but still choose to act. If the enemy knows that his efforts are futile, even if he is unafraid, rationally he will choose not to attack.

Art uses the term *swaggering* as a catchall category to include the uses of force other than for defense, deterrence, or compellence. In an admittedly ill-defined and diffuse explanation, Art contends that swaggering almost always involves the peaceful use of force usually in two ways: demonstrations of force and buying/building the most prestigious weapons.²³ Swaggering achieves influence through prestige and respect. But what are the mechanisms through which prestige and respect contribute to na-

tional power? It is the ability to compel or deter. Military exercises often seek to demonstrate capability and resolve in an effort to compel an adversary to back down. A demonstration of military might is an attempt to dissuade potential adversaries from pursuing courses of action detrimental to one's own goals and desires. Building the most effective weaponry can also deter an enemy from pursuing aggressive aims.

Defeating the enemy through force is the object of battle. As stated earlier, victory only occurs at the tactical level. At the strategic and grand-strategic levels, success is measured by achieving objectives and effects. As Vietnam demonstrated, you can win each major battle and still lose the war.

Functions of Military Power

If all forms of military power have the capacity to deter and compel, then what makes them different? The most obvious answer is the medium in which they operate. Land power controls the land, sea power controls the sea, and so on. Yet this explanation belies prescriptive power. What does it matter to control the land, sea, air, or cyberspace? What does control of the medium mean for deterrence and compellence? Perhaps a more relevant question is, what are the characteristics common to all forms of military power? The classification of these characteristics, or attributes, explains how to employ the forms of military power to deter and compel.²⁴

This section describes four functions common to all forms of military power; namely, presence, perspective, responsiveness, and destructive potential. At first blush these may seem intuitively obvious and simplistic. Indeed, David Hackett Fischer warns historians to avoid the reductive fallacy, a tendency to reduce complexity to simplicity or diversity to conformity, in causal relationships.²⁵ The fallacy is committed, however, only when the causal model is reduced in a manner or to a degree that the conclusion is distorted from reality. For example, one form of reductive fallacy is confusing necessary with sufficient causes. On the other hand, reductionism is often necessary for explanatory faculty. This analysis seeks to avoid charges of reductionism by relying on first principles in the characterization of military power. First principles posit the most intrinsic and seemingly incontrovertible truths. For military forces this consists of the most generalized and basic functions or states of being. At this level, military forces exist, observe, move, and destroy things.

Presence

At the most basic level, a military force simply exists. Military power exists in three states—as matter, energy, and information. In the form of matter they occupy space, have mass, and can be seen and touched. In the form of energy, they possess potential, form, and order. In the form of information, they are ideas, concepts, or discrete points of data that can be accessed and manipulated. Taken together, the matter, energy, and information are manifest in the military forces that define their existence—

the armies, navies, militias, intelligence services, weapons, strategies, doctrines, tactics, designs, and technologies. Figure 3 summarizes the various forms in which military power exists.

<i>Matter</i>	<i>Energy</i>	<i>Information</i>
Aircraft	Kinetic	Ideas
Tanks	Nuclear	Designs
Ships	Chemical	Concepts
Satellites	Radio	Strategies
Facilities	Frequency	Doctrine
People	Microwave	Tactics
Computers	Laser	Intelligence
	Cyber	

Figure 3. Forms of military power

Presence is more than a show of force. Simply by existing in physical, energy, or information forms, military force has power. The presence of military force alone, assuming its presence is credibly communicated to potential adversaries, gives it deterrent capability by threat of action. The latent capability (presence) takes the form of perspective, responsiveness, and destructive power. Presence has varying levels of effect. Simply the idea of a weapon system can have profound effects on the strategic calculus of adversaries and allies alike. Consider, for example, the impact of Pres. Ronald Reagan’s Strategic Defense Initiative on the former Soviet Union or the implications of Sputnik to the perceived vulnerability of the United States. Of course, actually possessing military force imbues much greater power upon the national actor. How the actor deploys the forces also matters. In his characterization of space and terrestrial power characteristics, Gregory Billman distinguishes characteristics of military power based on home-based, deployed, and engaged states of readiness for forces.²⁶ Home-based forces possess greater strategic agility or flexibility, while enhanced states of readiness demonstrate greater resolve and credibility through their potential to act.

Another aspect of presence is persistence, which is the degree of presence exhibited. Persistence can mean the ability to occupy territory or continually impose effects. Land forces exercise the greatest degree of persistent presence when in possession of territory, yet even this persistence is not complete. An occupation force only controls strategic areas of territory un-

der occupation, not every square inch, leaving a majority of land under control of the civilian population. Air forces persist by being able to loiter and revisit a target area; a capability vastly improved with the maturation of long-loiter unmanned aerial vehicles (UAV). Cyber forces persist perhaps imperceptibly in the memory and processing media of computers.

Presence also implies the ability to maintain existence through self-protection. Military forces must often exist in hostile environments where adversaries seek to terminate their existence. Protection is a defensive function that includes both passive and active characteristics. Passive defenses—like armor, hardening, fortresses, camouflage, and stealth—do not require overt offensive action. Active defenses are those meant to physically confront, impede, or destroy an attacker—like machine gun revetments, chaff, electronic countermeasures, or the Patriot Missile system. Active defense actually is part of the destructive capability of military forces addressed below.

Perspective

The second attribute of military power is perspective—the ability to observe and gather information. From the beginning of time, greater perspective has yielded military advantage. Armies have always sought the high ground from which to observe the enemy and launch attacks. Airpower found its first military use in the form of observation balloons as early as the American Civil War. Following airpower's legacy, US military space power evolved, in part, from a need to observe previously unobservable areas deep within the borders of the Soviet Union.²⁷ Presently, much of what is called military space power is intelligence, surveillance, and reconnaissance capability devoted to increasing the battle space awareness, or perspective, of military forces and national decision makers.

While not solely the province of military forces, perspective is an essential capability distinct from the others. A force can exist without perspective, but to move or act, it must know where to go and what to act upon. Military power can also exist without physical presence. A small nation might only exercise the perspective role of military power by purchasing overhead imagery from a third party without having indigenous capability (presence) itself. Such a diminutive space power could then rely on external military offensive power of an ally to react to the imagery and defend its interests.

Responsiveness

The third function of military power is responsiveness—the ability to get to and react to a situation. It is the ability to move presence from one place to another. Military forces can exert power simply by moving into a more threatening position. While presence is a state that serves useful functions by itself, often more overt action is necessary to exercise or threaten the use of force. Maneuver theory falls in this rubric.

Responsiveness is a function of time and range. How quickly one can exercise force and over what distance has a clear impact on the capability

of military force. The responsiveness of military forces ranges from days or weeks to move ships or aircraft into position in-theater, to a matter of minutes to configure and launch an ICBM. While blue-water navies and long-range bombers with refueling capability clearly possess global range, their responsiveness, or the inability to be in a specific place at a specific time, varies greatly. The airpower tenets of flexibility and versatility reflect the characteristic of responsiveness.²⁸

Destructive Force

Finally, military force breaks things and kills people. What makes military power distinct from other forms of national power is physical destruction. The so-called tip of the spear, however, may not be the only way, or the most efficient way to exercise military power, but it is the ultimate act of military power. A nation can have a capable military force; know the location, capability, and intention of the enemy; move into position to exert coercive pressure; but all is for naught without the ability to destroy the enemy's capability or prevent it from existing, observing, moving, or destroying. As Clausewitz said, "Force . . . is thus the means of war; to impose our will on the enemy is its object."²⁹ While power implies the latent ability to wield force, destructive power is the actual effective exercise of power.

Destructive effect is a function of energy expended and precision of application. Weapons destroy by one of three kill mechanisms: matter, energy, or information. Albert Einstein's famous Law of Relativity relates energy and matter with the classic equation $E = mc^2$, so the distinction between energy and matter is a practical rather than a fundamental one. Information is a completely different entity whose potential is just beginning to be explored. Energy weapons take numerous forms, from conventional explosives (chemical energy) to radio frequency, laser, and particle beams. Matter weapons destroy by kinetic energy, the impact of mass on mass. During impact, the matter becomes energy in the form of heat and movement. The range of destructive force is wide. Nuclear weapons remain the greatest human-made force in existence. Computer viruses destroy with minimal expenditure of energy. Interestingly, the American way of war tends to deemphasize brute force in favor of precision effects. While not the first method of guiding munitions, the GPS revolutionized all-weather delivery of precision-guided munitions. As accuracies improve, bombs become smaller and more easily carried. A much-touted chart depicts a single B-2 bomber carrying 16 independently targeted JDAMs as having an equivalent destructive capacity of 1,500 B-17 sorties carrying 1,125 tons of dumb bombs in World War II.³⁰ In the future, a hydrogen fluoride space-based laser could deliver 10 kilojoules (KJ)/square centimeter (cm²) of energy to a 10 cm radius spot on the skin of a ballistic missile, a significant weapon capacity.³¹

Military force does not have to destroy completely. Degrees of negation vary with the weapon and desired effect. Instead of destruction, denial, disruption, degradation, or neutralization may be all that is necessary to

impose one’s will.³² Using microwaves to destroy the electronics of a surface-to-air missile site would not destroy the emitter like a well-placed cruise missile, but the effect is equivalent. Positioning a micro-satellite to “blockade” the field of view of an orbiting optical sensor results in no physical destruction, yet it is a use of force to disarm the enemy.³³

In fact, much of what is considered military force does not exercise destructive power at all. Of the 4,338 aircraft in the active duty US Air Force inventory in 2001, only 1,737 were bombers or fighter/attack aircraft capable of physical destruction.³⁴ Military forces spend a vast majority of their time training and preparing for conflict, not actually participating in conflict. Even when deployed to hostile areas, most of the time is not spent exchanging gunfire. Clearly there is more to military power than the application of force. The other attributes capture this nature. All the other capabilities, attributes, functions, and types of forces support the ultimate aim—the application of force to compel the enemy to do our will (see fig. 4).³⁵

<i>Functions of Military Power</i>			
Presence	Responsiveness	Perspective	Destructive power

Figure 4. Four functions of military power

Summary

To recap, the purpose of military power is to deter and compel. Armed forces do so by providing presence, perspective, responsiveness, and destructive force. Examples abound.

ICBMs deter through their presence and their potential to respond and destroy. The latter two functions are not performed on a day-to-day basis to exert military force (though they are test launched periodically to demonstrate the credible threat). The mere presence of US forces in South Korea provides a deterrent effect. They also observe the actions on the other side of the demilitarized zone, can move into positions of heightened alert, and if necessary, destroy invaders from the north. GPS satellites provide presence—their existence as a force enhancer intensifies the deterrent and compellent capability of surface forces. GPS also provides enhanced perspective through the transmission of precise timing and navigation signals (not to mention nuclear detonation monitoring). A C-17 airlift aircraft provides responsiveness by facilitating the movement of other types of forces. Conceivably it could also provide destructive capability if used to drop a bomb out of the cargo hold. An aircraft carrier provides deterrence by its presence, employs sensors and aircraft for observation,

moves for responsiveness, and possesses destructive capacity through its attack aircraft. A Defense Support Program (DSP) early warning satellite provides unparalleled launch detection and tracking of ballistic missiles. Although it moves rapidly through space, it remains in a stationary position relative to the equator because of its geosynchronous orbit. For all intents and purposes, it is not capable of movement, but it can respond by altering its field of view. A DSP satellite is not capable of offensive military action. A summary of various weapon systems and their attributes is provided in figure 5.

Conclusion

This chapter deduced the foundation of a space power theory. The first step was to establish the role of military power within the national security system. Military power works with the diplomatic, economic, and informational instruments of national power to achieve the political objectives of the state. National security strategy relates the political objectives to the instruments of power. Military strategy then relates military means to military objectives that support the political objectives of the state. Military power consists of the power to deter and compel. It does so through the four functions of military power—presence, response, perspective, and force—described in the next chapter.

	<i>Presence</i>	<i>Perspective</i>	<i>Responsiveness</i>	<i>Destructive power</i>
<i>ICBM</i>	√		√	√
<i>GPS</i>	√	√	√	
<i>C-17</i>			√	
<i>Carrier Battle Group (CBG)</i>	√	√	√	√
<i>B-2</i>	√	√	√	√
<i>JDAM</i>	√		√	√

Figure 5. Attributes of military systems

The next chapter compares space power to other forms of military power. Since space power is a unique component of military power, then space power theory and strategy should likewise be unique. The insights gained from this comparison yield the basis of a space theory to support future strategies.

Notes

1. A distinction is often made between negative peace, the momentary absence of war, and positive peace, a condition in which war is unlikely. Ronald J. Glossop, *Confronting War: An Examination of Humanity's Most Pressing Problem*, 3d ed. (Jefferson, NC: McFarland & Company, Inc., 1994), 12–14.
2. International relations realists cite Hobbes' description of a world without government—or anarchy—as the condition between states. Thomas Hobbes, *Leviathan*, ed. Richard Tuck (Cambridge, MA: Cambridge University Press, 1991), 88–90.
3. Of late, information is considered a fourth dimension or, alternatively, intimately interwoven in the other three. US joint military doctrine considers the list to be four instruments of national power. Joint Publication (JP) 1, *Joint Warfare of the Armed Forces of the United States* (November 2000), states, “The United States relies for its security on the complementary application of the basic instruments of power: diplomatic, economic, informational, and military.”
4. In his classification, “Tactics teaches the use of armed forces in the engagement; strategy, the use of engagements for the object of war.” Clausewitz, *On War*, 128.
5. JP 1, *Joint Warfare of the Armed Forces*, 1–2.
6. President Bush, as documented in *Public Papers of the Presidents of the United States: George Bush, 1990 (Book II)* (Washington, DC: Office of the Federal Register, National Archives and Records Administration, 1991), 1108.
7. Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey Summary Report* (Washington, DC: Government Printing Office, 1993).
8. Stephen N. Whiting, “Space and Diplomacy: A New Tool for Leverage,” *Astropolitics* 1, no. 1 (2003): 54–77. See also Stephen Whiting, “Policy, Influence, and Diplomacy: Space as a National Power Element” (master's thesis, School of Advanced Airpower Studies, June 2002).
9. Federal Aviation Administration, *The Economic Impact of Commercial Space Transportation on the U.S. Economy* (Washington, DC: Department of Transportation, February 2001), http://ast.faa.gov/files/pdf/Econ_Final.pdf.
10. Oberg, *Space Power Theory*, 16.
11. Barry Watts assesses the 1998 Defense Science Board (DSB) projections that worldwide commercial space industry annual revenues will reach “several hundred billion dollars” over the next 10–15 years as possible. He argues that even if trends remain optimistic, space will not necessarily become “an economic or military center of gravity for the United States or any other nation” citing the saturation of the satellite communications market and the competition of fiber optics as evidence against the DSB conclusions. Barry D. Watts, *The Military Use of Space: A Diagnostic Assessment* (Washington, DC: Center for Strategic and Budgetary Assessments, February 2001), 71.
12. Simon P. Worden, “Space Control for the 21st Century,” in *Spacepower for a New Millennium: Space and U.S. National Security*, ed. Peter L. Hays et al. (New York: McGraw-Hill Companies, Inc., 2000), 228.
13. Andrea Shalaf-Esa, “Pentagon Sees Space as Military ‘High Ground,’” *Rueters*, 23 February 2003, <http://www.forbes.com/markets/newswire/2003/02/12/rtr878174.html> (accessed 23 March 2003).
14. Leonard David, “The NRO: Dark Secrets under Open Skies,” *Space.com*, 26 September 2000, http://www.space.com/news/spacehistory/nro_first_side_000926.html (accessed 21 April 2003); and Charles W. Kegley Jr. and Eugene R. Wittkopf, “The Role of Executive Depart-

ments and Agencies in Foreign Policy Making,” *American Foreign Policy*, 5th ed. (Bedford/St. Martin’s Press, 1996), 378–419.

15. Barry M. Blechman and Stephen S. Kaplan, *Force without War: U.S. Armed Forces as a Political Instrument* (Washington, DC: Brookings Institution, 1978), ix.

16. Robert J. Art, “The Fungibility of Force,” in *The Use of Force*, ed. Robert J. Art and Kenneth Waltz (Lanham, MD: Rowman & Littlefield Publishers, Inc., 1999), 3.

17. Clausewitz, *On War*, 75.

18. *Webster’s Ninth New Collegiate Dictionary* (Springfield, MA: Merriam-Webster, Inc., 1983), 256.

19. For Thomas Schelling, to *deter* means “to turn aside or discourage through fear; hence to prevent action by fear of consequences” and considers coercion to include both deterrence and compellence. Thomas C. Schelling, *Arms and Influence* (New Haven, CT: Yale University Press, 1966), 70–71. Pape, on the other hand, substitutes the term *coercion* for Schelling’s definition of compellence. In Robert A. Pape, *Bombing to Win: Airpower and Coercion in War* (Ithaca, NY: Cornell University Press, 1996), see p. 4, n. 6.

20. For example, Michael Howard includes reassurance, in addition to deterrence and compellence, as functions of military power. However, reassuring friendly governments is mostly a function of compelling or deterring their internal or external threats. Michael Howard, “Reassurance and Deterrence: Western Defense in the 1980’s,” *Foreign Affairs*, Winter 1982/83, 307–24.

21. Art, “The Four Functions of Force,” in *International Politics: Enduring Concepts and Contemporary Issues*, ed. Robert J. Art and Robert Jervis (New York: Addison-Wesley Educational Publishers, Inc., 2003), 153.

22. *Ibid.*

23. *Ibid.*, 153–65.

24. Bruce DeBlois notes “differences in land power, sea power, and airpower stem from distinctions in characteristics—that is, the different means by which one prosecutes the roles and missions.” He continues to propose an insightful construct to identify the characteristics and advantages of air and space power, concluding that air and space power are sufficiently different and that space power requires its own “fundamental, bottom-up, theoretical and doctrinal development.” Col Bruce M. DeBlois, “Ascendant Realms: Characteristics of Airpower and Space Power,” in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Col Phillip S. Meilinger (Maxwell AFB, AL: Air University Press, 1997), 564–65.

25. David Hackett Fischer, *Historians’ Fallacies: Toward a Logic of Historical Thought* (New York: Harper & Row Publishers, Inc., 1970), 172.

26. Maj Gregory Billman, “The Inherent Limitations of Space Power: Fact or Fiction?” in *Beyond the Paths of Heaven: The Emergence of Space Power Thought*, ed. Bruce M. DeBlois (Maxwell AFB, AL: Air University Press, September 1999), 507–59.

27. The Air Research and Development Command, based on RAND proposals for a satellite reconnaissance system, issued a formal operational requirement for the Advanced Reconnaissance System (formerly the WS-117L satellite) for continuous surveillance of areas in the Soviet Union in March 1955. David N. Spires et al., *Beyond Horizons: A Half Century of Air Force Space Leadership* (Peterson AFB, CO: Air Force Space Command, 1997), 36–37.

28. AFDD 1, *Air Force Basic Doctrine*, 23.

29. Clausewitz, *On War*, 75.

30. David R. Mets, “Conclusion: The USAF Airpower Experience: The First Century” (lecture, School of Advanced Air and Space Studies, Maxwell AFB, AL, February 2003).

31. Preston et al., *Space Weapons, Earth Wars*, 31.

32. Joint Doctrine defines five measures of negation: destroy, degrade, deny, disrupt, and deceive. Additionally, negation can include action against the ground, link, or space segments of an adversary’s space system. JP 3-14, *Joint Doctrine for Space Operations*, 9 August 2002, 4-6–7.

33. Simon P. Worden discusses the use of space blockade and other space control measures to protect “space lanes” of communication that are of increasing importance to international commerce. Worden, “Space Control,” 225–37.

34. “2002 USAF Almanac,” *Air Force Magazine*, May 2002, 58. Of the remaining 2,601 aircraft, 187 were reconnaissance/electronic warfare, 317 tanker, 549 transport, 13 fixed-wing search and rescue, 164 helicopter, 1,282 trainers, and 89 utility/observation/other. Additionally, there were 1,806 aircraft of various types assigned to the guard and reserve.

35. Defense or self-protection could constitute another category but was excluded because it is part in parcel of the other functions. Passive defense (armor, concealment, camouflage, etc.) is a means of preserving presence. Active defense combines perspective (awareness), responsiveness (maneuverability), and destructive power for self-preservation.

Chapter 3

Space and Military Power

Control of space means control of the world, for 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.

—Pres. Lyndon B. Johnson

Our space assets now are probably more important to warfighters and more important to win this global war on terrorism than they ever have been historically. . . . For us to be secure as a nation, we are going to need better eyes, ears, warning, rapid ability to respond to crisis . . . clearly, space is the high ground, and we need to capture that high ground and exploit it.

—Undersecretary of the Air Force and
Director, National Reconnaissance
Office, Peter Teets

Thucydides tells us that ancient Athens, flush with victory over the powerful Spartans and overconfident in its formidable fleet of triremes financed through imperial tribute, overextended itself in an ill-advised overseas campaign and suffered debilitating failure at Syracuse.¹ Rome, imperial ruler of the known world for almost six centuries, succumbed to invasions of barbarian hordes after it abandoned its legions of citizen-based, short-sword infantry and replaced them with mercenary formations of armored lancers.² For almost two decades spanning the transition from eighteenth to nineteenth centuries, Napoleon's armies trampled the combined forces of continental Europe, only to succumb to overextension in Spain and Russia, complicated by the ascendant Royal Navy's continental blockade, which hastened Napoleon's demise.³

Today, US military might reigns supreme. But unlike the examples cited above, US military power does not depend on a single technological or organizational advantage for its battlefield dominance. Instead, US military supremacy is predicated on full-spectrum dominance in all forms of military power. The emerging US way of war is based on overwhelming technical and informational superiority to achieve political objectives, while minimizing loss of human life and respecting the territorial integrity (if not the sovereignty) of other nations.⁴ Previous powers had a limited time with which to press their unique military advantages before other states copied and surpassed them, and this may in part explain their tendency toward overexpansion. The United States' reliance on multiple advantages may make it less susceptible to overreach.

The key to this new way of war is airpower, a necessary and potentially sufficient form of military force. Early airpower advocates—like Giulio Douhet, Billy Mitchell, and Hugh Trenchard—envisioned independent air forces bombing enemies into submission without the need for surface forces.

In *The Transformation of American Airpower*, Benjamin Lambeth argues that airpower's technology, organization, and employment have evolved to make it the predominant element of war. "Recent developments in combat capability of US air power have made possible a new way of war for the United States entailing entirely new concepts of operations. Owing to precision, stealth and expanded information, airmen are now paradoxically able to apply airpower as first envisioned by the early advocates, but not in a way that they could have foreseen."⁵ Lambeth uses airpower's success in the Gulf War and the Balkans to make his point.⁶

No such controversy exists for land or sea power. While one could conceive of conflicts where land or sea power might be sufficient, these are isolated exceptions. Certainly, a combined arms service like the Marine Corps could suffice for operations like those conducted in Grenada. A purely naval strategy combined with significant diplomatic overtures may have avoided a nuclear confrontation during the Cuban Missile Crisis, though the president's advisors debated the use of full-scale air strikes and land invasion.⁷ Land armies might suffice to quell a rebellion in Mexico. Even in these cases, however, military strategists would likely opt for a combined arms approach. Such is the strategy of plenty.

For the American way of war, space dominance may be a necessary (but not sufficient) condition for success. The United States relies on space power to maximize battle space awareness, communication, precision navigation and strike, and battle damage assessment, among others. Without these space-enhanced capabilities, the United States would have to rely on more brute-force strategies, based on greater force size and more dispersed, less precise force application. The military would still be extremely powerful, its airpower ensures that, but without space support it would be much less dominant. While the trend of increasing reliance on space support and enhancement continues, should US airpower's dominance prove ephemeral, space power is not yet poised to replace it. A great deal of maturation is needed.

A comparison of the qualitative and quantitative differences in land, sea, air, and space power helps discern the advantages of each form of military power, and offers heuristic evidence pointing to the day when space power may emerge as the dominant form. The functions of military power defined in the previous chapter established the baseline for comparison. The analysis articulated what is unique about military power in the aggregate, as well as the similarities and overlap with other forms. At the operational level of war, roughly analogous to service control, it was shown that it is not the weapon systems or the medium in which they operate that distinguishes the types of military power, but what they control and how they do it. The object of military power is control of the medium. The medium, in turn, determines how land, sea, air, and space power perform the functions of presence, observation, response, and destruction. At this level, the

fundamental character of space forces, vis-à-vis other military instruments of power, becomes evident.

Control of the Medium

Capt Alfred Thayer Mahan was perhaps the first to define control of the medium as the object of military power. In his classic treatise, *The Influence of Sea Power upon History*, Mahan defined *sea power* as the confluence of “production, with the necessity of exchanging products, shipping, whereby the exchange is carried on, and colonies, which facilitate and enlarge the operations of shipping and tend to protect it by multiplying points of safety.”⁸ He further defined the “principle conditions affecting the sea power of nations” as geographic position, physical conformation, extent of territory, number of population, character of people, and character of government including national institutions.⁹ Thus, Mahan’s delineation of sea power encompasses the military, economic, and diplomatic instruments. The role of navies was to control the sea lines of communications by destroying the enemy’s fleet, the “true end of naval war.”¹⁰ For, “If it is to assure one or more positions ashore, the navy becomes simply a branch of the army for a particular occasion, and subordinates its action accordingly; but if the true end is to preponderate over the enemy’s navy and so control the sea, then the enemy’s ships and fleet are the true objects to be assailed on all occasions.”¹¹

Like Mahan, Corbett also considered the aim of naval strategy as command of the sea. However, Corbett recognized that this meant “something quite different from the Military idea of occupying territory, for the sea cannot be the subject of political dominion or ownership.”¹² Therefore, command of the sea meant the control of the lines of communication of the belligerent parties. Command of the sea can be both general, when the enemy cannot “act dangerously against our line of passage and communications or to defend his own,” or local, where one can prevent interference in “one or more theatres of operation.”¹³ Additionally, both local and general command can be temporary or permanent.

Sea, air, and land power all subscribe to the need to control the medium. Early airpower enthusiasts Giulio Douhet and Billy Mitchell believed air superiority was a necessary condition, if not the object of aerial warfare, though they differed on the means to achieve it. Douhet believed command of the air, achieved by destroying “the enemy in its nests” and by the ability for the “battle plane” to always get through, was a necessary condition for attacking the vital centers of an enemy to weaken civilian morale.¹⁴ Mitchell also thought air superiority, achieved by aerial combat, was the key to the employment of bombers for the destruction of military and infrastructure centers of gravity.¹⁵ The modern airpower theorist, John Warden, considered air superiority crucial to the success of an air campaign based on centers of gravity he later codified as the Five Rings of Leadership, organic essentials, infrastructure, population, and fielded forces.¹⁶ This vision served as the model for the initial air campaign plan for Desert Storm. Indeed, Air

Force doctrine considers air and space superiority a core competency and a necessary first step in military operations.¹⁷

Likewise, the US Army considers control of land the *raison d'être* of its core competency of sustained land dominance. The difference for the Army is that sustained land dominance is an objective rather than a prerequisite. It is achieved through several specific supporting competencies including close with and destroy enemy forces; precision fires and maneuver; information superiority; command and control of forces; sustainment operations; and control and defend land, people, and resources.¹⁸

This brief foray into the requirement for control of the medium can be summarized as follows: the object of land power is to control land, of sea power to control the sea, of airpower to control the skies, and of space power to control space. If information power is to be a true military force, then the object of it is to control information—a domain that is not geographic but can be conceived as cyberspace. This is a vital issue for operational strategy, for it separates the span of control without defying the common overarching purpose of supporting the political objective via military means. Control allows exploitation of the medium—the *sine qua non* of each form of military power.

Exploitation of the Medium

The medium also determines the characteristics of military power, or how military force functions to accomplish its purpose of deterring or coercing. Perhaps surprisingly, it is difficult to find a comprehensive comparison of the relative advantages and disadvantages of the various forms of military power. Most military theorists have focused on the employment of a specific form of military power without regard to the others. But as Gray noted, “Politics do not wage land, sea, or air war: instead they wage war.”¹⁹ The US way of war is inherently joint, and while one form of military power may prove advantageous for given conditions, as was the case with naval power in the Falklands, all will have inherent characteristics that contribute.

This section examines these inherent characteristics in the context of the elements of military power. Starting with terrestrial forces and progressing through the air, space, and information environments, the relative qualitative and quantitative differences in exploiting each form of military power are examined.

Land Power

Only on land does man exist without the support of technology. Living on land is the natural human state of being, according to Gray, “Because humans are land animals whose security communities are territorially defined, strategy ultimately has a landward focus.”²⁰ Just as possession is

nine-tenths of the law, possession of territory has traditionally been the ultimate adjudication in international politics.

Physical presence is the fundamental advantage of ground forces, for possession of territory is a strong form of presence. By seizing and maintaining control of territory, a political entity potentially can more fully impose its will on the events taking place there. Indeed, that influence can extend from temporary occupation to permanent legal ownership, depending on the objectives of the state. The diplomatic and deterrent effect of true presence is undeniable and unique. The stabilizing ability of land forces for peacekeeping and peace enforcement is difficult to accomplish through other means. Land forces traditionally also demonstrate greater resolve and commitment because land operations place so many in harm's way, thereby increasing the ability to compel and deter.

As necessary as it may be, physical presence has significant disadvantages. Chief among these is the large footprint and logistics tail to any significant ground deployment. Current planning guides specify 160 C-141 sorties or 90 C-17 sorties over four days to deploy a light infantry brigade.²¹ Larger forces require greater logistical support. Deployment of a heavy mechanized corps of five divisions requires 75 days to deploy to theater by air and sea. Physical presence also risks greater loss of life, a prospect at odds with the US way of war. Even with force protection measures, forward-deployed forces are at greater risk, as the Beirut Marine Corps barracks bombing, the bombing of Khobar Towers, and the attack on the USS *Cole* attest.

Land forces have the power of perspective within a locally defined surface area. Sometimes this is a superior perspective. Close in, direct involvement, often through human interaction, provides a perspective that cannot be achieved from sensors, even those powerful enough to observe minute details from a distance. Still, the perspective from the surface is limited and biased. It tends to be overdetermined for locality, and so even the use of small UAVs like the Pioneer, which provides limited-range aerial perspective, is extremely valuable for reconnaissance and intelligence.²²

Maneuver has long been the hallmark of land warfare. Writings attributed to Sun Tzu, the ancient Chinese war philosopher, include a chapter on maneuver, which he considered the method of employing troops to one's advantage.²³ Army doctrine considers maneuver one of the primary elements of combat power (along with firepower, leadership, protection, and information).²⁴ Army Field Manual (FM) 3-0, *Operations*, defines *maneuver* as "the employment of force, through movement combined with fire or fire potential, to achieve a position advantage with respect to the enemy to accomplish the mission. Maneuver is the means by which commanders concentrate combat power to achieve surprise, shock, momentum and dominance."²⁵ Maneuver is thus an example of responsiveness within a theater of operation. Depending on size and means of conveyance, ground units can maneuver on foot, with mechanized vehicles, or with helicopters for air-assault forces. Regardless, the speed of maneuver is limited to modes

that operate on or near the surface. As a result, speeds are limited to tens of kilometers per hour, slow in comparison to the other forms.

The other element of responsiveness is the time to deploy. In this sense, armies are much less capable. The Army's objective force goals include the ability to deploy a combat-capable brigade to theater in 96 hours, a division in 120 hours, and five divisions in 30 days.²⁶ However, a recent RAND report questioned the ability and the necessity to meet these goals. The report concluded that a force of more than 1,000 vehicles could not be deployed from the continental United States to distant points on the globe in four days, under the most ideal conditions.²⁷ With some mobility enhancements, like fast sealift and prepositioning of forces, deployment timelines on the order of one to two weeks are conceivable. The report does note that US joint operations have been historically concentrated in a few regions of the world, and that past crises have usually developed over weeks and years, considerably reducing the actual need for rapid deployment. Still, the ability to respond is inherently limited by the logistical realities of moving large numbers of equipment and personnel over significant distances.

Sea Power

The role of navies is control of the seas. For Mahan, this meant decisive naval engagement to annihilate the enemy's fleet. Corbett believed that "nine times out of ten the most effective way of 'seeking out the enemy's fleet' " (i.e., forcing an action on him) is to obtain local and temporary control of lines of "passage and communications."²⁸ Oceans cover 70 percent of the earth's surface and are accessible to approximately 75 percent of the world's population, with a similar percentage of capitals and major commercial centers within littoral areas.²⁹ Undoubtedly, naval forces project power well beyond the confines of the world's oceans. Naval bombardment and aviation, ship- and submarine-launched cruise missiles, and amphibious forces impose influence well inland. This is the exploitation of sea power in support of land power, not sea power to control the sea. Both, however, require an understanding of naval presence.

The US Navy considers forward presence its *raison d'être*. Naval doctrine cites flexibility and self-sufficiency as the primary attributes that make naval forces "well-suited for the expeditionary nature of America's security and military strategies."³⁰ Under peacetime conditions, approximately one-third of all naval forces are deployed "on-scene" throughout the world, with another 20 percent under way from homeports.³¹ Yet this presence is not the same as with land forces. Corbett noted that unlike the occupation of territory, "the sea cannot be the subject of political dominion or ownership," a debatable point but one to which most modern naval strategists agree.³² The presence most naval strategists presume is that in support of land power, a carrier battle group would be ready to lend forces to an invasion or campaign, or to stand in harm's way between combatant navies to deter violence through the fear of forcing the US fleet to commit to battle. The latter was exemplified when the United States sent carriers

to the Straits of Taiwan in 1996 to deter a Chinese invasion of the island, but it is also an ancient practice dating back at least to the political use of the Athenian fleet in the Second Peloponnesian War.³³

For the most part, naval forces are more responsive than ground forces. A carrier battle group can transit approximately 500 nautical miles (nm) per day, giving it a three-day range of 1,500 nm plus aircraft striking distance. Once on site, the Navy claims a single carrier can sustain 120 sorties a day with a surge capacity of 150.³⁴ Although their range is somewhat limited to coastal areas, carrier aviation can extend well inland with help from Air Force aerial refueling. During Operation Enduring Freedom in Afghanistan, naval strike aircraft provided 75 percent of the strike sorties (though dropped only 30 percent of the ordinance) from aircraft carriers in the Arabian Sea, mainly due to land-based aerial refueling support.³⁵ Still, a limited number of deployable carrier battle groups cannot be everywhere at once. Moreover, carrier operations are among the most difficult and expensive today. They also represent a single-point failure; the sinking of a single carrier would cost many billions in lost investment and up to 6,000 American lives.

Naval forces have similar limitations of perspective to surface-bound land forces. While they can utilize space and airborne sensors to expand their field of vision, this is the use of space or airpower to augment sea power, not an inherent capability of sea power itself. Sea power's inherent perspective is limited to the theater- or local-level base on the range of shipboard and carrier-based aviation sensors.

Naval forces' destructive capacity is similar to other military forms of power. As stated earlier, weapons are independent of the type of military force. Naval forces can employ naval gunfire, infantry units, GPS and laser-guided bombs, cruise missiles, and submarine-launched nuclear weapons, to name a few. Weapons of the future will likely include directed-energy or particle-beam weapons. It is difficult to conceive of a type of weapon or destructive power that a navy could not employ in their mission to control and exploit the seas.

Airpower

From the days of Hugh Trenchard and Billy Mitchell, the proponents of airpower have long touted its virtues. Little has changed apart from the modern-day capacity for airpower to achieve the vision of these theorists and strategists. According to Gray, "It is the essence of airpower to offer elevation or altitude for superior observation, global domain for unlimited range, high speed in mission performance, physically unrestricted routing, and extraordinary flexibility in operations."³⁶ Raymond O'Mara and Everett Dolman aver

Airpower possesses three characteristics that make it dominant in modern conflict: speed, precision, and flexibility. Since air overlays both land and sea, air forces exploiting command of the air have the ability to deliver force to virtually any point on the surface of the planet faster than either land or sea forces that are not already deployed on the point of application. With the accelerated nature

of modern conflict, this is a vital capacity. In addition to speed, air forces can strike targets at long range with extreme precision.³⁷

It is these capabilities that make airpower the dominant form of military power in the twenty-first century.

The vantage point provided by airpower is undeniable. The ability to observe large areas provides awareness to all forms of military power. From Union and Confederate use of balloons to observe enemy positions in the US Civil War to today's U-2 flights, airpower has provided order-of-magnitude improvements in observation capability. Today, that capability is global. Nonetheless, airpower's ability to observe is limited in some cases by overflight restrictions, enemy air defenses, and by the limited coverage of sensors.

Responsiveness is airpower's forte. With aerial refueling, range is virtually unrestricted. B-2 bombers operating out of Missouri can strike anywhere in the world within hours of notification. Military planners can re-target or redirect these bombers en route, providing flexibility not available in other forms of intercontinental strike. However, the timeliness of airpower, though an order of magnitude greater than surface forces, is still measured in hours and, in some cases, days. The issue of time-critical targeting that arose in the great Scud hunt of the first Gulf War has been ameliorated by tightening the "sensor-to-shooter loop" and through tactics that place on-call strike platforms in the vicinity of suspected fleeting targets. Still, such doctrinal work-arounds are insufficient for near-real-time targeting on a global scale.

Presence is the bane of airpower. Although aircraft can travel any place in the world, they cannot loiter there forever (except in theory—in practice it would grind the air force into ineffectiveness over the long haul). Granted, long-duration UAVs and advanced propulsion systems might minimize this limitation. However, even with near-constant patrolling, airpower does not exert the same kind of physical presence as surface forces. Despite myths to the contrary, Britain's Royal Air Force aerial policing of its empire during the 1930s was neither complete nor independent. As James Corum attests, "Throughout the era of British air control, in all but the cases of minor local banditry, the British met any serious challenge to their authority with both airpower and sizeable ground forces."³⁸ Furthermore, while air forces can exert dominating aerial control in a local area for extended periods of time, to do so not only requires large expenditure of resources, but also has limited effects on terrestrial activity. US and British warplanes had enforced the UN-mandated no-fly zones over Iraq for 12 years and, despite maintaining continuous air superiority, could not control many activities on the ground.

On a theoretical level, all forms of military power can achieve equivalent destructive force since weapons can be delivered by any means. Practically speaking, however, the destructive capability of airpower is unmatched. With today's technology, the ability to deliver massive amounts of ord-

nance over a large area or to execute pinpoint strikes is best performed by air platforms.

Space Power

In 1946 the RAND Corporation's proposal for an Earth-circling spaceship foreshadowed space's potential, "We can see no more clearly all the utility and implications of spaceships than the Wright brothers could see flights of B-29s bombing Japan and air transports circling the globe."³⁹ Over 50 years later, space power still offers unrealized capability. In its current manifestation, space power primarily augments other forms of military power. Air Force Space Command's 2004 Strategic Master Plan identifies five mission areas for military space forces: force enhancement, counterspace, space force application, space support, and mission support. Of these, the overwhelming emphasis of current systems is force enhancement. That is, "The capabilities to gather and disseminate timely, highly accurate information to enable situation awareness and effective command and control (C2) for commanders and joint forces at all levels."⁴⁰ The focus of counterspace is space situational awareness, knowing the whereabouts and intentions of orbiting objects. Indictments by the 2001 Space Commission notwithstanding, the lack of active offensive and defensive space control measures remains. Space force application, the offensive use of force from or through space to strike terrestrial targets, is limited to nuclear-equipped ballistic missiles. US Strategic Command, in subsuming the previously independent US Space Command, has defined a nonnuclear global-strike mission but must rely on long-range bombers to execute it.

Despite current constraints, space power is more than just an externality, for it provides many inherent advantages. Perhaps space power's foremost advantage is global presence and perspective. For operating space forces, presence and perspective are derived from the nature of the medium. According to David Lupton, the nature of the medium includes the fact that space surrounds the other environs. As a result, "Space vehicles operate with high-altitude vantage that provides a line-of-sight view of large portions of the Earth, allowing a single orbiting satellite to 'see' enormous areas of the Earth."⁴¹ Once in orbit, space vehicles can sustain altitude without expending fuel providing sustainable persistence over the entire Earth.

The second primary advantage of constellations of satellites is persistent global presence. Constellations orbit without violating national sovereignty, having freedom of overflight under current international regimes. Three satellites in geosynchronous orbit can observe the majority of Earth's surface, except for regions around the poles. Twenty-four navigation satellites in medium earth orbit (approximately 12,500 mi.) provide surface users visibility of three or more satellites most of the time. Billman deems this a "virtual" presence, since the vehicles are out of sight and their presence largely unperceivable. Virtual presence becomes more substantial with weapons that could strike from space.⁴² Still, the presence is inherently different from ground forces that occupy territory, more akin to air forces, but also more permanent

in nature. The presence extends beyond the confines of Earth to the stars, an infinite operating area according to Lupton and infinite military depth in the words of Colin Gray.⁴³

Thirdly, space forces have the potential for near-instantaneous response. Operating with laser connectivity in full-Earth-coverage constellations, satellites provide the eyes, ears, and eventually the fists for global control. They can be completely unobtrusive or definitively assertive depending on political objectives and constraints. Billman refers to this characteristic as strategic agility—the ability to respond rapidly over global distances with appropriate capabilities to carry out operations in support of US international interests.⁴⁴

While the actual destructive power of space is still to be determined, theoretically it will equal other forms of military power employing similar technologies. Military space planes could deliver conventional ordinance (or nuclear ordinance for that matter) intercontinental distances, deploying many of them in reentry capsules for delivery to terrestrial targets.⁴⁵ A robust fleet of military space planes could easily supplant the ever-shrinking fleet of intercontinental bombers. Space-based lasers have the greatest affectivity within the vacuum of space, with lesser capability for high-flying air vehicles and ground targets due to atmospheric interference. Still, technology may prove this distinction irrelevant.

The introduction proposed that the United States has moved from relying on land and sea dominance to a way of war that relies more on air dominance augmented by space and information. Eventually the US military may evolve into a space- and information-dominated force. The qualitative advantages of the various forms of military power discussed above have definite quantitative traits as summarized in table 1 for surface-centric warfare.⁴⁶ The table is arranged into the land/sea dominant approach of the past, the air/space dominant approach of the present, and a projected space/info dominant approach of the future.

Table 1. Characteristics of military power

	<i>Land/Sea Power</i>	<i>Air/Space Power</i>	<i>Space/Info Power</i>
Presence	Permanent/Localized	Temporary/Localized	Permanent/Global
Perspective	Local/Enduring	Local/Temporary	Global/Persistent
Response			
-- Range	Regional	Global	Global
-- Speed	Days/Weeks	Hours/Days	Minutes/Hours
Destructive Power	Variable, dependent on weapons employed	Variable, dependent on weapons employed	Variable, dependent on weapons employed

While surface-centric and near-earth-centric warfare may dominate the future of the human race, we may eventually venture beyond our planet, where the contest of wills between human societies or with other societies will follow. A near-earth-centric means of war, transglobal if you will, may evolve into an interplanetary or intergalactic mode of war. For this, space

power will likely dominate. In the meantime, traditional forms of military force will have continued relevance. At various times one will be the supported force, and the others will support. Most often the synergistic application of various forms of military force will prevail. What is important for the strategist is to understand the quantitative and qualitative differences between these distinct forms. Only then can the strategist apply the capabilities available today and the planner provide the forces for the future.

Synthesis of Unique Space Capabilities

The analysis of the forms of military power shows that like all forms of military power, space power has its advantages and disadvantages. These unique characteristics form the basis of a theory for the full utilization of space to achieve the political objectives of the state. Spacecast 2020, a study conducted by Air University in 1994, cited two paramount advantages of space—"unparalleled perspective and very rapid access to the Earth's surface."⁴⁷ To these fundamental advantages, Christian Daehnck added non-territorial operations that he defined as "no worries about over flight rights or provocations in prehostility phases of crises."⁴⁸ A RAND project Air Force study listed access and reach, rapid response, distance from Earth and other objects, and difficulty of defense as the primary advantages of space weapons.⁴⁹ Lupton lists characteristics of space power in three rubrics: environmentally influenced, logistically influenced, and politically/legally influenced. Of the environmentally influenced, he cites, among others, global presence and infinite operating area.⁵⁰ Bruce DeBlois, in his comparison of air and space power, cites duration, range, and speed of response as realm-afforded capabilities for space. Environmental characteristics include size and position of the realm. He also considers sovereignty and likelihood of reduced casualties as political advantages.⁵¹ What is notable, besides the similarities of these assessments, is the resemblance to the characteristics of military power.

To be sure, space power also possesses disadvantages. While some disadvantages are relative and could be overcome by advances in technology, others are inherent, much to the chagrin of space proponents.⁵² Gray summarizes the limitations as the cost of transportation to orbit, the laws of motion in space, and the distance from territorial events.⁵³ The expensive access limitation is not inherent but a function of current technology and will likely be overcome. Kepler's Laws, which define orbital mechanics, are inherent as is the distance from terrestrial events. Distance is a disadvantage for some intelligence missions and for issues of resolve, or to simply possess territory. RAND's *Space Weapons, Earth Wars* lists similar disadvantages including static defense, predictable orbits, logistics expense, large numbers required, and legal consequences.⁵⁴ Of these, only predictable orbits represent an inherent weakness. Static defense can be overcome with active defenses to include microsatellite escorts and space-control lasers. Logistics expense is largely a function of cost to orbit, which will

likely decrease as technology matures. The need to populate large constellations in low and medium orbits for complete Earth coverage can also be a limitation. However, just a few vehicles, especially if small and cheap, compare favorably with air assets providing similar coverage and at great advantage to surface forces. For example “the fuel required to emplace and de-orbit the weapons might be as much as 50 times the mass of the weapons delivered (for kinetic energy weapons). This compares with a reported fuel-consumption ration of 40 tons per ton of air delivered ordinance in the Gulf War.”⁵⁵ Surprisingly, this is a fairly even comparison, and that is assuming that the cost of space lift to low Earth orbit (LEO) does not decrease from the current \$10,000 per pound to projected levels of \$1,000 per pound. This, of course, neglects the tremendous cost of building the space systems themselves, which tend to be specialized, highly complex, and individualized machines.

Actually, the high cost of space systems provides an important and almost insidious factor that would structurally limit the emergence of rival space powers. The high costs to build and maintain the infrastructure and technology base for an advanced space program set high entry barriers for potential competitors. The greater the cost potential rivals must bear to enter the industry, the less likely they would be to compete in that market. Furthermore, states with well-developed space industries enjoy the benefits of cost advantages due to economies of scale.⁵⁶ Another argument is that the tremendous cost would structurally limit the presumed evils of space dominance. The more expensive and difficult to reconstitute the orbiting systems, the more precious the assets, and the less likely the owner would be to use them except in the direst circumstances. In this way, expensive space systems embody a high degree of credibility. On the other hand, they may assume the paradoxical character of nuclear weapons, where their primary utility is in their nonuse.

Legal consequences represent self-imposed obstacles, not inherent limitations. Pres. George W. Bush withdrew from the Anti-Ballistic Missile (ABM) Treaty in 2002, declaring the US intention of fielding a limited missile-defense capability as soon as possible.⁵⁷ Importantly, Bush used the treaty’s specified means of withdrawal, demonstrating a continuing respect for international agreements and affirming the United States’ intent to abide by agreements. Despite objections from Russia, China, and the international community, the issue quickly faded into the background. Policy makers certainly should consider the political implications of treaty commitments when making national security policy regarding space. Still, these limitations are not inherent limiting characteristics, though they are practical realities.

Daehnck cites other perceived disadvantages of space systems including distance (requiring remote operations); predictability; poor continuity (lack of dwell time); inflexibility (long lead planning, difficult to make changes); unsatisfactory timeliness; vulnerability; environment; and costs.⁵⁸

These perceived disadvantages are not inherent but rather a function of technology and implementation.

These and other inherent advantages and disadvantages of space systems are summarized in table 2.

Table 2. Inherent qualities of space power

<i>ADVANTAGES</i>	<i>DISADVANTAGES</i>	<i>NEUTRAL QUALITIES</i>
Global presence	Lack of physical terrestrial presence	Destructive power (same for all forms of military power)
Global perspective	Predictable orbits	Range (global for all forces)
Near instantaneous response	Inhospitable environment	Destructive potential
Global persistence	Access (distance/cost)	Risk of casualties

Conclusions

In this chapter, the comparison of the fundamental characteristics of military power to provide presence, perspective, responsiveness, and destructive power revealed the unique character of space power. The analysis shows that space power has inherent advantages and disadvantages as an option for the employment of military force. If, as it stands now, space power serves primarily as a force-enhancement function, then a separate theory or strategy is plausibly not needed. Space power would simply augment the land, sea, and air theories and strategies and fit as a component within them. At best, space power would be subsumed into a general theory of war. If, as the analysis demonstrates, space power is intrinsically different and potentially capable of independent military operations and campaigns, then it requires its own theory and strategy.⁵⁹ Furthermore, the unique characteristics should form the basis of a unique theory and strategy of employment, one that maximizes space power's ultimate potential. Once realized, space power may become a dominant form of military power, much as airpower is today, and land and sea power were in past eras.

Notes

1. Robert B. Strassler, ed., *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War* (New York: Touchstone, 1998).

2. Robert L. O'Connell, *Of Arms and Men: A History of War, Weapons, and Aggression* (Oxford: Oxford University Press, 1989), 82–85.

3. Michael Howard, *War in European History* (Oxford: Oxford University Press, 1976), 88–90.

4. Russell F. Weigley, *The American Way of War* (New York: Macmillan, 1977). The term has evolved significantly since then and means different things to different people. More recent interpretations, reflective of the definition used here, include Gen Ronald R. Fogle-

man, "Airpower and the American Way of War," address to the Air Force Association Air Warfare Symposium, Orlando, FL, 15 February 1996, http://www.af.mil/news/speech/current/Air_Power_and_the_American_.html (accessed 13 April 2003); and Arthur K. Cebrowski and Thomas P. M. Barnett, "The American Way of War," *U.S. Naval Institute*, January 2003, 42–43, <http://www.nwc.navy.mil/newrulesets/TheAmericanWayofWar.html> (accessed 13 April 2003).

5. Benjamin S. Lambeth, *The Transformation of American Airpower* (Ithaca, NY: Cornell University Press, 2000), 314.

6. Lambeth states: "One must never forget that the operational setting of the 1991 Gulf war was almost uniquely congenial to the effective employment of airpower." *Ibid.*, 300; Thomas A. Keaney and Eliot A. Cohen surmise that airpower's dominance in the Gulf War was, in part, a result of "special circumstances." Keaney and Cohen, *Revolution in Warfare? Air Power in the Persian Gulf* (Annapolis, MD: Naval Institute Press, 1993), 225.

7. Graham Allison and Phillip Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis* (New York: Addison-Wesley Educational Publishers, Inc., 1999), 111–20.

8. A. T. Mahan, *The Influence of Sea Power upon History 1660–1783* (New York: Dover Publications, Inc., 1890), 28.

9. *Ibid.*, 28–29.

10. *Ibid.*, 287.

11. *Ibid.*, 287–88.

12. Corbett, *Some Principles of Maritime Strategy*, 316.

13. *Ibid.*, 318.

14. Giulio Douhet, *Command of the Air*, trans. Dino Ferrari (Washington, DC: Office of Air Force History, 1983).

15. William Mitchell, *Winged Defense: The Development and Possibilities of Modern Airpower—Economic and Military* (1925; repr., New York: Dover Publications, Inc., 1988).

16. John A. Warden III, *The Air Campaign* (New York: toExcel, 1998).

17. AFDD 1, *Air Force Basic Doctrine*, 29.

18. FM 1, *The Army*, 14 June 2001, 23–24.

19. Gray, *Modern Strategy*, 164.

20. *Ibid.*

21. "Army Forces and the JFC" (lecture, Air Command and Staff College, Maxwell AFB, AL, January 2002).

22. Robert Wall, "Spying Resistance," *Aviation Week and Space Technology*, 28 April 2003, 51.

23. Sun Tzu, *The Art of War*, trans. Samuel B. Griffith (London: Oxford University Press, 1971), 102–10.

24. FM 3-0, *Operations*, 14 June 2001, 4-4.

25. *Ibid.*

26. "Army Transformation Roadmap," *The Army Vision*, October 1999, http://www.army.mil/vision/Transformation_Roadmap.pdf (accessed 22 February 2003).

27. Alan Vick et al., *The Stryker Brigade Combat Team: Rethinking Strategic Responsiveness and Assessing Deployment Options* (Santa Monica, CA: RAND, 2002), xiv–xvi.

28. Corbett, *Some Principles of Maritime Strategy*, 307–24.

29. Department of the Navy, *Forward . . . From the Sea: The Navy Operational Concept*, March 1997, 66.

30. *Ibid.*, 79.

31. *Ibid.*, 74.

32. Corbett, *Some Principles of Maritime Strategy*, 316.

33. The seeds of the Second Peloponnesian War were sown in 434 BC when Epidamnus enlisted aid from Corinth (a Spartan ally) after being denied by her colonial power, Corcyra. Corcyraean outrage over the Corinthian aid led to war, prompting the Corcyraeans to petition Athens' help. Fearful of Corinthian power, Athens dispatched a fleet of triremes to support Corcyra with strict orders not to fight unless attacked. When Corcyra began to lose

the battle, the Athenian fleet was drawn into the conflict. Strassler, *The Landmark Thucydides*, 16-32.

34. "JF-519 NAVFOR in Support of the JFC" (lecture, Air Command and Staff College, Maxwell AFB, AL, 1 February 2002).

35. According to the Combined Air Operations Center, for the period from 7 October to 23 December 2001, the US Navy flew 4,900 of the 6,500 strike sorties but delivered only 30 percent of the ordinance. In contrast, the USAF flew 25 percent of the strike sorties but delivered 70 percent of the ordinance. Furthermore, B-52 and B-1 bombers based in Diego Garcia flew just 10 percent of the strike missions but delivered 65 percent of all weapons dropped. Anthony H. Cordesman, *The Lessons of Afghanistan* (Washington, DC: Center for Strategic & International Studies, 2003), 4-5. For a more laudatory view of the Navy's performance, see Vice Adm Mike Mullen, US Navy, "Capture the Vision," *Proceedings*, US Naval Institute, April 2002, 36-39.

36. Gray, *Modern Strategy*, 233.

37. Raymond O'Mara and Everett C. Dolman, ". . . to Command the Air" (unpublished paper, Maxwell AFB, AL: School of Advanced Air and Space Studies, n.d.), 22.

38. James Corum, "The Myth of Air Control: Reassessing the History," *Aerospace Power Journal* 14, no. 4 (Winter 2000): 61-77.

39. Quoted in Walter A. McDougall, . . . *The Heavens and the Earth: A Political History of the Space Age* (Baltimore, MD: Johns Hopkins University Press, 1985), in Douglas Aircraft Company, Inc., Report No. SM-11827, "Preliminary Designs of an Experimental World-Circling Spaceship," 2 May 1946, 8.

40. Air Force Space Command, *Strategic Master Plan FY04 and Beyond*, 5 November 2002, 8.

41. Lupton, *On Space Warfare*, 19.

42. The absentee ratio for global access would be about six, comparable to ratios for terrestrial platforms. However, it is only about five at 500 km altitude with a responsiveness of about an hour for conventional weapons delivered from space using reentry vehicles. Preston et al., *Space Weapons*, 47.

43. Gray, *Modern Strategy*, 261; and Lupton, *On Space Warfare*, 22.

44. Billman, "Inherent Limitations Space Power," 524; Department of the Air Force, *Global Presence 1995* (Washington, DC: Government Printing Office, 1995), 13.

45. Brian E. Fredriksson, "Fires from Heaven: The Application of Force through Space" (unpublished paper, Maxwell AFB, AL: Air Command and Staff College, 2002) for more information on space-transiting force applications systems.

46. Gordon R. Middleton compared air and space power for the characteristics of speed, range, flexibility, precision, and lethality in "Space is a Different Place" (unpublished paper, Maxwell AFB, AL: Air War College, 1992), 5-6.

47. *SPACECAST 2020 Executive Summary* (Maxwell AFB, AL: Air University Press, 23 June 1994), i.

48. Christian C. Daehnick, "Blueprints for the Future: Comparing National Security Space Architectures," in *Beyond the Paths of Heaven: The Emergence of Space Power Thought*, ed. Col Bruce M. DeBlois (Maxwell AFB, AL: Air University Press, September 1999), 109.

49. Preston et al., *Space Weapons*, xx.

50. Lupton mentions six environmentally influenced characteristics: global presence, quasi-positional siting or restriction due to orbital mechanics; congregational tendency (concentration of satellites in certain orbits); long-range electromagnetic weapons effects (lack of atmospheric interaction for space-to-space weapons); hypervelocity kill (easier also due to lack of atmosphere); and infinite operating area. His logistically influenced characteristics include: logistical handicap (other mediums are logistically easier); inaccessibility; lack of manning (space forces are primarily unmanned); and altitude/security tradeoff (lower altitudes are more vulnerable). Lupton's politically/legally influenced characteristics include legal overflight (over sovereign territories); vehicular sovereignty (like naval forces,

sovereignty resides with the vehicle not the location); and political insensitivity. (Space forces are “out of sight out of mind,” but this also makes them more vulnerable.)

51. DeBlois, “Ascendant Realms,” 564.

52. Gregory Billman, in an otherwise insightful assessment of space power, concludes that space does not have any inherent limitations. Billman, *The Inherent Limitations of Space Power*, 555.

53. Gray, *Modern Strategy*, 263.

54. Preston et al., *Space Weapons*, xxi.

55. *Ibid.*, 43.

56. Charles W. L. Hill and Gareth R. Jones, *Strategic Management: An Integrated Approach* (Boston: Houghton Mifflin Company, 1995), 69–70.

57. The White House, *ABM Treaty Fact Sheet* (Washington, DC: Office of the Press Secretary, 13 December, 2001), <http://www.whitehouse.gov/news/releases/2001/12/print/20011213-2.html> (accessed 7 June 2003); and The White House, *National Policy on Ballistic Missile Defense Fact Sheet* (Washington, DC: Office of the Press Secretary, 20 May 2003), <http://www.whitehouse.gov/news/releases/2003/05/print/20030520-15.html> (accessed 7 June 2003).

58. Daehnick, “Blueprints for the Future,” 11.

59. Maj Fred Marheine also reached this conclusion based on his analysis of US and Japanese development of undersea theory prior to and during World War II. He states, “In short, exploiting the space medium offers the opportunity to achieve effects not possible via any other media. The clearest advice the naval cases offer is that new and potentially decisive effects are possible through the emerging ability to exploit a medium. Determining what these effects may be requires that we first develop the theory to understand what potential capabilities are possible as a result of the physical characteristics of the medium.” Maj Fred H. Marheine, “Do We Need a Separate Space Theory: The Lessons of History” (master’s thesis, School of Advanced Airpower Studies, 2001), 82.

Chapter 4

Space Power Theory

The future of airpower was clearly discernible in 1918; the future of space power is similarly discernible today, following the experience of Desert Storm. Space power, in common with sensible approaches to sea power and airpower, can and should aspire to make the critical strategic difference in war. Despite its growing importance, no comprehensive theory of space power has been formulated.

—Colin Gray

In the emerging, less controllable world of global commerce and borderless nations, the military medium of dominance and, hence, of choice to power elites will be the aerospace continuum because of its universal, rapid access and unique vantage point. Hence, the control and exploitation of that medium, more than any other, will offer the widest range of military options and the highest degree of military power.

—Carl Builder

In his introductory essay to Clausewitz's classic, *On War*, Peter Paret eloquently describes the object of theory. He states, "The theory of any activity, even if aimed at effective performance rather than comprehensive understanding, must discover the essential, timeless elements of this activity, and distinguish them from its temporary features."¹ Indeed, this statement aptly summarizes the goal of this chapter.

On the continuing path toward a space power theory, this chapter begins with a more detailed examination of the purpose of theory, which sets the criterion by which to judge both extant theory and that proposed herein. Next, a review of current space power theory elucidates both the strengths and shortcomings of existing thought. Then, using the unique characteristics of space power derived from the enduring functions of military power in the previous chapter, a framework is developed that seeks to uncover the timeless elements of this activity called space power. These timeless elements—codified in laws, rules, and precepts—form the basis of a prototype theory unified by the basic principle of globalness.

Purpose of Theory

In essence, a theory is an explanation. As such, theory can explain at a multitude of levels, from a unifying theory of all things to the best way to put on your pants in the morning. In addition to scope, theory can vary in purpose. For example, military historian Harold Winton outlines five purposes for useful theory: "to define, to categorize, to explain, to connect, and ideally, to anticipate."² Judson Jussell condenses these purposes into three: to define, to explain, and to predict.³

Clearly, a useful theory of space power would accomplish all these ends. But developing such a comprehensive theory for space power, or any mili-

tary power for that matter, remains a worthy yet elusive goal. Quite simply, defining what a theory should do is easier than actually proposing a theory that meets these objectives.

Current Space Power Theory

Although Colin Gray's admonition regarding the dearth of space power theory in the epigraph rings true, a smattering of innovative thinkers has advanced ideas for space power theory, or at least, for the necessary components of some future theory. Each contributes useful precepts and principles, yet a brief review shows that all fall short of a truly comprehensive theory.

The present attempt to advance theory begins with a review of current space power theories. These theories fall within the rubrics of classical theory, categorizations, and propositions.

The Classical Theorist School

Some of the most fruitful space power theorizing has come from extending existing theories of land, sea, and airpower to the realm of space. Colin Gray proposes Clausewitzian foundations as a basis for building a theory for space.⁴ According to Gray, existing theories of sea power and airpower have already provided many of the elements of space power theory. For example, the idea of space control is borrowed from both sea and airpower theorists, while notions of space blockade and choke points evolved from naval origins.⁵ Yet, there is no body of writing "which attempts to explain in broad terms what space power is and how it will work as a pervasive, technologically dynamic influence upon strategic history in ways complementary to land-, sea-, and airpower."⁶

Given the similarities of the vast expanse of oceans to that of space, several authors have proposed sea power constructs for space. For example, Martin France applies Alfred Thayer Mahan's conditions of sea power (geography, physical conformation, extent of territory, size of population, character of people, and character of government) and its elements (position, bases, and the fleet) to the realm of space.⁷ In this view, space power is a function of national capabilities, character, and geography. In contrast to France's Mahanian view, John Fox argues that near-term space strategy more closely resembles the joint-arms concept forwarded by Corbett than the dominant sea power conception of Mahan. Fox observes that gaining space control mirrors the temporary and local control of ports and choke points advocated by Corbett rather than the decisive force-on-force battles between blue-water fleets envisioned by Mahan.⁸ While both naval theorists rightly assert the need to control interstate ocean commerce, Fox maintains that space will continue to be a crucial part of joint military operations, instead of an independent form of warfare, for the near future.⁹ George and Meredith Friedman see analogies between sea and space power as well. For example, both sea and space forces operate away from land for

months on end, naval and space vessels are expensive and few in number (compared to land/aircraft), unseen physical and economic “geography” determines operational patterns, and the vastness of the medium provides inherent protection.¹⁰

In *Astropolitik*, Everett Dolman extends the Mahanian geopolitical conception of power further, arguing that the United States, or any other aspiring space power, should endeavor to seize control of the strategic narrow of LEO. Dolman sums up his simple blueprint for space control with the dictum: “Who controls low-Earth orbit controls near-Earth space. Who controls near-Earth space dominates Terra. Who dominates Terra determines the destiny of the world.”¹¹ No doubt, Dolman takes a provocative stand, but one having a firm foundation in the geopolitical elements of space power. Dolman considers *Astropolitik* a long-term grand strategy, where the militarization of space is a means to an end. That end: a benevolent hegemony controlling the free market sovereignty of space to “maximize efficiency and wealth.”¹²

Like Dolman, James Oberg makes significant contributions to the development of space power theory based on classical theoretical constructs. His elements of space power—facilities, technology, industry, hardware, economy, populace, education, tradition and intellectual climate, geography, and exclusivity of capabilities/knowledge—are distinctly Mahanian. Unlike Dolman, Oberg does not posit a unifying principle or grand strategic vision. Rather, he proposes building blocks for a theory in the form of truths and beliefs. He begins by stating, “The primary attribute of current space systems lies in their extensive view of Earth.”¹³ While almost all functions performed by space systems have terrestrial equivalents, the vast, global nature of space affords “worldwide access in time spans measured in minutes as opposed to hours and days.”¹⁴ His corollary, that a space vehicle can view vast areas of Earth’s surface, reflects the fundamental characteristic of perspective.

Oberg rightly acknowledges the prolific commercial space industry, especially in the area of communications, but also in imagery, navigation, and Earth sensing.¹⁵ Not only does this affect the economic instrument of power, but the combining of traditional military functions on civilian platforms also creates difficulties for military strategists. The ability of any nation, organization, or individual to purchase space-derived information or turnkey capability greatly expands the notion of who has and what is space power. Oberg then jumps to the conclusion that “a national power theory based solely on military-exclusive generalities and tenets would be foolish.”¹⁶ While close ties to the commercial and civil communities factor in the employment of space, a theory for military applications is still feasible. If that were not the case, airpower theory would have to include all civilian aviation—and land power theory all car, truck, and rail traffic—as part of its military theory.

Oberg is more directly on the mark with his second basic truth about space power: that space exists as a separate medium with its own laws of motion and environmental characteristics. Many of the tenets and propositions of space power derive from this truth, and rightly so, for the medium defines space power’s fundamental character as is the case with air,

land, and sea power. The unique physical attributes of space, he claims, clearly differentiate space power from other mediums of national power.¹⁷ An important part of this difference is the relative lack of human presence in the medium itself.

Oberg also posits temporal aspects of space power that he argues are only valid “from our vantage point in history.”¹⁸ These include the need for technological competence, the inevitability of space weaponization, the requirement for physical human presence for greater situational awareness, the expense of space systems, and the need for continued research and exploration. Perhaps the most prophetic tenet resembles the preaching of Dolman. Oberg states that the “control of space is the linchpin upon which a nation’s space power depends.”¹⁹ While not going as far as Dolman to argue that space control is the linchpin for all national power, the access and control of space, which then allows exploitation of the medium, is a fundamental focus for space power theory.

The Categorical School

After defining *space power* as the “entire astronomical capabilities of the nation,” David Lupton asks the somewhat self-evident question, “Should there be a military component to space power?”²⁰ In the process of answering, he proposes four basic schools of thought.²¹ Proponents of the *sanctuary school* see space as a war-free zone devoid of weapons. The primary value of space systems is perspective, “the ability to ‘see’ within the boundaries of sovereign states” for the purposes of maintaining deterrence.²² The sanctuary position allows for military related systems, like those for intelligence gathering, reconnaissance, surveillance, and positioning, but specifically eschews weapons precisely because they threaten the enormously valuable space capabilities. The weapons-free sanctuary of space must be maintained for the purpose of space observation; otherwise the world will be a more dangerous place. The *survivability school* agrees that space systems can perform these military functions, but views space systems as inherently vulnerable, therefore requiring protection through defensive measures and through denying others accessibility to space. Indeed, the vulnerability of space systems calls into question the military value of space forces. States too reliant on space power may find themselves in an extremely weakened position should their own access be denied.

The *high-ground* enthusiasts view space as the ultimate high ground with the potential for domination over low-lying areas. In their opinion, space is a battlefield, where future wars will be won and lost. The high-ground school believes that with a full compliment of space weaponry, space forces can be the dominant form of military power. They argue that global presence combined with space-based weapons employed for ballistic missile defense could result in replacing the strategy of assured destruction with a strategy of assured survival. The *space control school* advocates see space and terrestrial forces as coequal but that whomever controls space controls Earth. This implies that space control is a necessary condition for

control of surface environs. The space control school argues that the capability to deter war is enhanced by the ability to control space.²³

Michael Mantz's detailed and aggressive vision for the military use of space power falls distinctly in the high-ground school. In *The New Sword, A Theory of Space Combat Power*, Mantz presents an organizational doctrine contingent on a robust military space force capability. Mantz proposes three main roles and missions: space support, force enhancement, and space combat.²⁴ The latter consists of space denial, space strike, and space protection. The bulk of his paper describes a space combat architecture involving sensors, battlefield management/command, control and communications, platforms, and weapons and describes in detail how they could be employed to accomplish space denial, strike, and protection. Mantz defers theory to an appendix where he lists 10 axioms of space combat power.²⁵ His "theory to orbit by," in deference to Carl Builder's "theory to fly by," states, "Space combat power can be applied decisively (and independently of airpower) by striking at the national elements of value of the enemy. Unlike airpower, space control may not be a prerequisite for the exploitation of space (e.g., space combat support and space strike). Like airpower, space power must be centrally and independently controlled."²⁶

The Propositional School

The epitome of the propositional school is Michael Smith, who describes the nature of space power in his "Ten Propositions Regarding Spacepower," based on the model provided by Phillip Meilinger's *Ten Propositions Regarding Airpower*.²⁷ He begins by defining *space* as a distinct medium, separated from the air medium by a transverse region where aircraft cannot fly and satellites cannot orbit.²⁸ He then describes the essence of space power as global access and presence, which serve as the most compelling reasons to orbit satellites. His argument is buoyed by a case study of the use of observation satellites in the Cold War. Like Lupton, Smith considers space power to encompass a state's entire space activities, from civil to commercial to military. Furthermore, commercial assets make all states potential space powers. A space power needs a cadre of trained professionals dedicated to space operations, and these will most likely come from the space industry. On an operational level, Smith argues for centralized control of space assets, the necessity of space control, and the inevitability of space weaponization. Perhaps most insightful, however, is his proposition that space power is a coercive force. The mere presence of space assets has the potential to influence actors hoping to conceal activities.

The integration of space assets in the sensor-to-shooter loop plus the inevitable evolution of space-based weapons provide not only a deterrent capability but a compelling threat as well. Smith then synthesizes his 10 axioms into a rough sketch of a space power theory. He cites Sun Tzu and Clausewitz as inspiration for the observation that space power is a tool of statecraft and warfare. The purpose of military space power, according to Smith, is to provide global capabilities to achieve political and military ob-

jectives. Near-Earth space provides access to a global landscape not available to terrestrial forces that “cannot loiter as economically as some satellites.”²⁹ The first and most enduring mission of space force, according to Smith, is to gain space control. Space control means maintaining space situational awareness, ensuring freedom of operations for friendly forces, and denying the same to the enemy.³⁰ Finally, Smith rightly argues that space power will not usurp the mission of terrestrial military forces.³¹ Rather, he recommends a combined arms approach that does not “put all the eggs in the one basket” of space or any other medium. In the near term, leveraging the advantages of space to enhance in-theater forces will evolve to include a niche role for force application from space.³²

Summary

All of these existing theories provide useful contributions to an eventual space power theory. As was the case in chapter 2, the many commonalities suggest fundamental truths about the nature of space power for political and military purposes. Together, they build from previous theories of military power, observations about the medium, efforts to categorize elements of systems, and projected means of employment.

Yet, none build from a foundation that characterizes the fundamental nature of space power. Herein lies the purpose of the next section, to use the characteristics defined by the medium to describe how space power achieves presence, response, observation, and destruction in order to deter or compel to achieve a political purpose.

Prototype Theory

This section proposes a rudimentary theory of space power. While far from a comprehensive theory of space power, it completely fulfills the criteria of Clausewitz, Winton, and Jussell. The theory first begins with principles regarding the nature of military power and seeks to unify the smattering of thought that pervades this field into a practical framework that attempts to define, explain, and predict. The proposed theory is consistent with and reflective of many of the concepts proposed by other theorists, as it well should. The focus here is only on the military use of space power as a distinct element of the military instrument of national power—one that is fundamentally unique, and one that requires a theory unto itself.

The logical starting point is the top of the power pyramid where Clausewitz’s timeless truth that war is an extension of politics applies. At the grand-strategic level, the political object—be it conquest of territory for material gain or security, or deterring others from doing so—is the basis for the exercise of the instruments of power. The military option provides one mechanism for deterring or compelling another to achieve the political purpose. Space power should deter and compel through the same military functions as do land, sea, and air forces. But space power divines its

unique and fundamental character from the inherent characteristics of the medium to provide presence, response, observation, and destruction. This theory defines that character.

Before continuing, a few definitions are necessary. A *law*, as it is used here and defined by Webster, is a statement of an order or relationship among phenomena that, as far as is known, is invariable under given conditions.³³ Clausewitz defined law in a cognitive sense as “the relationship between things and their effects.”³⁴ A *principle* is a comprehensive and fundamental law. It “represents the spirit and the sense of the law,” according to Clausewitz.³⁵ A *precept* suggests something advisory but not obligatory. A *rule* applies to more restrictive or specific situations and, as the proverb goes, there is an exception to every rule. In using these terms, one must heed Clausewitz’s warning that war may be described by, but is not governed by, laws. This thesis, however, is not a prescriptive formulation detailing exactly how to employ space forces. It is a conceptualization expressed in a compact form intended as a guide for critical thought.

What follows is an application of the presence-perspective-response-destruction framework discussed in the previous chapter. The common thread in this conceptualization of space power is its global nature; hence, we begin at the end with a unifying principle called *globalness*. From space power’s global presence, perspective, response, and destruction we derive laws, precepts, and rules particular to space as a unique (though not necessarily independent) form of warfare. While far from a comprehensive characterization of space power, this prototype theory provides an initial step toward space power theory.

The Unifying Principle of Globalness

Space surrounds the planet. While not absolutely pervasive (subterranean and deep submarine realms are largely inaccessible from space), systems in space could presumably reach every nook and cranny the world over. In contrast, land and sea abut only the littoral areas—the coastlines—of the other. Air adjoins both land and sea in a manner that makes the entire realm littoral, especially from the vantage of space. Like the game of rock-scissors-paper, sea forces routinely project their power to strike targets on land, air forces can sink ships, and land forces can destroy space ground control facilities. However, only space can exert persistent and complete influence over the other realms (recall the common military functions of presence, perspective, response, and destruction). Niccolò Machiavelli understood this notion and used it in a similar fashion in his own day, arguing that the Swiss pikemen dominated the French cavalry, which in turn dominated the Spanish *tercio*, which dominated the Swiss pikemen. The only way to assure victory, according to Machiavelli, was with a fourth option wholly outside the extant paradigm. In his case, Machiavelli advocated a citizen militia imbued with military “*virtù*.”³⁶ The unifying thread that distinguishes space power is the global capability space power exerts in each of these dimensions. Hence, the unifying principle of

space power, which gives space a distinct character, is its global nature—defined here as *globalness*. The Principle of Globalness states that space allows global presence, perspective, response, and destruction in a manner unachievable by other means.

The term *globalness* explicitly enunciates the worldwide influence of space forces.³⁷ Space forces provide global interconnectivity to a degree unmatched by other means. While landlines and radio communications could, potentially, blanket the land and extend across oceans, only space power, by virtue of its *globalness*, provides truly comprehensive coverage of the Earth and near-Earth environs. *Globalness* also extends to sensor coverage, be it reconnaissance, surveillance, weather, missile warning, or the like. Offensively, *globalness* means the ability to strike at any target regardless of geographic boundaries. Early airpower enthusiasts like Mitchell and Douhet touted the airplane's ability to bypass ground forces to strike at a state's vital center. *Globalness* is more than that. Space power could conceivably strike anywhere at any time, and assuming space superiority, there is little an adversary could do about it. Satellite-based weapon systems could further attack targets in orbit, engage high-value targets with little warning, provide fire for close support of surface conflict, or strike strategic targets deep within countries.

Globalness, though seemingly Earth-centric, applies beyond near-Earth space. Brian Sullivan suggests that what is commonly called space power is really "Earth power," since the power exercised from orbital space is focused on the planet and its inhabitants.³⁸ However, space surrounds not only Earth, but also all other heavenly bodies in the ever-expanding universe. If humans venture beyond our near-Earth existence, it will be through the vacuum of space. To extend *globalness* beyond the confines of Earth might require another term, on the order of *universalness*, which portends that space power provides universal presence, perspective, response, and destruction in a manner unachievable by other means.³⁹ Although the concept of *universalness* is well beyond the scope of this paper, the concept is introduced here simply to provide perspective, with the suggestion that the theory holds true beyond the Earth-centric of *globalness*. For the near future—at least the next 50 years or so—the Earth-centric theory remains most relevant. The work that follows builds on this principle of *globalness*. Each of the following subordinate laws derives from the exploitation of the medium as used to achieve presence, perspective, response, and destructive might via military means in support of political ends.

The First Law of Presence: Control of Space

The First Law of Presence is that control of space is necessary, not only for the exploitation of space, but increasingly for the exploitation of the other military realms as well. As stated in the previous chapter, presence derives from the ability to sustain influence in a particular place. If an adversary can prevent your freedom to do so, he can deny presence. Therefore, the ability to operate freely in space implies at least some level of control of the medium. One cannot have presence in space if the adversary can prevent you from

existing in that medium. The United States and other space-faring nations currently enjoy permissive control of space by virtue of its implied sanctuary status. No country actively prevents others from launching satellites or maintaining satellites in orbit (albeit limitations of technical transfer and allocation of orbital slots is a tacit form of space control). Temporary, local, or permissive control permits operations. The ability to temporarily, locally, or completely deny existence in space is the positive or overt control of space.

Most space theorists agree with the importance of space control. Gray deems the concept worthy of “master status,” decreeing, “If space control is lost or severely contested, almost everything else . . . will be rendered irrelevant, at best.”⁴⁰ Classical school theorists consider space control on par with the ideas of air and sea control. For example, France notes that the former US Space Command definition for *space control* “to assure access to space, freedom of operations within the space medium, and an ability to deny others the use of space, if required,” is an analog to the Mahanian definition of control of the sea.⁴¹ Others stake the same claim. M. V. Smith lists “space control is job one” as one of his 10 propositions regarding space power. Oberg considers space control the linchpin of space power.⁴² Only Mantz caveats the concepts by stating that total space control is neither achievable nor necessary given the extensiveness of space, though he recognizes the need for temporary or limited control.⁴³ Dolman takes the concept of space control even further, believing control of space “determines the destiny of the world.”⁴⁴ Indeed, the law of control of space includes this potentiality also.

Since space power can affect other mediums by means of global presence, perspective, response, and destruction, it is a necessary condition for the exploitation of all other mediums as well. With few exceptions, space forces possess the theoretical ability to find, fix, track, and destroy targets in the air, on land, or at sea. Now that is not to say it is a sufficient condition. Having control of space does not necessarily provide control of air, land, or sea. However, with sufficient resources and technology, a space power could exercise general control of the other mediums from space. Orbiting weapons platforms could conceivably destroy or incapacitate weapons in the other mediums. Space-based weapons have the potential to achieve air superiority and sea and land control. Just as air control is today a necessary condition for the successful prosecution of land and sea operations, so it is for the United States that space control is necessary for the full exercise of air, land, sea, and information power. Currently, much of space power’s functioning support is based on the ground; therefore, some control of land is a necessary, but again not sufficient, condition for space power (in the same way that airpower requires ground- or sea-based landing and repair facilities and troops to secure them). The difference is that space power has the capacity to dominate all other forms of military power.⁴⁵

Unlike other forms of military power, which by nature are regionally focused and operate with a degree of autonomy, the global presence of space forces dictates both centralized control and centralized execution. Space forces’ ability to respond, often simultaneously, to many points on the globe, and the limited

availability of these resources, dictates centralized command and control. Furthermore, deference to autonomous operations rather than human operators for most space operations necessitates centralized command and control. As a result of these factors, most space systems today are managed from a central control station and apportioned to theaters as needs arise. Theater commanders cannot exercise tactical control (TACON) for assets depended on by other theaters or even nonmilitary entities. For example, while Air Force Space Command can and does optimize GPS at the request of theater commanders, authority for enacting its selective availability capability to degrade the signal rests with the president because of its many civilian uses.

Centralized control and centralized execution is a rule, not a law. There are systems and circumstances calling for decentralized control and/or decentralized execution. Space transiting systems, like a space operations vehicle, or platforms apportioned in their entirety to a theater combatant commander or agency could be assigned operational control (OPCON) for the asset for a period of time. Theater commanders could assume TACON for intelligence, surveillance, and reconnaissance (ISR) assets assuming they possessed the command and control functions, perhaps relayed through a central control center, for the satellites or satellite services under their command.

A parallel exists with airpower. Airmen generally ascribe to centralized control, decentralized execution as the best means to effectively employ airpower, citing the fragmented control by competing commanders during the initial engagement of World War II and the entire Vietnam conflict as evidence.⁴⁶ There are, however, circumstances where airpower's decentralized control/decentralized execution works well. For example, combined arms operations like the German blitzkrieg and US Marine Corps doctrine effectively employ decentralized airpower under the direction of ground forces. The British were reasonably effective in their use of airpower to police their far-flung empire, and the French effectively employed "penny packets" of airpower to fight guerilla tactics in the Algerian War for independence.⁴⁷ Space assets are no different in this respect.

The Second Law of Presence: Omnipresence

Having control of space enables the second law of presence, the Law of Omnipresence, which states: *Because space systems exist and exert influence over all other mediums in a persistent global manner, they exert presence everywhere, all of the time.* The freedom of overflight, or the trans-sovereign operation of space forces, facilitates omnipresence.⁴⁸ While this presence is fundamentally different than with surface and air forces, it is, nonetheless, real. In many ways, virtual presence is more pervasive than so-called real presence, and often cheaper. Although an adversary cannot see space forces, it can be made aware of their presence by the effects space systems produce. Adversaries may not realize they are under observation until a space power brings an otherwise inexplicable action to their attention. Once that is done, adversaries may never know when they are not under observation and potential influence. The same space power, if in possession of offensive strike capability,

could make this effect all the more potent. Such omnipresence would give the space power truly global and sustained influence.

For example, the United States could use space reconnaissance systems to detect the movement of a mobile missile system to an offensive position, say a Scud missile launcher moving within range of a neighbor. This information could then be transmitted with a warning notice advising a potential aggressor to cease and desist—an information warning shot. Failing to heed the warning, a burst of kinetic energy could be fired to produce an effect, a small explosion in the vicinity of the missile launcher, for example. If preparation activities continued after the kinetic warning shot, another burst of energy could disable the electronics of the launcher. Demonstrating this capability provides a real, not virtual, presence in the mind of a potential adversary. Most likely, the next warning would be taken as seriously as if ground forces were within artillery range—perhaps even more so. Artillery close enough to be within range is also close enough to be attacked; it is vulnerable to a variety of countermeasures. Most adversaries will not have the ability to directly attack the satellites that threaten them. The example illustrates how space systems, by virtue of the Law of Omnipresence, can both coerce (as in the case of the warning shots) and deter (as, presumably, would happen after the first launcher was disabled).

First Corollary of Presence: Predictability of Trajectories

Not all of the attributes of global presence are positive. Limitations accompany the ability to orbit constellations of satellites that persistently overfly sovereign territory. This ability to maintain presence over the entire Earth is a function of physical laws, namely Kepler's Laws of Planetary Motion and Newton's Universal Law of Gravitation. Kepler's first law, as applied to Earth-orbiting satellites is as follows: The orbit of a satellite is an ellipse with the center at one focus.⁴⁹ The ballistic trajectory of a missile, not including the boost and reentry stages, is also an ellipse, one that intersects Earth's surface.⁵⁰ While the trajectory of an Earth-orbiting object is not static owing to perturbations from air resistance, the oblong shape of Earth and the force of gravity from other heavenly bodies, satellite operators correct for these perturbations to maintain predictable orbits. Ballistic-missile flights are also predictable once the boost phase is completed.

This predictability implies vulnerability. Enemies can plan for satellite passes and take steps to deny overhead visibility. They also can track and target predictable satellite and missile trajectories, provided they have the technology. Since it is easy to know where and when satellites pass overhead, adversaries can easily calculate the trajectory of a ballistic missile assuming an unguided and unpowered reentry vehicle.

The First Law of Perspective: Persistent Global View

While maintaining presence in space affords a unique and inherent power, the fact that this presence occupies the high ground leads to the Laws of Per-

spective. *The First Law of Perspective states, quite simply, that space affords a persistent global view.* By virtue of the ultimate high ground, space systems surround and can view every point on Earth's surface. This is not the case for other mediums. While airborne assets can overfly a position on Earth with the same sensor capabilities that orbit aboard satellites, their view is passing and temporary. While only geosynchronous satellites provide constant view of Earth, constellations of satellites (and in some cases phased satellites in highly elliptical orbits) provide the effect of constant view.

Practical limitations inhibit the degree to which space systems satisfy this law. For example, although hyperspectral, radar, and other advanced technologies provide promise, objects hidden by camouflage or buried underground or deep undersea can avoid overhead observation. But this is a technical, not a theoretical, limitation. Conceivably, technologies will exist that can penetrate and expose the recesses of terrestrial geography. Of course, determined adversaries will still seek to deceive and deny the ability to see everything all the time.

The Second Law of Perspective: Global Connectivity

The perspective of the high ground also allows for connectivity on a truly global scale. While this is not a capability unique to space, for the globalization of communication occurred with the advent of wire and wireless radio communications, it is an inherent characteristic of space power worthy of its own law. Global connectivity characterizes the ability of the space system to transfer information anywhere in the world. Satellite communications provide the most obvious example. While some individual satellite systems are regionally focused, LEO constellations of satellites provide point-to-point communications anywhere in the world. Commercial examples with military applications include the Iridium telecommunications systems and the now defunct Teledesic wideband data system.

Geosynchronous systems like Milstar provide global interconnectivity with relatively few, in this case four, satellites. Furthermore, interconnectivity is not limited to communications channels. The advantage of the GPS constellation is that individual users are connected simultaneously to multiple orbiting transmitters of precise timing and navigation signals. While not connected in two-way communications, the connectivity allows for precise geolocation on a global scale, unlike regional systems. Although the primary advantage of orbiting ABM systems is the ability to target in the boost phase of missile flight, global connectivity of such systems also facilitates coordinating defense against multiple point attacks.

The First Law of Responsiveness: Prompt Global Response

The next set of laws derives from the inherent ability of space forces to react on a global scale. *The First Law of Responsiveness states that space systems have the potential to provide near instantaneous response any-*

where on Earth's surface or in near-Earth space. The law defines two advantages of space power: response time and range.

Space affords military commanders the long-sought ability to react faster than their enemies. The ancient military philosopher, Sun Tzu said, "Appear at places to which he must hasten; move swiftly where he does not expect you."⁵¹ The modern theorist, John Boyd, believed the key to victory was to operate inside the enemies' observe, orient, decide, act (OODA) loop—that is, to be able to perform OODA faster than the enemy.⁵² The ability to act more quickly than an opponent yields natural advantages of maneuver, surprise, and initiative. By virtue of orbital velocity and global coverage, space forces have an innate ability to react quickly. In theory, response can be at the speed of light, as in the case of laser technology. Information transfer through space by radio frequency and laser cross-links occurs at near real time. Physical transport through space is hypersonic, with orbital velocities exceeding 10,000 km/hour. For example, a space shuttle in LEO travels at approximately 30,000 km/hour. Transport vehicles operating at such speeds could deliver a multitude of products from weapons to personnel to humanitarian relief supplies across the globe in a matter of minutes or hours.

The second attribute of prompt global response is range. Space systems possess global range in part because they operate outside the confines of Earth's atmosphere. Once in orbit, space vehicles expend minimal fuel to compensate for orbital decay and perturbation, yet travel at orbital velocities. Constellations of satellites providing global coverage inherently have global range.⁵³ For example, a constellation of GPS satellites in medium-Earth orbit (24,000 km altitude) provides near-global coverage with at least four satellites in view at any one point on Earth. The Iridium commercial mobile communications system initially employed a constellation of 66 satellites in LEO (725 km altitude) to provide at least one satellite in view of any point on Earth.

The Air Force recognizes a need for prompt global response. Under Air Force chief of staff general John Jumper, the Air Force organized six task forces into seven key task forces in 2002, including task forces for Global Strike and Global Reach.⁵⁴ The 1998 US Space Command Long-Range Plan calls for the on-demand ability to strike globally "within minutes" by the year 2020, with limited capability as early as 2010.⁵⁵ Finally, Air Force Space Command is in the process of coordinating a mission need statement for prompt global strike that calls for an ability to strike targets in 120 minutes or less.⁵⁶ The space requirements envisage minimal "silver bullet" capability to deliver weapons on target for the near future. Traditional military theory expounds responsiveness in terms of the ability to concentrate mass on a decisive point—which leads to the next rule.

Mass and concentration take on different meanings for space forces.⁵⁷ Prescribed orbits and the limited maneuverability (space vehicles do not fly about with sudden changes in direction) make conventional concepts of assembling forces in one place impractical. Like airpower in the age of precision and stealth, space forces achieve concentration and mass of effects.

Satellite constellations are inherently networked entities that deliver effects to precise locations without maneuvering to do so. Space traversing systems may serve as an exception to this rule if robust fleets were launched along similar trajectories to deliver mass loads of bombs or supplies. For large-scale movements, however, the more flexible surface or air forces are probably more effective.

The Second Law of Responsiveness: Full-Spectrum Deterrence

The ability to observe and react to any action of an adversary at any time provides the basis for the *Second Law of Responsiveness*, which states that *space systems have the potential to provide full-spectrum deterrence*. Full spectrum means the ability to deter from the lowest levels of conventional and unconventional warfare to the use of nuclear weapons. Constant monitoring and the capacity to negate any offensive act prior to or as it occurs deny the adversary the capability for aggression. The threat of preemptive strike, in theory, could deter an adversary from conducting hostile acts. Granted, an adversary will attempt to deceive or conceal preparatory actions leading to offense. As a result, this law depends on the ability to observe the action. Even if enemies successfully hide preparatory actions, they must still deploy or deliver the blow. During the finite amount of time it takes to do so, the ability for prompt global strike can negate the offensive capability before it culminates. The power to prevent offensive action by preemptive strike or defensive shield provides a deterrent effect for all levels of conflict. Full-spectrum deterrence suggests the superiority of the defense for space forces though, in fact, this is not so.

Space systems are neither inherently offensive nor defensive. Stated in the positive, space systems contribute equally to offense and defense. Gray notes that this dialectic holds regardless of the type of weapon system. "Offense and defense are matters of such subjective judgment at the level of policy, and are so closely interwoven and interdependent in tactics, operations and military strategy, that they have limited merit as the base of a theory to understand strategic history."⁵⁸

Clausewitz tells us that defense is the stronger form of war. Indeed, this is probably true for land warfare, where familiarity of terrain, fortifications, and interior lines provide distinct advantages. The vulnerability of predictable satellites suggests that defense is not the stronger form of war for these assets, however, particularly those in LEO that are susceptible to surface-launched attacks. Then again, the vast openness of space gives orbiting assets with passive and active defensive measures an inestimable advantage. Gray notes, "There is some safety in sheer distance (equal to time, provided speed-of-light directed energy weapons are not relevant)."⁵⁹ On the other hand, space-traversing systems, like a space plane, capable of delivering destructive space-to-space or space-to-surface power, can be offensive in nature.⁶⁰ Space orbiting weapons can be both offensively and defensively oriented. It is in the employment, not the character, of the weapon that offense and defense have meaning.

The First Law of Destructive Power: Equality of Destructive Potential

The First Law of Destructive Power states that space systems have the same destructive potential as systems employed in other mediums. The fact is, the type of weapon, be it matter, energy, or information based, does not define the power behind space, land, sea, or airpower (refer to chap. 2, fig. 3). The possible exception is cyber warfare, though this too is merely the employment of energy (in the form of ones and zeros) as an information weapon. Air, land, sea, or space vehicles could conceivably transmit such informational energy. The dropping of propaganda leaflets by air is an example of the use of an information weapon delivered by aerial means. Nuclear weapons, the most destructive weapons known to man, can be delivered by systems in all mediums. Even in cyberspace the potential to crack into the computer systems of a nuclear power plant could render it a weapon. Air, land, sea, and space systems have the same potential to deliver conventional bombs, directed energy, or kinetic kill vehicles. The altitude of space does give some advantage for space delivery of kinetic kill vehicles, but this distinction can be minimal if alternate kill mechanisms are considered. The bottom line: military force can deliver all types of weapons through any medium, and space force is no different, in theory.

Precept of Precision. In like vein, space systems are no more or less precise than systems operating in other mediums. Some writers consider precision an attribute of space power, mostly because GPS navigation and timing enable the precise delivery of bombs in all weather (as opposed to laser-guided munitions that can be thwarted by smoke, dust, clouds, and other atmospheric disturbances).

However, the use of GPS for precision-guided munitions (PGM) constitutes the use of space to enhance other forms of military power; this is not an inherent attribute of space itself. Similarly, the use of lasers, eventually providing an even more precise application of destructive force, is not limited to space, though there are advantages to operating in a vacuum. The recently developed airborne laser is a case in point. Thus, while space provides an advantageous means for enhancing precision weapons, particularly on a global scale, precision is not an inherent characteristic of the medium.

Precept of Weapons Delivery. While space weapons are equal in effects to other modes of delivery, the means of delivery has meaning in and of itself. Because they are always deployed, space weapons are less intrusive and therefore, in some ways, less provocative. This is a perception that can only be tested in deployment, but numerous analogies can be cited. The visible presence of police at social events has a calming effect on the bulk of crowds. Only the deviants are dismayed by their presence.

Should a potential enemy attempt to counter a space asset with a ground-based weapon, the response in-kind of a space weapon is reasonable. Destruction of a ground antisatellite laser in the heart of China via a space-based laser, for example, could have considerably different political implications than destroying the same site with a B-2. Similarly, destroying a terrorist

training site with a Common Aero Vehicle delivered by a space operations vehicle is intrinsically different than infiltrating the country with a special operations unit to deliver the same amount of conventional explosives.

The Second Law of Destruction: Prompt Global Strike

Finally, global perspective, presence, and response, combined with destructive potential affords *the ability to deliver destructive effects anywhere in the world, which defines the law of Prompt Global Strike*. Be it orbiting platforms with kinetic kill projectiles, so called “rods from god” systems, space-based lasers, electromagnetic weapons, or space-transiting conventional munitions delivery systems (space planes and the Common Aero Vehicle), the key attribute of offensive space power is the ability to destroy terrestrial targets anywhere in the world on very short notice. Space strike systems could strike strategic and tactical targets deep within countries with impunity, inducing unprecedented coercive effects. Furthermore, space forces can provide a global strike while avoiding the logistical footprint and force vulnerability of a forward presence (see fig. 6).

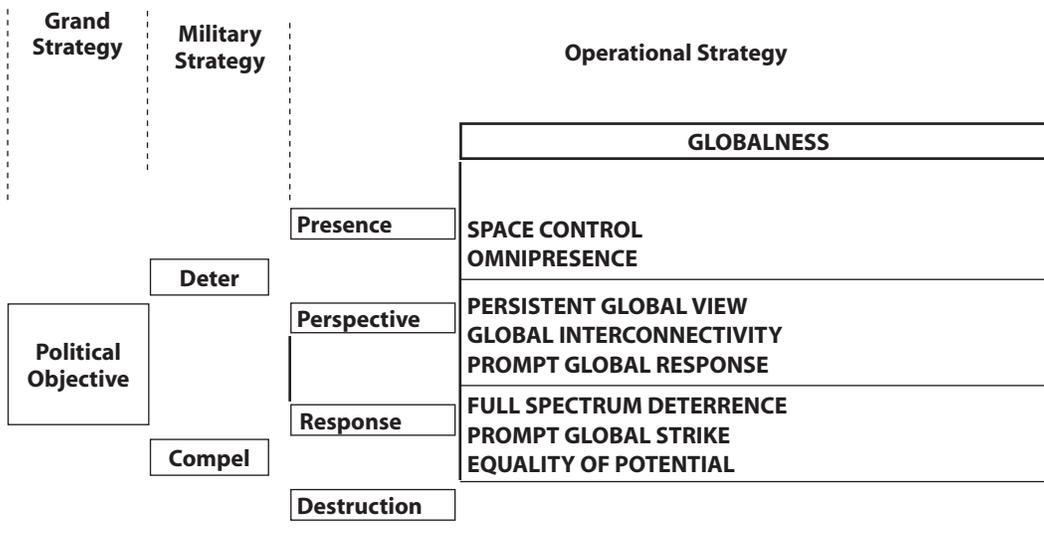


Figure 6. Space power theory at a glance

Summary

The prototype theory presented here is only one small step toward a comprehensive and applicable space power theory; hopefully, it is a significant one. Rather than simply extrapolating from existing theories of space and other mediums, the attempt here was to build from first principles a conceptualization of space power that defines, explains, and predicts. Obvious

overlaps with preexisting theory tend to validate this formulation as well as the ideas of my predecessors.

Unique, however, is the unifying principle of globalness, which connects laws and rules of space power derived from the fundamental functions of presence, perspective, response, and destructive potential. Figure 6 summarizes the results of this analysis. These laws and rules serve as a foundation for a theory of space power.

Notes

1. Peter Paret, "The Genesis of *On War*," in *On War*, 11 (see chap.1, n. 4).
2. Harold R. Winton, "A Black Hole in the Wild Blue Yonder: The Need for a Comprehensive Theory of Airpower," *Air Power History* 39, no. 4 (Winter 1992): 34.
3. Judson J. Jussell, "Space Power Theory: A Rising Star" (unpublished paper, Maxwell AFB, AL: Air Command and Staff College, April 1998), 4.
4. Gray, *Modern Strategy*, 256–57 (see chap. 1, n.1). Gray's Clausewitzian ideas include the following:
 - a. War in space has its own distinctive characteristics but is subject to the purposes of policy.
 - b. Space forces can enhance the ability of other kinds of military power to locate, threaten, harass, and destroy strategic "centers of gravity."
 - c. Space power assuages some of the fog and friction of war but is also subject to these forces itself.
 - d. Space power is an "essential team player," and will probably become the team player with the greatest value in the twenty-first century.
 - e. Just war tradition applies to space power including the principle of proportionality.
 - f. The concept of "decisive points" applies to space as it does for other forms of military activity.
 - g. In space, defense is probably the stronger form of war for high (beyond 35,000 km) and medium (800 to 35,000 km) Earth orbit but probably not in low (150 to 800 km) Earth orbit.
5. *Ibid.*, 257–58.
6. *Ibid.*, 258.
7. Martin E. B. France, "Mahan's Elements of Sea Power Applied to the Development of Space Power," course no. 5602 (Washington, DC: National Defense University, National War College, 2000).
8. John G. Fox, "Some Principles of Space Strategy: or 'Corbett in Orbit'" (Washington, DC: National Defense University, National War College, 2000), <http://www.ndu.edu/nwc/writing/AY00/AA/FoxPaperCorbett2000.rtf> (accessed 1 April 2003).
9. *Ibid.*
10. George Friedman and Meredith Friedman, *The Future of War: Power, Technology, and American World Dominance in the 21st Century* (New York: Crown Publishers, Inc., 1996), 370–71.
11. Dolman, *Astropolitik*, 8 (see chap. 1, n. 2).
12. *Ibid.*, 183.
13. Oberg, *Space Power Theory*, 124.
14. *Ibid.*

15. Ibid., 18–20.
16. Ibid., 125.
17. Ibid., 127.
18. Ibid., 128.
19. Ibid., 130.
20. Lupton, *On Space Warfare*, 7 (see chap. 1, n. 9).
21. Lupton distinguishes his environmental definition of doctrine from fundamental and organizational doctrine. He defines *environmental doctrine* as the best way to employ forces in a particular medium (land, sea, air, or space). This is a step down from the more abstract concept of fundamental doctrine regarding the purposes of military power and the nature and principles of war, and a step above organizational doctrine that defines the organization, roles, and missions of military forces. The latter is the level most commonly published as military doctrine.
22. Lupton, *On Space Warfare*, 35.
23. Ibid., 37.
24. As opposed to those embodied in Air Force and Joint Doctrine, JP 3-14, *Joint Doctrine for Space Operations*, lists four mission areas: space support, space control, force enhancement, and force application. Interestingly, the most recent version of AFDD 2-2, *Space Operations*, integrates space roles in missions within the broader and more numerous Air Force functions specified in AFDD 1, *Air Force Basic Doctrine*, including counterspace, spacelift, counterinformation, command and control, intelligence, surveillance, reconnaissance, navigation and timing, weather services, combat search and rescue, counter air/land/sea, special operations, strategic attack, airlift, and air refueling. AFSC's *Strategic Master Plan for FY04 and Beyond* still lists five mission areas: space force enhancement, counterspace (as opposed to space control), space force application, space support, and mission support.
25. Mantz's axioms of space-combat power are as follows:
 - a. Space strike systems can be employed decisively by striking earth forces, both independently and jointly.
 - b. 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.
 - c. Space strike systems can be employed decisively by striking the decision-making structure (leadership, command and control) of the enemy.
 - d. Space strike systems can deter hostile actions by holding forces, decision-making (leadership and command and control), and infrastructure (industry, transportation, and communications) at risk.
 - e. Space denial systems can be employed decisively by denying enemy access to space-derived data.
 - f. Space denial systems can be employed decisively by physically denying enemy access to space.
 - g. Space protection systems can be employed to assure friendly access and use of space.
 - h. Total space control (the combination of space denial, space protection, and passive space defense measures) is neither achievable nor necessary.
 - i. Space combat power must be centrally and independently controlled.
 - j. Space power is not intrinsically linked to airpower.
26. Ibid., 80.
27. M. V. Smith, "Ten Propositions Regarding Spacepower" (master's thesis, School of Advanced Airpower Studies, June 2001), <http://research.au.af.mil/papers/student/ay2001/>

saas/smith.pdf (accessed 8 February 2003); and Col Phillip S. Meilinger, *Ten Propositions Regarding Airpower* (Washington, DC: Air Force History and Museums Program, 1995).

28. Smith defines the upper boundary of the air medium as 28 miles, the highest altitude achieved by an air-breathing aircraft, and the lower boundary of space as 93 miles. Smith, "Ten Propositions Regarding Spacepower," 44.

29. *Ibid.*, 114.

30. *Ibid.*, 115, 118.

31. *Ibid.*, 120.

32. *Ibid.*, 123.

33. Webster's, 678 (see chap. 2, n. 18).

34. Clausewitz, *On War*, 151 (see chap. 1, n. 4).

35. *Ibid.*

36. Niccolo Machiavelli, *The Prince*, trans. by Russell Price, in *Cambridge Texts in the History of Political Thought*, ed. Quentin Skinner and Russell Price (New York: Cambridge University Press, 1985), 89.

37. The term *globalness*, rather than the term *globalism*, is used because of the latter's common usage in political science. Globalism refers to "a state of the world involving networks of interdependence at multicontinental distances." Accordingly, globalization refers to the increase in globalism. Robert O. Keohane and Joseph S. Nye Jr., "Globalization: What's New? What's Not (And So What?)," *Foreign Policy* 118 (Spring 2000): 104–19.

38. Brian R. Sullivan, "Spacepower and America's Future," in *Spacepower for a New Millennium*, ed. Peter L. Hays et al. (New York: McGraw-Hill Companies, Inc., 2000), 266.

39. The idea that space power is universal is subject to present practical understanding of the dimensions of time and space. Concepts like time travel or higher dimensions of existence may provide other mediums that pervade beyond space.

40. Gray, "The Influence of Space Power upon History," 293–308 (see chap. 1, n. 8).

41. France, "Mahan's Elements of Sea Power Applied to the Development of Space Power," 10–11.

42. Oberg, *Space Power Theory*, 130.

43. Mantz, *New Sword*, 79.

44. Dolman, *Astropolitik*, 8.

45. The great geopolitician Sir Halford Mackinder argued that all of history could be viewed as a cyclical battle between sea and land power, each having temporary periods of dominance and neither (yet) able to completely contain the other. Mackinder, *Democratic Ideals and Reality* (New York: Henry Holt and Company, 1942).

46. AFDD 1, *Air Force Basic Doctrine*, 23.

47. James Corum and Wray Johnson, *Airpower and Small Wars* (Lawrence, KS: University Press of Kansas, 2003), particularly chap. 4, "The French Colonial Wars, 1946–1962, Indochina and Algeria," and chap. 5, "The British Colonial Wars, 1945–1975: Malaya, South Arabia, and Oman."

48. In response to the launch of *Sputnik* in October 1957, the Eisenhower administration created the Advanced Research Projects Agency to oversee research and development of space and other advanced technologies in November 1958. In accordance with this action, the administration promoted a policy for the peaceful use of space that legitimized the overflight of satellites across state borders. This regime was later adopted by the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) in November 1958 and remains in place, albeit informally, today. Hays, *United States Military Space*, 65 (see chap. 1, n. 12); and Stares, *Militarization of Space*, 38–58 (see chap. 1, n. 13).

49. Muolo, *Space Handbook*, 28 (see chap. 1, n. 16).

50. *Ibid.*

51. Sun Tzu, *Art of War*, 96 (see chap. 3, n. 23).

52. Although Boyd never formally published his theories, he did expound upon them in an essay entitled "Destruction and Creation," written in 1976. Boyd's ideas later evolved into a five-part series of briefings available as John R. Boyd, "A Discourse on Winning and

Losing,” August 1987, 2, document no. M-U 30352-16, no. 7791, Air University Library, Maxwell AFB, AL. Lt Col David S. Fadok, “John Boyd and John Warden: Airpower’s Quest for Strategic Paralysis,” in *Paths of Heaven*, 363–64 (see chap. 2, n. 24).

53. Dolman, *Astropolitik*, 81 (see chap. 1, n. 2).

54. Elaine M. Grossman, “Air Force to Name Seven Colonels to ‘Champion’ Key Task Forces,” *Inside the Pentagon*, 21 February 2002, <http://ebird.dtic.mil/Feb2002/s20020022colonels.htm> (accessed 22 February 2002).

55. USSPACECOM Director of Plans, *Long Range Plan: Implementing USSPACECOM Vision for 2020*, March 1998, 65. USSPACECOM was integrated with US Strategic Command as of 1 October 2002.

56. AFSPC 002-01, DRAFT Mission Need Statement, Prompt Global Strike, AFSPC/DRM, 22 October 2001.

57. The use of precision weapons and stealth has altered this notion for airpower as well.

58. Gray, *Modern Strategy*, 181 (see chap. 1, n. 1).

59. *Ibid.*, 257.

60. For arguments for and against space traversing weapon systems, see Fredriksson, “Fires from Heaven” (see chap. 3, n. 45).

Chapter 5

Conclusions

For the U.S. to sustain its superpower status it will become necessary not only to show global awareness through space-based information, but also to project power from space directly to the earth's surface or to airborne targets with kinetic or directed energy weapons.

—USAF Scientific Advisory Board

God and politicians willing, the United States can declare peace upon the world, and win it.

—Ely Culbertson

War and peace coexist. Wars are fought to attain a better state of peace, and respites are used to prepare for the next war so as to maintain and extend that peace. There may come a day when war becomes truly obsolete, and peace is the universal condition of all peoples. Yet, Culbertson's hopeful admonition seems beyond the grasp of even a self-proclaimed benevolent, though dominant, nation. As long as human interests compete, conflict remains inevitable. Conflict, in the absence of higher international authority, results in war when nonviolent coercion fails.

The United States is uniquely poised as the sole superpower to shape the nature of this not-so-anarchical world. However, the opportunity is fleeting. If the United States is to make the most of its power to truly make the world a better place for all, it needs a truly global strategy—military, economic, diplomatic, and informational. The unrivaled US military possesses global reach; yet, unrivaled power cannot be everywhere all of the time. Its ability to control and influence events is practically limited. Moreover, an expeditionary mind-set pervades where task forces are gathered to venture beyond borders when crises arise. This is a reactionary approach based on global reach, not globalism.

Globalness serves as the unifying principle for a basic theory of space power that encompasses descriptive and predictive (though not prescriptive) laws, rules, and precepts. The theory was constructed by first examining the role of space power within the construct of the power cone, a depiction of national power from grand-strategic to tactical levels. This model avers that space power is one form of the military instrument of power—like air, land, sea, and information—employed at the operational or campaign level. The object at this level is to control and exploit the medium of combat to accomplish military objectives.

Next, examination of the various forms of military power revealed the common functions of military power—presence, perspective, response, protection, and destruction. All forms of military power accomplish military objectives

through these functions. The distinctive manner in which they do so is based on the characteristics of the medium. Comparing the forms of military power at the operational level reveals the fundamental character of space power, which, in turn, formed the basis of the theory. An obvious and inherent conclusion is that space power is a unique form of military power. Therefore, space power requires its own theory, and by extension, doctrine and tactics as well.

The previous chapter outlined a foundation for a theory based on these fundamental characteristics. The unifying principle of globalness is derived from these characteristics and links the various laws. The first law of presence is that control of space is necessary, not only for the exploitation of space, but also for the exploitation of the other realms as well. Under most circumstances, space systems are most effectively managed under centralized control and centralized execution. The second law of presence states that because space systems can exist and exert influence over all other mediums in a persistent global manner, they can exert presence everywhere all of the time. A corollary is that orbital and ballistic space systems have predictable trajectories that provide both advantages and vulnerabilities. Among the advantages is persistent global view, the ability to observe every point on the Earth's surface repeatedly, over time. The First Law of Responsiveness states that space systems have the potential to provide instantaneous reaction. The Second Law of Responsiveness states that space systems have the potential to provide full spectrum deterrence, or the ability to deter from the lowest levels of conventional and unconventional warfare to the use of nuclear weapons. The Rule of Offense and Defense purports that space systems contribute equally to offense and defense. The Law of Destructive Power states space systems have the same destructive potential as systems employed in other mediums, all of which can employ matter, energy, and information-based weapons. Finally, the Law of Prompt Global Strike defines the ability for space systems to strike targets anywhere on the Earth's surface or near-Earth space in a matter of minutes. While hardly comprehensive, the theory advances a theoretical construct for space power. The question remains, How useful is this theory of globalness?

Applications

Global theory serves as the basis of a global strategy for a global era. As threats multiply, disperse, and become asymmetric, the relevance of conventional military power diminishes. The enemy, quite often, is no longer a military entity or a nation-state bent on traditional war. As Max Manwarling intones, "Other 'non-traditional' threats emanating from virtually a thousand different political actors with a cause—and the will to conduct asymmetrical warfare—are spreading havoc throughout the global community."¹ Granted, the state must maintain a conventional capability to deter and defeat potential rivals and the occasional rogue. However, a reliance on large conventional forces, combined with an expeditionary mindset, will drain coffers, keep the world community in turmoil, and ultimately

dampen political will. Globalism provides an alternative to address some of today's most pressing problems while preparing for the future.

The United States is already engaged in a global fight against transnational terrorist organizations. While hardly a purely military battle, it does involve armed conflict against nations harboring terrorists, as well as military strikes against terrorist organizations, like al-Qaeda. Contemporary writers argue that coercing such amorphous and, in their minds, amoral actors is at best difficult.² Certainly, space and information assets already contribute a great deal. Imagine, however, a capability to deter terrorism by denying any capability to act: classic defense in support of deterrence. A truly global surveillance capability—largely based in space but also dependent on aerial, human, and information intelligence—that can detect, identify, locate, and track illegal actors is the first line of defense. Once it is clear that intentions are hostile, precise preemptive strikes using space-based assets could eliminate individuals, their assets, and ultimately their ability to act at all. Knowing this, terrorists would be forced to resort to alternative and hopefully peaceful and legal means to air their grievances. If they do not, prompt global strike could quickly disable any credible functioning of their organizations.

As the Law of Full Spectrum Deterrence states, this coercive ability can extend to the upper limits of conflict to deter rogue nations and potential peer competitors from exercising nuclear options. Imagine the ability to strike deep within the heart of a country at the first signs of offensive posturing to destroy an ICBM before it is launched or a bomber en route to its target. The possibility of a strategic or operational-level surprise attack would be remote, and any strategy that relies on such attack would be worse than useless. Even a robust capability of several hundred missiles could be targeted and destroyed using space-based weapons. In this way, an adversary can be deterred from building weapons it knows are defeated a priori.

On a more practical level, global response also allows a benevolent nation to come to the aid of others who need military assistance (to quell internal unrest or prevent humanitarian tragedies, for example) without having to deploy troops into harm's way. Space-based systems that can provide intelligence, surveillance, reconnaissance, navigation, and if necessary, fire support to friendly governments moreover reduces the need to station troops in a multiplicity of locations around the world. In time, this would reduce reliance on conventional forces and budget outlays. Space provides a less invasive commitment to help friendly governments fight their own battles. Such a strategy enhances the effect of global presence without a large deployment of troops.

Final Thoughts

The application of space power's globalness to deter and compel is pervasive. Globalness provides a theory for a global strategy in an age of global threats. The United States, as the world's dominant power, might not seek global hegemony—but it may not have a choice. Today, no state makes in-

ternational decisions without at least considering the US reaction. Whether or not the United States wishes to take up the mantle of global leadership may be moot. Dolman presents a compelling argument that the only realistic option for the United States is to use its dominant power for noble ends “to create for ourselves and for all peoples of the world a safe and prosperous future.”³ Such a peaceful future can be enhanced to a great degree by employing space power in a more comprehensive role. Space power has the potential to one day become the dominant form of military power, just as airpower rose to dominance by the early twenty-first century. Other forms of military power will undoubtedly continue to have significance. An all-star player on a basketball team can carry the bulk of the scoring or make the buzzer-beating shot; however, the individual player cannot win the game alone. Indeed, the synergistic effect of the combined arms approach is an undeniable asset. As Colin Gray rightly observed, “No environment has been retired militarily on grounds of general obsolescence or irrelevance.”⁴ Some wars of the future will require a close-in fight more suited for surface and air forces. However, a nation choosing to fully embrace the globalness of space power, to include weapons in and through space, will gain a competitive advantage over those mired in the past.

The theory outlined here offers an option for conceptualizing space power. It is an option not only for the employment of space power, though indeed that is the focus, but also an option for employing the military instruments of power—air, land, sea, and space—in a manner commensurate with a truly global strategy. Over time, space power may become the dominant form of military power to control and influence the world. A bold and daunting concept it is, but military planners and government decision makers must seriously consider it if the United States is to continue as the preeminent world power, one dedicated not toward war and conquest, but to lasting peace.

Notes

1. Max Manwaring, “The United States Security Policy in the Western Hemisphere: Why Columbia, Why Now, and What Is to Be Done?” *Small Wars and Insurgencies* 12, no. 3 (Autumn 2001): 67–96. Also see David A. Baldwin, “Security Studies and the End of the Cold War,” *World Politics* 48 (October 1995): 117–41.

2. Joseph Leggold argues that trans-state organizations like terrorists and drug traffickers are very difficult to deter because they have very different motivations than democratic governments. State sponsorship tends to enhance coercibility, since it provides coercers fixed, known targets. Leggold, “Hypothesis on Vulnerability: Are Terrorists and Drug Traffickers Coerceable?” in *Strategic Coercion: Concepts and Cases*, ed. Lawrence Freedman (Oxford: Oxford University Press, 1998), 131–50. Blyman and Waxman discuss the difficulty the United States faces in coercing lesser adversaries, particularly rogue nations and leaders in Daniel Byman and Mathew Waxman, “Defeating US Coercion,” *Survival* 41, no. 2 (Summer 1999): 107–20.

3. Dolman, “Space Power and US Hegemony: Maintaining a Liberal World Order in the 21st Century,” forthcoming in *Space Weaponization*, ed. John Logsdon, a Macarthur Foundation publication. Dolman argues further that by seizing the initiative and securing low Earth orbit now through space weaponization, the United States can maximize its era of hegemony.

4. Gray, *Modern Strategy*, 228 (see chap. 1, n. 1).

Glossary

ABM	antiballistic missile
AFDD	Air Force Doctrine Document
AFSPC	Air Force Space Command
DSP	Defense Support Program
GPS	Global Positioning System
ICBM	intercontinental ballistic missile
ISR	intelligence, surveillance, and reconnaissance
JDAM	Joint Direct Attack Munition
JP	joint publication
LEO	low Earth orbit
OODA	observe, orient, decide, act
OPCON	operational control
PGM	precision-guided munition
RAND	research and development
TACON	tactical control
UAV	unmanned aerial vehicle
USSPACECOM	United States Space Command

Bibliography

Books and Chapters

- Allison, Graham, and Phillip Zelikow. *Essence of Decision: Explaining the Cuban Missile Crisis*. New York: Addison-Wesley Educational Publishers, Inc., 1999.
- Art, Robert J. "The Fungibility of Force." In *The Use of Force*, edited by Robert J. Art and Kenneth Waltz. Lanham, MD: Rowman & Littlefield Publishers, Inc., 1999.
- Bacevich, Andrew J. *American Empire*. Cambridge, MA: Harvard University Press, 2003.
- Bate, Roger R., Donald D. Mueller, and Jerry E. White. *The Fundamentals of Astrodynamics*. New York: Dover Publications, Inc., 1971.
- Bernstein, Alvin. "The Strategy of a Warrior-State: Rome and the Wars against Carthage, 264–201 B.C." In *The Making of Modern Strategy: Rulers, States, and War*, edited by Williamson Murray, Alvin Bernstein, and MacGregor Knox. Cambridge: Cambridge University Press, 1994.
- Billman, Gregory. "The Inherent Limitations of Space Power: Fact or Fiction?" In *Beyond the Paths of Heaven: The Emergence of Space Power Thought*, edited by Col Bruce M. DeBlois. Maxwell AFB, AL: Air University Press, September 1999.
- Blechman, Barry M., and Stephen S. Kaplan. *Force without War: U.S. Armed Forces as a Political Instrument*. Washington, DC: Brookings Institution, 1978.
- Builder, Carl H. *The Icarus Syndrome*. New Brunswick, NJ: Transaction Publishers, 1994.
- Clausewitz, Carl von. *On War*. Edited and translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press, 1976.
- Corbett, Julian S. *Some Principles of Maritime Strategy*. 1911. Reprint, Annapolis, MD: Naval Institute Press, 1988.
- Cordesman, Anthony H. *The Lessons of Afghanistan*. Washington, DC: Center for Strategic & International Studies, 2003.
- Corum, James, and Wray Johnson. *Airpower and Small Wars*. Lawrence, KS: University Press of Kansas, 2003.
- Daehnick, Christian C. "Blueprints for the Future: Comparing National Security Space Architectures." In *Beyond the Paths of Heaven: The Emergence of Space Power Thought*, edited by Col Bruce M. DeBlois. Maxwell AFB, AL: Air University Press, September 1999.
- Dolman, Everett C. *Astropolitik: Classical Geopolitics in the Space Age*. London and Portland, OR: Frank Cass Publishers, 2002.
- Douhet, Giulio. *Command of the Air*. Translated by Dino Ferrari. Washington, DC: Office of Air Force History, 1983.

BIBLIOGRAPHY

- Dublois, Maj Bruce M. "Ascendant Realms: Characteristics of Airpower and Space Power." In *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Col Phillip S. Meilinger. Maxwell AFB, AL: Air University Press, 1997.
- . *Beyond the Paths of Heaven: The Emergence of Space Power Thought*. Maxwell AFB, AL: Air University Press, 1999.
- Fadok, Lt Col David S. "John Boyd and John Warden: Airpower's Quest for Strategic Paralysis." In *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Col Phillip S. Meilinger. Maxwell AFB, AL: Air University Press, 1997.
- Fischer, David Hackett. *Historians' Fallacies: Toward a Logic of Historical Thought*. New York: Harper & Row Publishers, Inc., 1970.
- Friedman, George, and Meredith Friedman. *The Future of War: Power, Technology, and American World Dominance in the 21st Century*. New York: Crown Publishers, Inc., 1996.
- Glossop, Ronald J. *Confronting War: An Examination of Humanity's Most Pressing Problem*. 3d ed. Jefferson, NC: McFarland & Company, Inc., 1994.
- Gray, Colin S. *Modern Strategy*. Oxford: Oxford University Press, 1999.
- Haass, Richard N. *The Reluctant Sheriff*. New York: Council on Foreign Relations, 1997.
- Hays, Peter L. *United States Military Space: Into the Twenty-First Century*. Maxwell AFB, AL: Air University Press, 2002.
- Hill, Charles W. L., and Gareth R. Jones. *Strategic Management: An Integrated Approach*. Boston: Houghton Mifflin Company, 1995.
- Hobbes, Thomas. *Leviathan*. Edited by Richard Tuck. Cambridge: Cambridge University Press, 1991.
- Howard, Michael. *War in European History*. Oxford: Oxford University Press, 1976.
- Keaney, Thomas A., and Eliot A. Cohen. *Revolution in Warfare? Air Power in the Persian Gulf*. Annapolis, MD: Naval Institute Press, 1993.
- Lambakis, Steven. *On the Edge of Earth: The Future of American Space Power*. Lexington, KY: University Press of Kentucky, 2001.
- Lambeth, Benjamin S. *The Transformation of American Airpower*. Ithaca, NY: Cornell University Press, 2000.
- Lepgold, Joseph. "Hypothesis on Vulnerability: Are Terrorists and Drug Traffickers Coerceable?" In *Strategic Coercion: Concepts and Cases*, edited by Lawrence Freedman. Oxford: Oxford University Press, 1998.
- Lupton, David E. *On Space Warfare: A Space Power Doctrine*. Maxwell AFB, AL: Air University Press, June 1988.
- Machiavelli, Niccolo. *The Prince*. Translated by Russell Price. In *Cambridge Texts in the History of Political Thought*, edited by Quentin Skinner and Russell Price. New York: Cambridge University Press, 1985.
- Mackinder, Halford. *Democratic Ideals and Reality*. New York: Henry Holt and Company, 1942.

- Mahan, A. T. *The Influence of Sea Power upon History, 1660–1783*. New York: Dover Publications, Inc., 1890.
- Mantz, Michael R. *The New Sword: A Theory of Space Combat Power*. Maxwell AFB, AL: Air University Press, May 1995.
- McDougall, Walter A. . . . *The Heavens and the Earth: A Political History of the Space Age*. Baltimore, MD: Johns Hopkins University Press, 1985.
- Meilinger, Col Phillip S. *Ten Propositions Regarding Airpower*. Washington, DC: Air Force History and Museums Program, 1995.
- Menon, P. K. *The United Nations' Efforts to Outlaw the Arms Race in Outer Space: A Brief History with Key Documents*. Lewiston, NY: Edwin Mellen Press, 1988.
- Middleton, Gordon R. *Space is a Different Place*. Maxwell AFB, AL: Air War College, 1992.
- Mitchell, William. *Winged Defense: The Development and Possibilities of Modern Air Power—Economic and Military*. 1925. Reprint, New York: Dover Publications, Inc., 1988.
- Muolo, Michael J. *Space Handbook*. Vol. 2, *An Analyst's Guide*. Maxwell AFB, AL: Air University Press, December 1993.
- Oberg, James E. *Space Power Theory*. Washington, DC: Government Printing Office, 1999.
- O'Connell, Robert L. *Of Arms and Men: A History of War, Weapons, and Aggression*. Oxford: Oxford University Press, 1989.
- Pape, Robert A. *Bombing to Win: Air Power and Coercion in War*. Ithaca, NY: Cornell University Press, 1996.
- Paret, Peter. "The Genesis of *On War*." In *On War*, edited and translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press, 1976.
- Petersen, Steven R. *Space Control and the Role of Antisatellite Weapons*. Maxwell AFB, AL: Air University Press, May 1991.
- Schelling, Thomas C. *Arms and Influence*. New Haven, CT: Yale University Press, 1966.
- Spires, David N. *Beyond Horizons: A Half Century of Air Force Space Leadership*. Peterson AFB, CO: Air Force Space Command, 1997.
- Stares, Paul B. *The Militarization of Space: U.S. Policy, 1945–1984*. Ithaca, NY: Cornell University Press, 1985.
- . *Space and National Security*. Washington, DC: Brookings Institution, 1987.
- Strassler, Robert B., ed. *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War*. New York: Touchstone, 1998.
- Sullivan, Brian R. "Spacepower and America's Future." In *Spacepower for a New Millennium*, edited by Peter L. Hays, James M. Smith, Alan R. Van Tassel, and Guy M. Walsh. New York: McGraw-Hill Companies, Inc., 2000.
- Sun Tzu. *The Art of War*. Translated by Samuel B. Griffith. London: Oxford University Press, 1971.
- Warden, John A., III. *The Air Campaign*. New York: toExcel, 1998.

BIBLIOGRAPHY

- Webster's Ninth New Collegiate Dictionary*. Springfield, MA: Merriam-Webster, Inc., 1983.
- Weigley, Russell F. *The American Way of War*. New York: Macmillan, 1977.
- Worden, Simon P. "Space Control for the 21st Century." In *Spacepower for a New Millennium: Space and U.S. National Security*, edited by Peter L. Hays, James M. Smith, Alan R. Van Tassel, and Guy M. Walsh. New York: McGraw-Hill Companies, Inc., 2000.
- Zeigler, David W. "Safe Heavens: Military Strategy and Space Sanctuary." In *Beyond the Paths of Heaven: The Emergence of Space Power Thought*, edited by Col Bruce M. DeBlois. Maxwell AFB, AL: Air University Press, September 1999.

Articles

- Baldwin, David A. "Security Studies and the End of the Cold War." *World Politics* 48 (October 1995): 117–41.
- Belote, Maj Howard D. "The Weaponization of Space: It Doesn't Happen in a Vacuum." *Aerospace Power Journal* 14, no. 1 (Spring 2000): 46–52. <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj00/spr00/belote.htm> (accessed 8 October 2001).
- Byman, Daniel, and Mathew Waxman. "Defeating US Coercion." *Survival* 41, no. 2 (Summer, 1999): 107–20.
- Cebrowski, Arthur K., and Thomas P. M. Barnett. "The American Way of War." *U.S. Naval Institute*, January 2003, 42–43. <http://www.nwc.navy.mil/newrulesets/TheAmericanWayofWar.html> (accessed 13 April 2003).
- Corum, James. "The Myth of Air Control: Reassessing the History." *Aerospace Power Journal* 14, no. 4 (Winter 2000): 61–77.
- David, Leonard. "The NRO: Dark Secrets under Open Skies." *Space.com*, 26 September 2000. http://www.space.com/news/spacehistory/nro_first_side_000926.html (accessed 21 April 2003).
- Gray, Colin S. "The Influence of Space Power upon History." *Comparative Strategy*, October–December 1996, 293–308.
- Grossman, Elaine M. "Air Force to Name Seven Colonels to 'Champion' Key Task Forces." *Inside the Pentagon*, 21 February 2002. <http://ebird.dtic.mil/Feb2002/s20020022colonels.htm.22> (accessed February 2002).
- Howard, Michael. "Reassurance and Deterrence: Western Defense in the 1980's." *Foreign Affairs*, Winter 1982–1983, 307–24.
- Keohane, Robert O., and Joseph S. Nye Jr. "Globalization: What's New? What's Not (And So What?)" *Foreign Policy* 118 (Spring 2000): 104–19.
- Manwaring, Max. "The United States Security Policy in the Western Hemisphere: Why Columbia, Why Now, and What Is to Be Done?" *Small Wars and Insurgencies* 12, no. 3 (Autumn 2001): 67–96.
- Mullen, Vice Adm Mike. "Capture the Vision." *Proceedings*, US Naval Institute, April 2002, 36–39.

- Shalaf-Esa, Andrea. "Pentagon Sees Space as Military 'High Ground,'" *Rueters*, 23 February 2003. <http://www.forbes.com/markets/newswire/2003/02/12/rtr878174.html> (accessed 23 March 2003).
- Smith, Senator Bob. "The Challenge of Space Power." *Airpower Journal*, 13, no. 1 (Spring 1999): 32–39. <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj99/spr99/smith.html> (accessed 8 October 2001).
- Tolson, Jay. "The New American Empire?" *US News and World Report*, 13 January 2003.
- "USAF Almanac." *Air Force Magazine*, May 2002.
- Wall, Robert. "Spying Resistance." *Aviation Week and Space Technology*, 28 April 2003, 51.
- Whiting, Stephen N. "Space and Diplomacy: A New Tool for Leverage." *Astropolitics* 1, no. 1 (2003): 54–77.
- Winton, Harold R. "A Black Hole in the Wild Blue Yonder: The Need for a Comprehensive Theory of Air Power." *Air Power History* 39, no. 4 (Winter 1992): 32–34.

Manuals, Instructions, Directives and Other Publications

- Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, September 1997.
- AFDD 1-2, *Air Force Glossary*, 9 July 1999.
- AFDD 2-2, *Space Operations*, 27 November 2001.
- Air Force Space Command (AFSPC). *Strategic Master Plan FY04 and Beyond*, 5 November 2002.
- AFSPC 002-01, Draft Mission Need Statement, Prompt Global Strike (PGS), AFSPC/DRM, 22 October 2001.
- "Army Transformation Roadmap." *The Army Vision*. October 1999. http://www.army.mil/vision/Transformation_Roadmap.pdf (accessed 22 February 2003).
- Department of the Navy. *Forward . . . From the Sea: The Navy Operational Concept*, March 1997.
- Field Manual (FM) 1. *The Army*, 14 June 2001.
- FM 3-0. *Operations*, 14 June 2001.
- Joint Publication (JP) 1, *Joint Warfare of the Armed Forces of the United States*, November 2000.
- JP 3-14. *Joint Doctrine for Space Operations*, 9 August 2002.
- United States Space Command, Director of Plans. *Long Range Plan: Implementing USSPACECOM Vision for 2020*, March 1998.

Unpublished Papers

- Bille, Matt, and Maj Lester Lorenz. "Requirements for a Conventional Prompt Global Strike Capability." Draft paper for the National Defense Industry Association, April 2001.

BIBLIOGRAPHY

- Dolman, Everett. "Space Power and US Hegemony: Maintaining a Liberal World Order in the 21st Century." Forthcoming in *Space Weaponization*, edited by John Logsdon. A MacArthur Foundation Publication, n.d.
- France, Martin E. B. "Mahan's Elements of Sea Power Applied to the Development of Space Power." Course No. 5602. Washington, DC: National Defense University, National War College, 2000.
- Fox, John G. "Some Principles of Space Strategy: Or 'Corbett in Orbit.'" National Defense University, Washington, DC: National War College, 2000. <http://www.ndu.edu/nwc/writing/AY00/AA/FoxPaperCorbett2000.rtf.1> (accessed 1 April 2003).
- Fredriksson, Brian E. "Fires from Heaven: The Application of Force through Space." Unpublished paper. Maxwell AFB, AL: Air Command and Staff College, 2002.
- Johnsen, William T. "Redefining Land Power for the 21st Century." Unpublished paper. Carlisle Barracks, PA: Army War College, 7 May 1998.
- Jussell, Judson J. "Space Power Theory: A Rising Star." Unpublished paper. Maxwell AFB, AL: Air Command and Staff College, April 1998.
- Marheine, Maj Fred H. "Do We Need a Separate Space Theory: The Lessons of History." Master's thesis, School of Advanced Airpower Studies, 2001.
- Middleton, Gordon R. "Space is a Different Place." Unpublished paper. Maxwell AFB, AL: Air War College, 1992.
- O'Mara, Raymond, and Everett C. Dolman. ". . . to Command the Air." Unpublished paper. School of Advanced Air and Space Studies, n.d.
- Smith, M. V. "Ten Propositions Regarding Spacepower." Master's thesis, School of Advanced Airpower Studies, June 2001. <http://research.au.af.mil/papers/student/ay2001/saas/smith.pdf> (accessed 8 February 2003).
- Whiting, Stephen N. "Policy, Influence, and Diplomacy: Space as a National Power Element." Master's thesis, School of Advanced Airpower Studies, June 2002.
- . "Space and Diplomacy: A New Tool for Leverage." Unpublished paper. 2002.
- Worden, Simon P., and Martin E. B. France. "Towards an Evolving Deterrence Strategy: Space and Information Dominance." Unpublished paper. n.d.

Reports

- Federal Aviation Administration. *The Economic Impact of Commercial Space Transportation on the U.S. Economy*. Washington, DC: Department of Transportation, February 2001. http://ast.faa.gov/files/pdf/Econ_Final.pdf.
- Keaney, Thomas A., and Eliot Cohen. *Gulf War Air Power Survey Summary Report*. Washington, DC: Government Printing Office, 1993.

- Preston, Bob, Dana J. Johnson, Sean Edwards, Mike Miller, and Calvin Shipbaugh. *Space Weapons, Earth Wars*. Santa Monica, CA: RAND, 2002.
- Report of the Commission to Assess United States National Security Space Management and Organization*. Commission to Assess United States National Security Space Management and Organization. Pursuant to Public Law 106-65, 11 January 2001.
- SPACECAST 2020 Executive Summary*. Maxwell AFB, AL: Air University Press, 23 June 1994.
- Vick, Alan J., David T. Orletsky, Bruce R. Pirnie, and Seth G. Jones. *The Stryker Brigade Combat Team: Rethinking Strategic Responsiveness and Assessing Deployment Options*. Santa Monica, CA: RAND, 2002.
- Watts, Barry D. *The Military Use of Space: A Diagnostic Assessment*. Washington, DC: Center for Strategic and Budgetary Assessment, February 2001.

Lectures, Briefings, Addresses

- “Army Forces and the JFC.” Lecture. Air Command and Staff College. Maxwell AFB, AL, January 2002.
- Boyd, John R. Briefing. Subject: A Discourse on Winning and Losing. August 1987, document no. M-U 30352-16, no. 7791, Air University Library, Maxwell AFB, AL.
- Fogleman, Gen Ronald R. “Airpower and the American Way of War.” Address. Air Force Association Air Warfare Symposium, Orlando, FL, 15 February 1996. http://www.af.mil/news/speech/current/Air_Power_and_the_American_.html (accessed 13 April 2003).
- “JF-519 NAVFOR in Support of the JFC.” Lecture. Air Command and Staff College, Maxwell AFB, AL, 1 February 2002.
- Mets, David R. “Conclusion: The USAF Airpower Experience: The First Century.” Lecture. School of Advanced Air and Space Studies, Maxwell AFB, AL, February 2003.

Public Statements

- Bush, George H. W. *Public Papers of the Presidents of the United States: George Bush, 1990 (Book II)*. Washington, DC: Office of the Federal Register, National Archives and Records Administration, 1991.
- The White House. *ABM Treaty Fact Sheet*. Washington, DC: Office of the Press Secretary, 13 December 2001. <http://www.whitehouse.gov/news/releases/2001/12/print/20011213-2.html> (accessed 7 June 2003).
- The White House. *National Policy on Ballistic Missile Defense Fact Sheet*. Washington, DC: Office of the Press Secretary. 20 May 2003. <http://www.whitehouse.gov/news/releases/2003/05/print/20030520-15.html> (accessed 7 June 2003).

