Introduction

More than five decades after the opening of space in 1957, the United States finds itself in a position of unique global strength and influence. A major reason for this power is U.S. space technology. Satellites speed our personal, business, and military communications around the world, transferring tremendous amounts of data nearly instantaneously. Global positioning system (GPS) spacecraft track our products and save lives by locating ships, keeping planes from colliding, and delivering weapons with uncanny precision, reducing casualties and collateral damage. Weather and remote-sensing satellites boost agricultural production and warn of coming disasters. Military early-warning and reconnaissance satellites enforce treaties, help track foreign armies and navies, and provide advance information on missile launches. No other country enjoys the advantages that the United States currently reaps from space, and no other country has made such an investment in space technology.

Despite this power, some U.S. officials and policy analysts fear that space is an Achilles' heel, an environment on which the United States is uniquely dependent but also in which it is highly vulnerable to possible attack.[1] They argue that the increasing number of countries (such as Iran and North Korea) now acquiring ballistic missiles might be able to place objects into space—including crude weapons—to put our assets at risk. There are also fears that space powers with more developed capabilities, such as China, will develop weapons that could eventually hold a number of U.S. satellites "hostage" in a crisis. As a consequence, these officials and analysts argue that substantial U.S. space defenses will be needed

[1] For example, see the "Report of the Commission to Assess United States National Security Space Management and Organization," Pursuant to Public Law 108–65, January 11, 2001, online via DefenseLINK at <http://www.defenselink.mil/pubs/space20010111.html> (accessed September 24, 2006).

to protect access to critical military assets in orbit or risk a conflict where these now-essential communications, reconnaissance, and targeting spacecraft are denied to U.S. warfighters. For these reasons, the United States from 2001 to 2008 resumed active consideration of space-based, anti-ballistic missile (ABM) defenses and anti-satellite (ASAT) weapons, programs it had largely moved to the back burner of national priorities during the 1990s. It also used a sea-based ABM system for ASAT purposes. Some air force officials and certain members of Congress continue to call for space-based weapons and "Global Strike" capabilities,[2] whose constellations of military spacecraft might destroy rising missiles or hurl high-speed tungsten rods down on rogue states or terrorist facilities harboring weapons of mass destruction (WMD).[3] From their perspective, newly threatening conditions in space provide the rationale for the need to act now.

On the other side of this equation is a perspective that views space as a valuable "sanctuary" from deployed weapons and active military conflict, one that we disturb only at our peril.[4] Supporters of this viewpoint note that the United States and the Soviet Union did not station weapons in space; they question whether threats today are actually worse than during the Cold War. As one study points out, "If the United States detected a missile that appeared to be attacking a satellite, even a relatively small maneuver could essentially eliminate the probability of an intercept."[5] This school argues that the active testing and deployment of space defenses and offensive weapons would alter dramatically a system of tacit and formal restraint in space behavior established during the Cold War, harming U.S. security in the long run.[6] They argue that the further testing of kinetic-kill weapons in orbit (particularly like China's high-altitude destruction of a satellite in January 2007, which produced considerable long-lasting orbital debris) could ruin space for other purposes and might stimulate a global arms race. Their an-

[2] For the origins of this concept, see Gen. (USAF) John P. Jumper, "Global Strike Task Force: A Transforming Concept, Forged by Experience," *Aerospace Power Journal*, Vol. 15, No. 1 (Spring 2001), at <http://www.airpower.au.af.mil/airchronicles/apj/apj01/spr01/jumper.htm> (accessed September 24, 2006).

[3] On U.S. plans, see Tim Weiner, "Air Force Seeks Bush's Approval for Space Weapons," *New York Times*, May 18, 2005, p. A1.

[4] See, for example, "Space Security or Space Weapons? A Guide to the Issue," Space Security Project, Henry L. Stimson Center, Washington, D.C., 2005, online at <http://stimson.org/space/pdf/issueguide.pdf> (accessed July 20, 2006).

[5] David Wright, Laura Grego, and Lisbeth Gronlund, *The Physics of Space Security: A Reference Manual* (Cambridge, Mass.: American Academy of Arts and Sciences, 2005), p. 164. Also, as the United States found with its own ground-based ASAT program in the 1960s, one of the problems of such a system is that targets have to pass close enough to the basing site in order for it to be used.

[6] See, for example, Nancy Gallagher, "Towards a Reconsideration of the Rules for Space Security," in John M. Logsdon and Audrey M. Schaffer, eds., *Perspectives on Space Security* (Washington, D.C.: Space Policy Institute, George Washington University, December 2005), p. 35.

swer to this security challenge lies instead in crafting new treaties or "rules of the road" to safeguard space against weapons,[7] drawing on the transparency of space for the necessary verification. They point out that the overwhelming majority of states at the United Nations are on record condemning the notion of an arms race in outer space[8] and that only a handful of countries maintain military space programs of any sort, mostly for reconnaissance and communications.

Given the importance of this debate to future U.S. national security and the lack of a comprehensive study of the first five decades of space security, this book analyzes the period from 1957 to the present in hopes of explaining past outcomes and drawing some practical lessons for the future. The aim is not to describe every launch or mission (which has been done admirably by other authors[9]) or to provide new data on civilian cooperation,[10] but instead to focus on space security issues and turning points in the management of *military* space threats as experienced to date.[11] The book traces the main trends in military space developments—including weapons tests and deployments, arms control treaties, and less formal cooperative agreements—their underlying causes, and the factors that are likely to influence their future course. It is intended primarily for a scholarly audience (particularly students and analysts in the fields of space policy and security studies), but it also may be hoped to reach interested members of the policymaking community, the media, and the general public. Although it provides some background and arguments (particularly in Chapters One and Two) from the academic literature, the book keeps jargon to a minimum so that it may provide an accessible framework for addressing practical problems in the area of space security policymaking.

[7] See Michael Krepon (with Christopher Clary), *Space Assurance or Space Dominance? The Case Against Weaponizing Space* (Washington, D.C.: Henry L. Stimson Center, 2003).

[8] For example, the yearly U.N. resolution (60/54) calling for the "Prevention of an Arms Race in Space" passed on December 8, 2005, with a vote of 180–2. Only the United States and Israel opposed the measure.

[9] For example, on the U.S. side, see William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998). On the Soviet side, see the two-volume history by Asif A. Siddiqi, *Sputnik and the Soviet Space Challenge* (Gainesville: University of Florida Press, 2003) and *The Soviet Race with Apollo* (Gainesville: University of Florida Press, 2003).

[10] For detailed studies on U.S.-Soviet and U.S.-Russian civilian space cooperation, see Matthew J. Von Bencke, *The Politics of Space: A History of U.S.-Soviet/Russian Competition and Cooperation* (Boulder, Colo.: Westview Press, 1997); and Susan Eisenhower, ed., *Partners in Space: US-Russian Cooperation After the Cold War* (Washington, D.C.: Eisenhower Institute, 2004).

[11] Given the book's focus on space security, it does not deal extensively with deep-space issues or with questions related to near-Earth objects (i.e., planetary defense). Both of these topics are likely to become of greater interest as the space age progresses, but they have not factored to date as central space security issues, which focused almost exclusively on Earth-orbital space (from geostationary to low–Earth orbits).

Outline of the Chapters

This book is organized into three parts. Part I ("Explaining Space Security: Concepts and Historical Comparisons") covers the existing literature, its strengths and weaknesses, and possible alternative explanations for space outcomes. Chapter One focuses in particular on historical analogies and underlying assumptions among analysts of space security in the four existing schools of thought. Chapter Two provides an alternative explanation to these interpretations, stressing the role of the space environment and gradual learning regarding such problems as man-made electromagnetic pulse radiation and orbital debris in explaining the surprisingly cooperative outcomes seen since 1957. The argument also shows that these developments were not inevitable. Situational factors, communication breakdowns between leaders, and attempts to assert unilateral advantages could have led already distrustful U.S. and Soviet officials to adopt policies of heightened confrontation rather than strategic restraint.

Following this groundwork, Part II ("Reassessing Twentieth-Century Space Security") provides a detailed history of U.S.-Soviet space security relations, focusing in particular on how more limited forms of competition emerged from initially hostile, open-ended, and military-led space programs. The Cold War evidence presented in Chapters Three through Five shows how and why the two sides gradually accepted mutual constraints on deployable weapons in return for safe access to the space environment for military reconnaissance, weather forecasting, tracking, early warning, and a range of civilian uses. This cooperation proved exceptionally durable despite the periodic rise of political hostilities, such as during Soviet ASAT testing in the 1970s and in the context of the U.S. Strategic Defense Initiative in the early to mid-1980s.

Next, Chapter Six examines the end of the Cold War in 1991 and how norms of self-restraint and negotiated space security came under question as Russia's space capabilities declined and as the United States emerged as the dominant player. Nevertheless, the U.S. government made a strategic decision not to exploit this asymmetry in space power and to continue—and even expand—prior forms of cooperative space relations. The data for Chapters Three through Six are drawn from primary source materials in English and in Russian (including declassified U.S. and Soviet government documents), secondary sources, and personal interviews with past and present participants in the two space programs, with industry representatives, and with military officials.

Finally, Part III ("Considering Twenty-First-Century Space Security") examines the new dynamics that have emerged in international space activity since 2001. Chapter Seven discusses the major shift in military space policy under President George W. Bush, including the U.S. decision to withdraw from the

ABM Treaty in 2002 and to examine seriously the placement of missile defenses and other weapons in space, thus returning to the military-led direction of U.S. policies typical of the late 1950s and early 1960s. It analyzes the factors behind this shift, reactions from other states, and the stability of the broader space restraint regime in the face of this challenge. China's rise as a major space power—including in the military sector—is also traced. Finally, this chapter highlights the emergence of new commercial actors and activities, as well as the greater practical demands of multilateral (compared to bilateral) space management.

Chapter Eight examines President Barack Obama's space policies and his administration's efforts to shift the U.S. emphasis to international engagement and norm building. It also considers the expanded capabilities of such varied actors as the European Space Agency, India, Iran, Japan, and South Korea, as well as China's continued development.

With this background, Chapter Nine looks to the future. It considers the contradictory trends in military and commercial space activities, one toward increasing nationalism and one toward greater internationalism. A major concern is whether weapons deployments could stunt the development of new commercial applications and also threaten passive military assets because of the worsening problem of orbital space debris. Yet, new means for addressing the vulnerability of space assets may emerge out of enhanced communications, interactions, and transparency among space actors, as well as from strategies allowing for the diversification of space platforms (making individual targets less attractive). The book concludes with the elaboration of alternative space futures, ranging from atomized and state-centric to highly integrated and transnational.

Themes and Overall Argument

Ultimately, given the destructive powers of modern states and the particular fragility of the space environment, this book argues that there is a compelling logic to the exercise of military restraint by all actors in space because of their shared national interest in maintaining safe access to critical regions of space—especially low–Earth orbit (from around 60 to 1,000 miles in altitude).[12] During the Cold War, the United States and the Soviet Union (and, indeed, a handful of other nuclear and missile powers of the time) had the potential to render space unusable. The launch of even a dozen nuclear weapons or the dispersal of large amounts of speeding debris into critical low–Earth orbits could have

[12] Space itself can be defined as the area beginning at roughly 60 miles above the Earth's surface. Above this altitude, the Earth's atmosphere dissipates to a degree that orbital flight becomes possible, although higher orbits are more favorable because of the further lessening of the effects of atmospheric drag.

ruined near-Earth space for any significant commercial, scientific, or passive military uses for an indefinite period of time. Today, there are about two dozen states that could do so with nuclear or conventional weapons, and a few states among those—with more sophisticated space tracking networks—that have the capability to hit *specific* space targets. This is the threat that some military analysts point to when they argue that advanced space defenses are needed.[13] However, as the history of the Cold War shows, vulnerability in space cannot be erased through military means alone. As University of California physicist Joel R. Primack argues, space "is the most fragile environment that exists because it has the least ability to repair itself."[14] Using orbital physics, he makes the case that "any kind of space warfare will put all satellites at risk."[15] Interestingly, the recent growth of the debris problem has enlisted some unlikely allies to this school's perspective, including at the Pentagon. Air Force Undersecretary for Space Programs Gary Payton argued in 2006 for a more sophisticated U.S. policy of rejecting debris-producing weapons, explaining, "We'd be fools to actually get into the kinetic energy anti-satellite business."[16] But other U.S., Chinese, and perhaps additional foreign officials still remain supportive of keeping destructive weapons available as an option. The U.S. decision to destroy an ailing National Reconnaissance Office satellite packed with hydrazine fuel in February 2008 indicated the Bush administration's willingness to use space weapons in at least certain prescribed conditions—high perceived threat and low orbital altitude (thus minimizing debris consequences). Whether new international norms will be developed to ensure the adoption of these restrictive criteria by other military space powers remains to be seen.

As noted earlier, another factor that may change space activity over time is the emergence of new commercial actors. While "revolutions" in space commerce have long been overpredicted, recent developments that are making satellite technology, manned spacecraft, and low-cost launchers more accessible are finally beginning to alter the military-dominated nature of the space age. Space's second fifty years may look very different because of this greater diver-

[13] Critics of "space control" theories raise the logical objection: even if such weapons are developed, other countries will still retain the ability to negate U.S. space assets through *asymmetric* military means—including resort to space debris and radiation, jamming, and attacks on ground stations.

[14] Joel R. Primack, "Debris and Future Space Activities," in James Clay Moltz, ed., *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs*, Occasional Paper No. 10 (Monterey, Calif.: Center for Nonproliferation Studies, Monterey Institute of International Studies, July 2002), p. 18.

[15] Ibid., p. 21.

[16] Quoted in Jeremy Singer, "USAF Interest in Lasers Triggers Concerns About Anti-Satellite Weapons," *Space News*, May 1, 2006, p. A4.

sity of actors and their impact on practical dynamics. As then–Commander in Chief of U.S. Space Command General Howell M. Estes predicted in a speech in April 1997, "It is not the future of military space that is critical to the United States—it is the continued commercial development of space that will provide continued strength for our great country in the decades ahead."[17]

In this context, effective coordination among a range of actors and activities may be the most serious emerging space challenge. This is a fundamentally *political* task. The aim of this book, therefore, is first to analyze the past connections among national politics, the space environment, and the practice of space security; then, taking into account the influence of emerging changes, it seeks to project these lessons forward in order to develop meaningful guidelines for the future. Its main conclusion is that the most useful framework for analyzing the past, present, and future of these issues in space is not a traditional military-strategic one, but instead the interdependent concept of environmental security.

[17] Quoted in Lt. Col. (USAF) Peter L. Hays, *United States Military Space: Into the Twenty-First Century*, Occasional Paper No. 42 (Colorado Springs: U.S. Air Force Academy, Institute for National Security Studies, September 2002), p. 14.