CHAPTER ONE

The Dynamics of Space Security

Existing Explanations

The concept of national security describes the relationship between a country's capabilities and the challenges posed by the surroundings in which it must operate. When a country is *secure*, it enjoys the ability to conduct its activities free from harm. Although we normally view security as reliant solely on military power, it is also influenced by a variety of other factors: alliances, economic strength, treaty memberships, political stance (such as declared neutrality), social cohesion, and even perceived moral authority.

In space, the attainment of security involves the task of overcoming both man-made and natural threats, given the extreme hostility of the space environment. Since orbital dynamics require a certain level of interaction with other actors, the behavior of all space-faring entities (states, companies, universities, private citizens, and international consortia) inevitably affects the security of others, more so than in other realms. In general, we can define "space security" as *the ability to place and operate assets outside the Earth's atmosphere without external interference, damage, or destruction*. By this definition, all actors have enjoyed a high level of space security for most of the space age, with very few exceptions, as will be discussed later. Unfortunately, challenges to space security are increasing today, particularly as space becomes more crowded. Arguably, at least three alternatives exist: (1) space actors can assume the worst and prepare for eventual warfare; (2) they can hedge their bets with weapons research and begin efforts at better coordination and conflict avoidance; or (3) they can reject military options altogether and heighten their efforts to build new cooperative mechanisms for developing space jointly.

During the Cold War, the behavior of the Soviet Union and the United States dominated space security considerations. These two sides conducted well more than 95 percent of space activities during the Cold War. Although Russian activ-

ity has declined significantly since 1991, even in 2005 the combined total of U.S. and Russian activities still made up 50 percent of all commercial space launches, 63 percent of civil launches,[1] and fully 68 percent of military launches.[2] For each of these two countries, achieving space security was for many years primarily a matter of understanding the policies of the other side and trying to reach consensus on how to manage disputes and prevent hostile acts. As discussed in this book, space security evolved during the Cold War in two primary stages: the 1957–62 period (characterized by military-led approaches) and the 1963–91 period (characterized mainly by military "hedging" and negotiated approaches). With the end of the Cold War in 1991, space became a realm led mainly by the United States. For a decade, Washington continued a policy of negotiated space security, in close cooperation with the Russian Federation (drawing on the third option listed above). After 2001, however, a new U.S. leadership, focusing on emerging foreign missile threats and eventual U.S. space vulnerabilities, shifted course back toward a military-led strategy in the belief that hostile actors would arise among new space powers and create threats requiring military solutions. In part for this reason, it withdrew from one of the main, negotiated space security arrangements of the Cold War—the 1972 Anti-Ballistic Missile Treaty—and also developed more space-specific military plans for defensive operations. However, the United States did not abandon the 1967 Outer Space Treaty or a number of other cooperative agreements.

Some analysts believed that the George W. Bush administration's moves had finally paved the way for an historically inevitable process of space's weaponization and the occurrence of direct military conflict, which had been delayed by political and technological factors. As Steven Lambakis of the National Institute of Public Policy in a 2001 book complained, regarding the behavior of past U.S. space policies: "If freedom of space is our guidestar, what is being done to nurture and protect it? Are not U.S. policy makers setting a bad precedent by unilaterally restricting national activities in the force-application and space-control areas, limiting in effect the country's freedom to exploit space?"[3] For others, these developments marked a sharp and negative change from wise policies by past presidents that had helped create the foundations for U.S. space preeminence. As the Center for Defense Information's Theresa Hitchens argued in 2003: "Unfortunately, this [Bush] administration has done little thinking . . .

[1] "Civil" space refers to launches for the purpose of noncommercial, nonmilitary activities, including primarily human exploration and space science.

[2] Spacesecurity.org, *Space Security 2006* (accessed July 2006), pp. 78, 95, 113.

[3] Steven Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington: University Press of Kentucky, 2001), p. 276.

about the potential for far-reaching military, political and economic ramifications of a U.S. move to break the taboo against weaponizing space."[4] Whether this outcome and the U.S. movement toward the deployment of space-based defenses is somehow historically predetermined or instead related mainly to the specific policy preferences of the Bush administration remains a subject of debate among space experts.

These developments and the prospect of space-based defenses and offensive weapons raise a series of important questions: Is the deployment of space-based weapons somehow unavoidable, or can space actors prevent it through rules of the road, treaties, or tacit avoidance? Is there such a thing as the "partial" weaponization of space? Are there definable cut-off lines among systems and could they be enforced? Or, could weapons in space be used to prevent an arms race through some form of "space hegemony"?[5] Skeptics believe that any form of weaponization would be a slippery slope, likely to result in a multilateral arms race and a reversion by states to military-led solutions. But there is also the possibility that recent military trends are an epiphenomenon and instead that the expansion of commercial actors in space will change priorities in Washington and other capitals and lead human space developments away from conflictual, weapons-based scenarios.

In seeking guidance on these questions, we might observe that space is but one of many new frontiers visited by states over the past several centuries; to better understand the dynamics of space, we can start with this history. Indeed, many analysts of space security have attempted to draw lessons from historical rivalries on new physical frontiers. This chapter begins by summarizing some of the key dynamics involved in policies of "expansionist security." It then focuses on the three most often mentioned historical analogies for space security—the settling of the New World, the development of sea and air power in the late 1800s and early 1900s (taken together), and negotiations over Antarctica in the late 1950s—examining "how parallel" their dynamics actually are in regard to space. The analysis then turns to the four main schools of existing thought regarding space security and where their strengths and weaknesses lie. The chapter concludes with an argument for a new approach: environmentally influenced learning.

[4] Theresa Hitchens, "Weapons in Space: Silver Bullet or Russian Roulette? The Policy Implications of U.S. Pursuit of Space-Based Weapons," in John M. Logsdon and Gordon Adams, eds., *Space Weapons: Are They Needed?* (Washington, D.C.: Space Policy Institute, George Washington University, October 2003), p. 88.

[5] On this point, see Everett Carl Dolman, "Space Power and US Hegemony: Maintaining a Liberal World Order in the 21st Century," in Logsdon and Adams, *Space Weapons.*

The Past as Precedent: Three Analogies

Debates on the future of international relations in space revisit a long history of great power competition on new frontiers, coincident with the rise of the modern nation-state. Advances in maritime technology (sails, rudders, and portable chronometers[6]) allowed countries to seize and control distant lands with the aim of achieving strategic, military, political, and economic advantages over their rivals for the purposes of maintaining or advancing their security. At the domestic level, powerful coalitions often pushed these enterprises in order to promote self-interested aims,[7] with the prizes being profitable new lands, their populations, and their natural resources. Frederick Jackson Turner argued in the late 1800s that expansionism offered states a natural and psychologically necessary release from domestic tensions, and might even be *required* for the continued stability and development of major nation-states.[8]

By the twentieth century, however, competing Western countries had seized all of the most readily accessible regions of the world that could not be defended by resident populations, leaving only unpopulated areas: the seabed, the polar icecaps, and, finally, space. These new frontiers required a combination of technological innovations and considerable funding to enable human beings to navigate, operate in, and make use of their more hostile environments.[9]

Part of the motivation for states to enter new frontiers has to do with national reputation. As political leaders have long recognized, international influence at any given point in history is a product not only of a country's economic and military power but also of its perceived *momentum* as a state.[10] As seen in

[6] Portable clocks were critical to the calculation of longitudinal coordinates, which could finally be linked with previously accessible latitudinal information from sextants. See Martin van Creveld, *Technology and War: From 2000 B.C. to the Present* (New York: Free Press, 1991), p. 128.

[7] For a study of expansionism drawing on the combined forces of coalition building and ideology, see Jack Snyder, *Myths of Empire: Domestic Politics and International Ambition* (Ithaca, N.Y.: Cornell University Press, 1991).

[8] Frederick Jackson Turner, "The Significance of the Frontier in American History," speech before the American Historical Association, Chicago, July 12, 1893, reprinted in Frederick Jackson Turner, *The Frontier in American History* (New York: Henry Holt, 1921).

[9] Looking ahead, the frontiers of other dimensions (such as nanotechnology and even time travel) may yet create future forms of international competition.

[10] The importance of national "reputation" in international relations has long been recognized both by game theorists and by those working in the area of deterrence theory. For a recent summary of these issues, see especially chapters by Jack Levy and by Stern, Axelrod, Jervis, and Radner in Paul C. Stern, Robert Axelrod, Robert Jervis, and Roy Radner, eds., *Perspectives on Deterrence* (New York: Oxford University Press, 1989). See also Robert Wilson, "Reputations in Games and Markets," in G. F. Feiwel, ed., *Game-Theoretic Models of Bargaining* (New York: Cambridge University Press, 1985). For a two-level view analyzing both the creation of state reputations and their *interpretation*

the troubles of the Ottoman Empire in the late 1800s, the malaise of the United States in the late 1970s, and the stagnation of the Soviet Union in the late 1980s, when a major world government fails to maintain a national image of power, efficacy, and forward technological progress, it can be perceived as weak by its adversaries and, in the eyes of its population, even as questionable in its claim of legitimacy.

For countries and corporations alike, however, deciding *when* and *where* to compete is not easy given the limits of available resources and the presence of risks.[11] While offering great opportunities for those who succeed, costly failures in frontier struggles can destabilize national governments and make them liable to domestic or external subversion. As Paul Kennedy, Richard Rosecrance, and Jack Snyder have observed, this struggle to achieve expansionist versions of security has had many losers resulting from the unexpected effects of frontier competitions on geopolitics, trade, political affairs, and military alliances.[12]

The New World Analogy

The opening of space by the Soviet Union and the United States in the late 1950s and 1960s shares certain characteristics with the competition between Spain and Portugal over the New World in the late fifteenth and early sixteenth centuries.[13] For this reason, the New World analogy has been frequently referred to by officials, analysts, and authors on space since the 1950s.[14] As in space, the effort to develop new sea routes to India and the eastern islands required the utmost secrecy and involved technologies crucial to national security.[15] The actu-

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by other states, see Barry Nalebuff, "Rational Deterrence in an Imperfect World," *World Politics*, Vol. 43, No. 3 (April 1991), pp. 314–16.

[11] President Dwight D. Eisenhower, for example, believed that racing in space made no sense. He was eventually overwhelmed by public and congressional pressure.

[12] Paul Kennedy, *The Rise and Fall of the Great Powers* (New York: Vintage, 1989); Richard Rosecrance, *The Rise of the Trading State: Commerce and Conquest in the Modern Age* (New York: Basic, 1986); Snyder, *Myths of Empire*.

[13] This discussion excludes the earlier missions to present-day Greenland and Canada by various Viking explorers, whose missions failed to result in permanent settlements.

[14] For example, on the use of the Columbus analogy during the 1950s' debates about the U.S. response to *Sputnik*, see Walter A. McDougall, . . . *the Heavens and the Earth: A Political History of the Space Age* (New York: Basic, 1985), p. 225.

[15] This account of the Spanish-Portuguese competition draws on the following sources: Roger Bigelow Merriman, *The Rise of the Spanish Empire in the Old World and in the New*, Volume II (New York: Macmillan, 1918); Charles E. Nowell, *A History of Portugal* (Princeton, N.J.: Van Nostrand, 1952); William C. Atkinson, *A History of Spain and Portugal* (Baltimore: Penguin, 1960); H. V. Livermore, *Portugal: A Short History* (Edinburgh, Scotland: Edinburgh University Press, 1973); Daniel J. Boorstin, *The Discoverers* (New York: Vintage [Random House], 1983), pp. 235–54; and J. M. Roberts, *The Pelican History of the World* (New York: Penguin, 1980), pp. 506–8.

al execution of the missions involved costly expeditions relying on the skills of teams of individuals: state leaders, explorers, scientists, and expert technicians. Like Yuri Gagarin and John Glenn in space, the leaders of these voyages—including Christopher Columbus and Amerigo Vespucci—became national heroes. Similarly, the fascinating realms these explorers uncovered created new objects for the popular imagination, as well as opportunities for economic and military advantage.

After Columbus's first voyage in 1492, his sponsor, Spain, made unilateral claims to the new territories, which Pope Alexander VI duly endorsed in April 1493.[16] But King John II of Portugal used his powerful navy to force negotiations with the Spanish crown, yielding a compromise that gave Portugal the right to regions located east of a demarcation line in the south Atlantic.[17] In 1500, Portuguese explorers under Pedro Alvarez Cabral reached Brazil and staked a claim to the rich territory within their zone. It seemed that direct, bilateral negotiations and the formation of a cooperative regime had successfully averted an impending conflict.

But the Spanish-Portuguese entente contained certain fatal flaws. First, it relied on a fragile web of secrecy held together only by the elaborate security precautions taken by the two countries to conceal their maps and specific routes to the New World. Second, it deliberately excluded other European powers in a system characterized by multiple states of relatively equal might. The agreement held for a few decades, but word of the New World's location and its riches eventually leaked out and spread throughout Europe, bringing new challengers and their militaries.[18] Relying on now widely distributed maritime technologies, other European powers soon began to exploit this new route to prospective wealth and colonies. As French King Francis I summed up the views of other European claimants in rejecting the Spanish-Portuguese entente: "The sun shines for me the same as for others: I would like to see that clause in Adam's will that excluded me from the partition of the world."[19] The

[16] According to Merriman, the Spanish crown had leverage over the Vatican in this time of trouble because its relative proximity made it the most likely country to send troops in case the Vatican was seized by hostile forces. Merriman writes that "[Pope] Alexander . . . was like wax in the hands of Ferdinand and Isabella" (Merriman, *Rise of the Spanish Empire*, p. 202). Nowell (*History of Portugal*, p. 61) also points out that the pontiff was himself a Spaniard.

[17] The agreement was called the Treaty of Tordesillas, signed in June 1494. The accepted dividing line between the respective Spanish and Portuguese claims lay about 370 leagues west of the Cape Verde Islands.

[18] As Boorstin (*Discoverers*) points out, the simultaneous development of the printing press promoted the rapid diffusion of this knowledge as maps to the New World became common.

[19] Reply to the Spanish ambassador in Paris, quoted in Atkinson, *History of Spain and Portugal*, p. 97.

same basic statements about space are now being made by China, India, and other emerging space powers regarding the past history of Russian and U.S. dominance.

The collapse of the Spanish-Portuguese entente and the aggressive activities of France, Holland, and England eventually ruined any chance of managing New World conflicts over colonies and resources.[20] The existence of a system of multiple competing powers in Europe at the time—valuing territory and raw materials as assets of power and seeing nothing to stop their conquests—transformed a peaceful division of spoils (although at the expense of native populations) into a military contest of seek, occupy, and defend.

Notably, the precedent of New World and other multilateral competition on new frontiers has provided a framework for much thinking about space, which assumes a survival-of-the-fittest strategy aimed at edging out the enemy (or suffering similar consequences oneself). Yet such a dire scenario of warfare has not yet emerged in space, contrary to many expectations. One difference may be that, unlike Cold War leaders, reigning kings and queens during the New World struggle viewed war as an acceptable outcome and as fully compatible with the pursuit of expansionist security. But such conflicts were rarely system-destroying, did not involve the elimination of nation-states, and created no crippling environmental damage. One can only imagine, for example, the different outcome in the New World if—as with orbital space debris—all of the arrows and bullets fired in those wars of conquest had continued to speed around the Earth causing damage for decades after they had been fired. These factors (discussed in Chapter Two) make the surrounding context of space security very different. For these reasons, we cannot easily accept arguments about historical inevitability of space conflict and warfare based on the New World analogy.

The Sea and Air Power Analogies

A second common set of analogies used in attempts to explain the dynamics of space security are those of sea and air power. These characterizations of space are most frequently used by military analysts. Common to these studies are references to the great late nineteenth- and early twentieth-century American naval historian Alfred Thayer Mahan. In his time, Mahan played an influential role in rousing the U.S. public, political circles, and the military to abandon its "sluggish attitude" toward maritime competition and join those powers that "cherish . . . aspirations for commercial extension, for colonies,

[20] The Protestant Reformation also intervened to reduce the moderating power of Rome in colonial disputes among the European powers.

and for influence in distant regions."[21] Mahan cited the requirement for a canal through Central America and a strong U.S. navy to defend its commercial and strategic interests abroad. Mahan's ideas influenced future President Theodore Roosevelt and other leading officials of the day, resulting in the creation of the Great White Fleet, which toured the world from 1907 to 1909 showing the U.S. flag and America's new naval might.

Supporters of the sea power analogy also emphasize the link between commerce and the military, in that the development of one is viewed as requiring the simultaneous expansion of the other in order to be effective in serving national security. As Air Force Lieutenant Colonel (ret.) David E. Lupton argues, "Space control is very much like past and present concepts of sea control," citing such parallels as lines of communications, cluster points, and the relevance of technological advantages.[22] He compares, for example, Great Britain's ability to dominate access and control of great swathes of the ocean in the nineteenth century to the likely ability of a small number of space-faring states to control upper orbits and keep out adversaries because of their greater technological prowess.[23]

The similar air power analogy has also been studied by analysts seeking to explain and predict the behavior of states in space. What started with civilians Orville and Wilbur Wright in 1903 soon developed into military uses of aircraft during World War I and strategic bombing during World War II. As Steven Lambakis writes: "What Billy Mitchell said about air power . . . is also true of space power and the space environment." In other words, the strong belief is that space will eventually become a dominant field of military endeavor and bring about a revolution in military affairs. U.S. Marine Corps Major Franz Gayl argues in this regard: "As with aviation, access and technology will drive forward to exploit any and all warfighting relevance, application, and advantage from space, quite independent of a nation's will to prevent it."[24] These points lead Major Gayl to conclude that "missions relating to space control, global strike, missile defense, transport, assault support, and such will necessarily follow."[25]

In critiquing these analogies, several points need to be emphasized. In the world that Mahan observed, imperialist states following policies of mercantil-

[21] Capt. (USN) A. T. Mahan, *The Interest of America in Sea Power, Present and Future* (Port Washington, N.Y.: Kennikat Press, 1897), pp. 5, 7.

[22] Lt. Col. (USAF, ret.) David E. Lupton, *On Space Warfare: A Space Power Doctrine* (Maxwell Air Force Base, Ala.: Air University Press, June 1998), Chapter 7, p. 5.

[23] Ibid.

[24] Maj. (USMC, ret.) Franz J. Gayl, "Time for a Military Space Service," *Proceedings* (July 2004), p. 44.

[25] Ibid.

ism dominated. In other words, the goal of navies was to protect sea lanes and colonies. Commerce involved trade largely (and sometimes exclusively) with nationally designated monopolies, whose purpose was to funnel resources back to the home economy and provide taxes to the colonial power's government. Today, however, space commerce is becoming more and more international, making it difficult for countries to tell what a company belongs to—it might be registered in Bermuda, operate in the United States, and use technology from Russia. Moreover, as Air Force Lieutenant Colonel Peter Hays observes, "The logic of this 'flag follows trade' argument is clear and has historical precedents, but to date it has not yet prompted any significant calls [by commercial space actors] for better protection."[26] Also, space law currently bans the colonization of the Moon and other celestial bodies, which suggests that maritime analogies centered on securing ownership of and access to colonies may not be relevant to space, at least as long as such treaties remain in force.

Finally, the notion of sea and air power implies the possibility of environmental "control" and the ability of leading countries to exclude other parties. With sea power, littoral seas can be more easily defended than blue water in part because of shore-based support, but there is also the possibility (as in the case of Britain) that a large navy possessing greater speed and firepower than its rivals may dominant the open ocean as well, even to the point of making it inaccessible to weaker navies. In the air, such control has also been realized in actual military contexts, as with the United States over Japan in the latter portion of World War II. But in space the analogy is harder to follow. Unlike in terrestrial, air, or sea environments, it is not clear how orbital space would be controlled. Although analysts cite predominance in space-based platforms and an ability to overwhelm potential adversaries with lasers and kinetic-kill weapons, the viability of "control" remains questionable in a situation where defenses are extremely costly from space, weapons systems are highly transparent (and in predictable orbits), and existing ground systems can be used to attack space assets. As strategist Herman Kahn argued, regarding space, in 1960, "It is very easy to make the obvious Mahan analogy on 'control of the sea' and talk blithely and superficially of 'control of space.' The analogy was never really accurate even for control of the air, and . . . it seems to be completely misleading for space."[27] Similarly, U.S. Navy Commander John Klein observes that "space is a unique

[26] 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. 15.

[27] Herman Kahn, *On Thermonuclear War* (Princeton, N.J.: Princeton University Press, 1960), p. 486.

environment, and any historically based strategic framework—whether naval, air, or maritime—cannot be realistically taken verbatim in its application to space strategy."[28] This is not to say that the sea and air power analogies do not have relevance for space today, but the linkages are not as clear nor as directly relevant as their supporters have argued. Moreover, the experience of at least the first fifty years of space security has shown little evidence of such policies.

Antarctica and Possible Lessons for Space

A third analogy that has been referred to in regard to space is the case of the frozen continent of Antarctica.[29] Although expert Christopher Joyner writes that the Antarctic case has been "largely ignored and undervalued" by experts in international relations,[30] the importance of the continent and its unique governance is now beginning to be recognized because of the "far-reaching impacts exerted by Antarctica on the Earth's climate, atmosphere, and oceans."[31]

Whaling and seal-hunting ships visited Antarctica sporadically beginning in the early 1800s, but the harshness of the Antarctic climate kept the continent from settlement and year-round occupation until after 1945.[32,33] But this did not stop a number of states from making formal claims on Antarctic territory, including Britain (1908), New Zealand (1923), France (1924), Australia (1933), Norway (1939), Chile (1940), and Argentina (1942). In the 1940s, skirmishes among Argentina, Chile, and Britain over territory in the region threatened the militarization of the Antarctic. German and South American troops occupied parts of Antarctica during World War II.

[28] Cmdr. (USN) John J. Klein, *Space Warfare: Strategy, Principles and Policy* (London: Routledge, 2006), p. 20.

[29] See, for example, Phillip Jessup and Howard J. Taubenfeld, *Controls for Outer Space and the Antarctic Analogy* (New York: Columbia University Press, 1959).

[30] Christopher C. Joyner, *Governing the Frozen Commons: The Antarctic Regime and Environmental Protection* (Columbia: University of South Carolina Press, 1998), p. 52.

[31] Ibid.

[32] On the history of human activity on the Antarctic continent, see Jack Child, *Antarctica and South American Geopolitics: Frozen Lebensraum* (New York: Praeger, 1988); M. J. Peterson, *Managing the Frozen South: The Creation and Evolution of the Antarctic Treaty System* (Berkeley: University of California Press, 1988); and Chapter Two in National Academy of Sciences, *Antarctic Treaty System: An Assessment, National Research Council* (Washington, D.C.: National Academy Press, 1986). On the similarities and differences of Antarctica in regard to space, see Jessup and Taubenfeld, *Controls for Outer Space and the Antarctic Analogy*.

[33] Following difficult missions of discovery into the interior of the continent in the early 1900s, a series of more deliberate U.S. expeditions led by Admiral Richard E. Byrd in the 1920s and 1930s set up semipermanent research facilities using modern mechanized equipment and airplanes to survey the continent.

After the war, however, the growing depletion of whaling stocks and evolving public opposition to the excessive killing of wildlife (such as penguins, used for lamp oil) began to dim the perceived advantages of occupying the frozen continent.[34] Instead of military personnel, scientists came to dominate the growing population of visitors after World War II, setting up research stations rather than fortified bases. Still, political and economic claims (particularly over future mining rights—as perhaps on the Moon) continued to be made.[35]

On the initiative of the United States, the twelve countries that established research stations in Antarctica as part of the International Geophysical Year opened negotiations aimed at establishing a cooperative regime to govern international activities there. Within a year, these countries had agreed to the Antarctic Treaty, a sweeping document calling for a suspension of territorial claims, a ban on all military activities, denuclearization, and scientific cooperation.[36] Thus, despite significant international rivalry in the early part of the twentieth century, a strong cooperative arrangement emerged on Antarctica after 1961.

As time wore on, however, Third World nations began to challenge the closed membership of the new Antarctic Treaty system.[37] These outsiders argued that the existing treaty cheated them out of the potential wealth to be had from Antarctic resources. To head off this challenge to the regime, the leading nations of the Antarctic Treaty invited key opponents to visit the region in the late 1960s. Many did, but when they witnessed the extreme harshness of the environment and the obvious near-term impossibility of setting up profitable mining or fishing operations, they dropped their opposition to the restrictive regime.

By the late 1980s, however, developments in technology posed new threats to the Antarctic Treaty, as certain member nations identified commercially viable projects for exploiting such Antarctic resources as oil, minerals, and

[34] Beyond the more widely established sealing and whaling activities of nations, there was an active penguin oil industry run from Australia in the early 1900s in which some 150,000 Antarctic penguins a year were killed and boiled down for their (albeit limited) oil fat. Public outcry in that country, however, finally ended this practice. On these issues related to the industrial killing of Antarctic wildlife, see K. D. Suter, *World Law and the Last Wilderness* (Sydney: Friends of the Earth, 1980).

[35] For a detailed discussion of the competing national claims in the Antarctic, see Child, *Antarctica and South American Geopolitics*; for a formal analysis (using an expected utility model) of these issues, see William E. Westermeyer, *The Politics of Mineral Resource Development in Antarctica: Alternative Regimes for the Future* (Boulder, Colo.: Westview Press, 1984).

[36] The nations agreed to use the right of free inspection of bases as the primary guarantor of this agreement.

[37] It had been limited to those with a commitment to the region, based on the maintenance of a scientific research station.

seafood.[38] In June 1988, representatives from thirty-three countries initialed a mining agreement to begin what many had long expected: the "inevitable" process of commercial development on the Antarctic continent.[39]

These events led a motivated and highly committed group of scientists—headed by French oceanographer Jacques Cousteau—to begin a serious effort to save Antarctica from commercial exploitation and possible environmental disaster. Cousteau's widely recognizable name and worldwide respect for his work on oceans contributed to media coverage and pressure on various governments. Finally, France and Australia—aided by treaty rules requiring unanimity for all changes—blocked the new commercial agreement on the argument that it would cause irreparable environmental damage.[40] By the time the Antarctic Treaty came up for formal renegotiation in 1991, lobbying by scientists and supportive governments in a number of countries had turned the tide against commercial development. After a brief holdout by the United States, treaty members agreed unanimously to prohibit Antarctic mining for a period of fifty years.

In critiquing the relevance of the Antarctic case to space, we can observe similar outcomes for space in the decision of countries to adopt rules of nonterritoriality and to sharply limit military activities. The role of scientific knowledge in altering initial military-led strategies can also be seen. But there are also a number of differences. Space witnessed extensive military testing through 1962, and then sporadic tests of more limited systems for anti-ballistic missile defense and anti-satellite purposes subsequently. Moreover, extensive military support programs played a major role in the U.S. and Soviet space programs throughout much of the Cold War. Similarly, commercial programs made up an increasing portion of space activity, suggesting other priorities besides environmental concerns. Finally, overall spending on space activity dwarfs the amount of money associated with activities in Antarctica, suggesting that coop-

[38] Developments in the areas of oil drilling techniques and shipboard food processing equipment (for Antarctic krill) were particularly important in changing cost-benefit calculations regarding commercialization of the Antarctic. For a detailed description of Antarctic resources and legal issues raised by their possible exploitation, see Gillian D. Triggs, *The Antarctic Treaty Regime: Law, Environment and Resources* (New York: Cambridge University Press, 1987).

[39] The main interest of these states was in oil extraction and the use of Antarctic mineral resources. See Philip Shabecoff, "Development Seen for the Minerals of All Antarctica," *New York Times*, June 8, 1988, p. 1.

[40] A joint statement of the French and Australian and prime ministers argued, "Mining in Antarctica is not compatible with protection of the fragile Antarctic environment." Cited in Malcolm W. Browne, "French and Australians Kill Accord on Antarctic," *New York Times*, September 25, 1989, p. 8.

eration on the frozen continent may be a factor of the relative lack of national attention. For similar outcomes to be realized in space, much greater pulling and hauling, politically, economically, and militarily, would be needed to bring parties around to cooperate and to keep them moving in that direction. Still, some aspects of the Antarctic case, especially in terms of science-based collective learning, may be relevant to explaining the process of conflict limitation seen in space.

What is clear from this discussion is that none of the common analogies applied to space provide a close match to actual dynamics in space. Each, however, helps explain pieces of the puzzle of space security. Analyzing them also contributes to a better grounding in the history of expansionist security and the range of outcomes that are possible. The next task is to move from these general metaphors to more complete explanations and policy perspectives on space that have been developed by analysts over the first fifty years of space security.

Existing Schools of Thought

Despite its growing topicality, the debate on space security has largely been among experts. With the exception of the *Sputnik* period, the years of the Moon race, particularly 1969, and periodic disasters (such as the 2003 *Columbia* accident), public attention to space security has been relatively limited. Nevertheless, among space analysts there has been a wide range of opinion, allowing us to break down the debate between "space defense" versus "space sanctuary" perspectives (mentioned in the Introduction) into four main schools of thought, prediction, and policy representation. Moving from the most conflictual to the most cooperative, they are *space nationalism, technological determinism, social interactionism,* and *global institutionalism.*[41] We will begin with the two poles and also the two largest schools (space nationalism and global institutionalism) and then take on the smaller, but more nuanced technological determinism and social interactionism. Unlike other accounts, this discussion will analyze these schools as dynamic entities (not static perspectives) and track their refinements over time in terms of argument and emphasis as changing space events have stimulated adjustments.

[41] For different categorizations, see Karl Mueller, "Totem and Taboo: Depolarizing the Space Weaponization Debate," in Logsdon and Adams, *Space Weapons;* and Hays, *United States Military Space.* Mueller breaks the debate down into six schools: space racers, space controllers, space hegemonists, sanctuary idealists, sanctuary internationalists, and sanctuary nationalists. Hays employs four categories, although with slightly different criteria than are used here: space hawks, inevitable weaponizers, militarization realists, and space doves.

Space Nationalism

Historian Walter McDougall has argued that space activity—like nuclear weapons development—became possible as a result of large, government-run military programs being conducted by the Soviet Union and the United States after World War II.[42] Without such efforts and the bitter rivalry and fear encapsulated in this competition, human space activity would likely have occurred decades later, on a considerably smaller scale, and with a far slower pace of development. In this context, the school of space nationalism arose. This perspective derives its core dynamics from three sources: (1) the political theory of realism; (2) the competitive history of great power rivalry on prior frontiers; and (3) the context of Cold War hostility. Indeed, given the circumstances of the birth of the space age, in 1957, it is not surprising that most authors of space history have embraced these basic assumptions about space. Such varied analysts as Kash (1967), Harvey and Ciccoritti (1974), Pardoe (1984), Westwood (1984), Gray (1986), Von Bencke (1997), Lambakis (2001), Dolman (2002), and Klein (2006) have all adopted versions of space nationalism, while rejecting the notion that space might somehow be more favorable to cooperation than past great power rivalries in new environments.[43]

The space nationalist perspective on space history is aptly summed up by McDougall's comment that "the international system absorbed space just as it absorbed the atom."[44] But the core of the space nationalist school is rooted in traditions in international relations that go back as far as the work of Thucydides and his observation in the fifth century B.C.E. that "the strong do what they can and the weak suffer what they must."[45] As applied to space, realism makes the assumption that human behavior is essentially static and unchanging, meaning that the prevalence of Machiavellian notions of duplicity, power seeking, and brutality are likely.

[42] McDougall, . . . *the Heavens and the Earth*, pp. 5–6.

[43] See Don Kash, *Cooperation in Space* (Lafayette, Ind.: Purdue University Press, 1967); Dodd L. Harvey and Linda C. Ciccoritti, *U.S.-Soviet Cooperation in Space* (Miami, Fla.: University of Miami Press, 1974); Geoffrey K. C. Pardoe, *The Future for Space Technology* (London: Frances Pinter, 1984); James T. Westwood, "Military Strategy and Space Warfare," *Journal of Defense and Diplomacy*, Vol. 2, No. 11 (November 1984); Colin S. Gray, "Space Arms Control: A Skeptical View," in *America Plans for Space: A Reader Based on the National Defense University Space Symposium* (Washington, D.C.: National Defense University Press, 1986); Matthew J. Von Bencke, *The Politics of Space: A History of U.S.-Soviet/Russian Competition and Cooperation* (Boulder, Colo.: Westview Press, 1997); Lambakis, *On the Edge of Earth* (2001); Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age* (London: Frank Cass, 2002); and Klein, *Space Warfare*.

[44] McDougall, . . . *the Heavens and the Earth*, p. 405.

[45] Thucydides, "The Melian Dialogue," reprinted in Richard K. Betts, *Conflict After the Cold War: Arguments on Causes of War and Peace* (New York: Longman, 2008), p. 57.

Regarding space cooperation, Thomas Hobbes's seventeenth-century comment that "the condition of man . . . is a condition of war of everyone against everyone" helps explain these authors' highly skeptical views.[46] Given their assumption about the anarchic nature of the international system, these authors doubt that international agreements to limit competition or ban specific weapons will work, since the states that engage in them can't be trusted *not* to defect from such agreements when they feel threatened. As Colin Gray concludes on this issue, "Much of what has been said and written in favor of various proposals for space arms control amounts . . . to little more than pious nonsense."[47]

According to this perspective, what passed for cooperation during the Cold War was mainly the result of a lack of state interest in pursuing the types of space defenses or other military activities limited by space-related treaties and agreements in the first place. Everett C. Dolman of the U.S. Air Force's School of Advanced Air Power Studies, for example, argues that the 1967 Outer Space Treaty was not a highlight of superpower cooperation and restraint but instead merely a "reaffirmation of Cold War realism and national rivalry, a slick diplomatic maneuver that both bought time for the United States and checked Soviet expansionism."[48]

Space nationalists downplay the significance of U.S.-Soviet weapons restraint after 1963 by pointing to the high costs and technical inadequacy (or redundancy) of early space weapons. Through the late 1980s, they argue, the United States and the Soviet Union cooperated only in areas—such as banning nuclear weapons in space—where they did not intend to deploy such systems anyway. When new, more useful military technologies become available,[49] they predict, states will inevitably deploy them.

Military officers in this school, such as Navy Commander Klein, have outlined a range of desired American preparations for space warfare and the need for eventual establishment of a separate military space service.[50] For such analysts, space weapons are largely a question of defense, a response to the rather dismal global history of ever-escalating military threats whose root cause lies in the anarchic nature of the international system and the inevitable rise of rivals to U.S. interests.

A more extreme form of space nationalism, seeking to move beyond endless space competition, emerged after the end of the Cold War: U.S. space hege-

[46] Thomas Hobbes, *Leviathan, Parts One and Two* (original, 1651) (Indianapolis, Ind.: Liberal Arts Press, 1977), p. 110.

[47] Gray, "Space Arms Control."

[48] Dolman, *Astropolitik*, p. 8.

[49] Some of the areas pointed to include kinetic-kill weapons, lasers, and space mines.

[50] See Klein, *Space Warfare*.

mony. Dolman's work is largely responsible for developing this amplification, which combines traditional realism with concepts of social Darwinism popular in the late 1800s and late twentieth-century "democratic peace" theory.[51] From his perspective, space weapons and the competitive instincts they might inspire should be viewed as positive forces for both American security and for space's overall political management and commercial development. Dolman argues that "the United States is the morally superior choice to seize and control space."[52]

These hypernationalist views gained influence among neoconservatives in high positions during the George W. Bush administration. Similarly, according to Joan Johnson-Freese of the Naval War College, documents such as the Air Force's 2004 *Counterspace Operations* moved the United States "down a road leading to near-term weaponization."[53] To provide the hardware for such an effort, a 2006 report by the Independent Working Group (consisting of a number of past Reagan administration officials and longtime missile defense supporters) urged near-term U.S. deployment of one thousand space-based interceptors to defeat any potential adversary and to establish conditions of space dominance.[54] In Congress, after the 2007 Chinese anti-satellite (ASAT) test, Senator Jon Kyl (Rep., Arizona) emerged as a leading proponent of U.S. military space readiness and the need for near-term deployment of similar space-based defenses. While also serving other purposes, the February 2008 U.S. ASAT shot may have been intended in part as a "signal" from administration proponents of such a view to the Chinese military regarding U.S. resolve.

Looking back at the history of new frontiers, one can see a compelling logic behind the space nationalist position. International arms control and other restraint-based regimes have not had a very impressive record, except in recent cases where adequate verification has been possible through new technologies (or on-site inspections) or where groups of states and their militaries have embraced generally shared values and norms.[55] Yet, given the vast developments in technology since the time of the nineteenth-century great powers—which forms the most

[51] On this concept, see Bruce Russett, *Grasping the Democratic Peace: Principles for a Post-Cold War World* (Princeton, N.J.: Princeton University Press, 1993).

[52] Dolman, "Space Power and US Hegemony," p. 39.

[53] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), p. 3.

[54] See the text of the Independent Working Group's "Missile Defense, the Space Relationship, & the Twenty-First Century: 2007 Report," posted on the IWG's Web site at <http://ifpa.org/pdf/IWGreport.pdf> (accessed July 31, 2006).

[55] The exceptions include European restraint regarding chemical weapons use after World War I, which was based on the collective rejection of such weapons by national militaries, largely on

salient point of reference for many space nationalists—one must raise the question of what factors might have changed (or may yet change) due to the influence of enhanced international communications, knowledge about modern weapons and their effects, or conditions related to the specific environment of space.

Consistent with realism, however, space nationalists reject the possible transformative role of emerging actors in space, including transnational corporations, nongovernmental organizations, multistate consortia, venture capitalists, and international organizations. Typical of this line of thinking is James Westwood's prediction that "the historic linkage between commerce and military activities will carry over into space."[56] The end result of this competition concerning space, therefore, is viewed as an increasingly militaristic drive by the leading space powers to secure geostrategic advantages over their rivals, as during the age of sea power.

Global Institutionalism

A second and sharply contrasting perspective, developed around the time of the International Geophysical Year (IGY) organized by scientists worldwide for 1957–58, focused on hopes that space might become a sanctuary from world political conflicts. The IGY had helped bring new attention to space and the desirability of international cooperation in exploring this exciting new environment. The global institutionalist school emphasizes the possible role of new forms of shared human and scientific thinking, supported by international cooperation, treaties, and organizations, in providing space security rather than weapons-based approaches. Its adherents take a far more optimistic view of the lessons of space history and the prospects for future cooperation, seeing space cooperation as a means of transcending conflicts on Earth. As British space writer Arthur C. Clarke wrote in 1959, "Only through space-flight can Mankind find a permanent outlet for its aggressive and pioneering instincts."[57] German-born U.S. space enthusiast Willey Ley similarly hypothesized that "nations might become 'extroverted' to the point where their urge to overcome the unknown would dwarf their historic desires for power, wealth, and recognition—attributes that have so often led to war in the past."[58] Ley noted in this regard the establishment already in 1959 of the U.N. Committee on the Peace-

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professional grounds. Another example is U.S.-Soviet arms control, which, as will be discussed later in this book, was greatly facilitated by the new technology of space-based reconnaissance.

[56] Westwood, "Military Strategy and Space Warfare."

[57] Arthur C. Clarke, *The Exploration of Space* (New York: Harper, 1959), p. 181.

[58] Willey Ley, *Harnessing Space* (New York: Macmillan, 1963), p. 223.

ful Uses of Outer Space.[59] Another early adherent to the global institutionalist school, physicist Albert R. Hibbs, asked rhetorically in arguing against military-led nationalism in space and instead in support of a human-wide approach to the future manned exploration: "Is it not possible that we will help [in this process] simply because we want a man to stand on Mars?"[60]

Although global institutionalists rarely mentioned political theory, their assumptions expressed concepts going back centuries within so-called idealist approaches to international relations. Seventeenth-century Dutch lawyer Hugo Grotius, for example, observed that man is endowed by his creator with a higher form of reason than animals and argued that "among the traits characteristic of man is an impelling desire for society, that is, for the social life—not of any and every sort, but peaceful and organized according to the measure of his intelligence."[61] A supporting elaboration of these views for space could be traced back to Immanuel Kant's assertion that "perpetual peace" could be achieved by universalist thinking and a federation of nations.[62] As applied to space, analysts used similar concepts to make the case that humans might be able to live peaceably in space through new methods of transnational governance. Indeed, early members of this school saw space as a means of escaping traditional patterns of human conflict, thanks in part to the positive pressures exerted by, on the one hand, international communications and, on the other, a desire to avoid catastrophic war. They depicted cooperation as the *more likely* outcome in space, compared to competition,[63] and argued that as states integrated their economies and national identities began to break down, old notions of state-centric realism could become anachronistic and even fade into history. One especially innovative 1965 book suggested breaking out of superpower military competition via the redirection of defense funding, arguing, "By inviting Soviet cooperation in an intensive program of space exploration . . . we would tend to eliminate warlike preparations."[64] This study concluded that heightened space

[59] Ibid.

[60] A. R. Hibbs, "Space Man Versus Space Machine," in Lester M. Hirsh, ed., *Man and Space: A Controlled Research Reader* (New York: Pitman, 1966), p. 87.

[61] Hugo Grotius, "War, Peace, and the Law of Nations," reprinted in Paul R. Viotti and Mark V. Kauppi, *International Relations Theory: Realism, Pluralism, Globalism, and Beyond* (New York: Longman, 1999), p. 411.

[62] Immanuel Kant, "Perpetual Peace: A Philosophical Sketch" (original, 1795), reprinted in John A. Vasquez, *Classics of International Relations* (Upper Saddle River, N.J.: Prentice-Hall, 1996).

[63] More recent concepts of globalization support this case, although few discuss space directly. On globalization, see, for example, Thomas L. Friedman, *The Lexus and the Olive Tree: Understanding Globalization* (New York: Anchor, 2000).

[64] Frank Gibney and George J. Feldman, *The Reluctant Space-Farers: A Study in the Politics of Discovery* (New York: New American Library, 1965), p. 168.

investments would "make further armament expenditures immensely difficult if not impossible."[65]

While some of these more fanciful views did not take hold, evidence to support the global institutionalist case began to emerge early in the space age. The 1963 signing of the Partial Test Ban Treaty, halting space nuclear tests, showed that cooperation between the two rivals had begun and represented a viable alternative to seemingly inevitable space conflict.[66] By the mid-1960s, the two rivals took another major step toward *limiting* the scope of their competition by negotiating the Outer Space Treaty in 1967 and opening it to international membership at the United Nations.[67] This agreement applied existing international law to space, banned all military activities on the Moon and other celestial bodies (on threat of open inspection rights granted to signatory states), and most importantly, removed the Moon and celestial bodies from territorial competition by declaring them to be "the province of all mankind." Soon after, other cooperative efforts followed, including the ABM Treaty and the Apollo-Soyuz joint manned mission. In the commercial area, the Convention on International Liability (1972) and the Convention on Registration of Objects (1974) added further stability and "rules" to space activity.[68] As one analyst observed in 1976, "The USA and USSR have gone further to achieve arms control in space than in any other area."[69] This evidence clearly seems to contradict space nationalist patterns and predictions. Peter Jankowitsch observed in 1976: "In the past [such as with the oceans and the world's airspace], international cooperation was slow to follow new dimensions of human activity."[70] But in space, human activity was "soon followed by the development of new forms of international cooperation, including the rapid formation of a new body of international law."[71]

The global institutionalist school quickly peaked in the early to mid-1970s, when the decline of U.S.-Soviet détente resulted in a sharp decline in civilian space cooperation and yielded to new military space testing in the late 1970s

[65] Ibid.

[66] See Glenn T. Seaborg, *Kennedy, Khrushchev, and the Test Ban* (Berkeley: University of California Press, 1981).

[67] See text of the Outer Space Treaty as passed by the United Nations General Assembly (Resolution 2222) on December 19, 1966, on the State Department Web site at <http://www.state. gov/t/ac/trt/5181.htm> (accessed September 9, 2006).

[68] These agreements are described in greater detail in Chapter Four.

[69] William H. Schauer, *The Politics of Space: A Comparison of the Soviet and American Programs* (New York: Holmes and Meier, 1976), p. 71.

[70] Peter Jankowitsch, "International Cooperation in Outer Space," Occasional Paper No. 11 (Muscatine, Iowa: Stanley Foundation, 1976), p. 3.

[71] Ibid., p. 4.

and early 1980s. By the late 1980s, however, the school had resumed its development. Now somewhat sobered by past disappointments, the global institutionalists had largely abandoned idealist notions for more achievable notions of neoliberalism.[72] In other words, analysts no longer predicted an ultimate philosophical convergence among states in space but instead a form of enlightened self-interest and improved behavior through the benefit of cooperative space treaties, international organizations, and new forms of bilateral and multilateral engagement in space. The rapid growth in U.S.-Russian collaboration in a number of highly sensitive areas of spaceflight after 1991 seemed to confirm their predictions of a coming new era in space. But Bush administration policies after 2001, inspired by concepts of space nationalism, explicitly rejected new treaty-based approaches and additional "rules" for space, thus moving these ideas to the back burner of U.S. policymaking.

Today, a growing *international* pressure for new legal instruments to prevent conflict in space continues to motivate this school of thought, as seen in the nearly unanimous international support at the United Nations for the yearly resolution on the Prevention of an Arms Race in Outer Space. Global institutionalists emphasize the role of international treaties in preserving the benefits of space and the need for expanded efforts to close existing loopholes and create strong prohibitions against the testing and deployment of weapons in space.

Air Force Lieutenant Colonel Bruce DeBlois, for example, rejects the inevitability of space nationalism. He describes the dichotomy of "either defending space assets with weapons or not defending them at all" as a "*false dilemma.*"[73] Instead, he argues for broadening the tool kit and abandoning the U.S. "do nothing" diplomatic strategy for space. DeBlois makes the global institutionalist case that a smarter U.S. policy would be one of undertaking "intense diplomatic efforts to convince a world of nations that space as a sanctuary for peaceful and cooperative existence and stability best serves all."[74] As Theresa Hitchens argues, new forms of international cooperation "will be . . . necessary to ensuring the future security of space."[75]

Among European experts, German legal scholar Detlev Wolter has called for

[72] Neoliberalism seeks to explain cooperation among states not on the basis of the inherent "goodness" (or perfectability) of human beings, but instead on the basis of self-interest under conditions of interdependence and the evolution of legal and other rule-based norms.

[73] Lt. Col. (USAF) Bruce DeBlois, "Space Sanctuary: A Viable National Strategy," *Aerospace Power Journal*, Vol. 12, No. 4 (Winter 1998), p. 48.

[74] Ibid., p. 53.

[75] Theresa Hitchens, *Future Security in Space: Charting a Cooperative Course* (Washington, D.C.: Center for Defense Information, September 2004), p. 91.

the negotiation of a Cooperative Security in Outer Space Treaty and the formation of a formal international organization to implement the new agreement.[76] The treaty would ban destructive weapons from space, including ASATs, space-strike weapons, and antiballistic missile technologies. It would also set up an international system for monitoring and verification. Wolter's concept is consistent with treaty proposals at the United Nations offered by China and Russia in recent years but goes further to institutionalize decision making and implementation at the international level. In the United States, the 2002 proposal from Congressman Dennis Kucinich (Dem., Ohio) to cut off U.S funding for space defenses and to negotiate a binding treaty to prevent the weaponization of space fits into this school as well.[77] Political scientist and former State Department official Nancy Gallagher argues that true space security will "require formal negotiations, legally binding agreements, and implementing organizations that have both resources and political clout."[78]

Technological Determinism

A third school of thought regarding space security has focused not on political factors but instead on technology and the resulting structural context of space decision making. This school arose in part out of the technological optimism that pervaded the United States in the 1950s, when officials predicted that nuclear power would soon provide safe and virtually free electricity. Space technology could offer spin-off benefits for life on Earth that would improve living standards and make work less difficult. But others foresaw a darker evolution: the emergence of military space technologies that would likely lead to conflict and possibly large-scale destruction in or from space. Such fears seemed easily predictable given the evidence of the ongoing superpower arms race. At the same, however, nuclear war had not occurred during the Cold War, thus giving technological determinists the ability to consider outcomes with less than cataclysmic consequences and developments that might fall short of warfare in space.

Early in the Cold War, the optimistic school of technological determinism emerged in the form of science-based "convergence" theories. Such concepts,

[76] Detlev Wolter, *Common Security in Outer Space and International Law* (Geneva: U.N. Institute for Disarmament Research, 2006).

[77] See text of the "Space Preservation Act of 2002" (H.R. 3616), on the Web site of the Federation of the American Scientists at <http://www.fas.org/sgp/congress/2002/hr3616.html> (accessed February 19, 2007).

[78] 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.

in fact, linked two very different sets of analysts writing on space security—Soviet and American technologists. Although many of their assumptions differed (such as about the processes of technological change), both subscribed to a fundamentally *materialist* view of history and mankind's space possibilities. This led them to view space activity as a likely driver of new forms of internationalism, thus breaking down existing political barriers between states.

The early U.S. group of technological determinists predicted that cooperation in space would arise out of the objective forces of advanced scientific research and development. Their reasoning was that cost and complexity would eventually drive states to work together in space, as in other areas of high technology. They argued, for example, that the massive, state-funded technological programs developed since World War II would contribute to international stability and create new forms of social engagement by urging caution on their possessors. As Victor Basiuk argued, "Advanced technologies, because of their huge costs, large scale, and, in the case of nuclear weapons, immense destructive power, provide an important impetus to international cooperation."[79] These theorists argued that societies were beginning to converge because of the necessity of performing similar, technologically oriented tasks. Under these conditions, some speculated that competition might itself fade away due to the increasing similarity of erstwhile adversaries, with ideological differences eventually fading into irrelevance.[80] Futurist Neil P. Ruzic foresaw the Moon being settled first by separate teams of Americans and Soviets, who would then begin to cooperate after several decades in the face of shared technological challenges.[81]

Meanwhile, Soviet space analysts writing in the middle of the Cold War enunciated a similar view, although with different political conclusions. Within their communist-inspired framework, Soviet authors portrayed advanced space systems as helping to drive the world beyond its existing conflicts, thus integrating international social forces within the ongoing so-called scientific-technical revolution.[82] Such dynamics, they predicted, would eventually lead to

[79] Victor Basiuk, *Technology, World Politics, and American Policy* (New York: Columbia University Press, 1977), p. 7.

[80] For a recent (and highly detailed) application of broader (economically based) convergence theory, see Harold L. Wilensky, *Rich Democracies: Political Economy, Public Policy, and Performance* (Berkeley: University of California Press, 2002).

[81] Neil P. Ruzic, *Where the Winds Sleep: Man's Future on the Moon, A Projected History* (Garden City, N.Y.: Doubleday, 1970).

[82] For a thorough discussion of this trend among Soviet theorists during the Brezhnev era, see Erik P. Hoffmann and Robbin F. Laird's two exhaustive studies, *The Scientific-Technological Revolution and Soviet Foreign Policy* (New York: Pergamon Press, 1982); and *Technocratic Socialism: The Soviet Union in the Advanced Industrial Era* (Durham, N.C.: Duke University Press, 1985).

the creation of the single world class that Karl Marx had predicted and, therefore, to harmony in space. This Soviet school included such varied authors as Vereshchetin (1977), Lukin (1980), Savitskaya (1985), Zhukov (1985), Gavrilov and Sitnina (1985), and Sagdeev (1986).[83] In the course of social progress, they saw space playing a leading role, since it represented the *most* advanced area of human technology. As Gavrilov and Sitnina argued, "Never before has space played such a role in the business of the transformation of civilization as it does in our time."[84] These analysts saw the so-called atomic space age as a new human era, whose technologies would create the advanced industrial conditions necessary for the emergence of a harmonious, communist society. But censorship and state direction clearly affected this work, as such writings and their scripted unanimity evaporated with the demise of the Communist Party and the emergence of an independent Russian Federation.

On the more pessimistic side of the technological determinist school, a significant group of analysts in the space security debate emerged out of a concern about the U.S. and Soviet military-industrial complexes and the factors driving military and space procurement. It included such authors as Jessup and Taubenfeld (1959), Frutkin (1965), and York (1970).[85] In general, the gloomy predictions of these authors were rooted in their observation that it would be difficult to halt the seemingly inevitable superpower development of more advanced and more destructive military technologies, including those for space. At the domestic politics level, these authors identified several forces at work: natural fears of military leaders about their need to protect the nation, and

[83] See V. S. Vereshchetin, *Mezdunarodone sotrudnichestvo v kosmose* [International cooperation in space] (Moscow: Nauka, 1977); P. I. Lukin, et al., *Kosmos i pravo* [Space and law] (Moscow: Institute of State and Law, 1980); G. P. Zhukov, *Kosmos i mir* [Space and peace] (Moscow: Nauka, 1985); S. Savitskaya, "Gorizonty otkrytogo kosmosa" [Horizons of deep space], *Kommunist*, No. 6 (April 1985); V. M. Gavrilov and M. Yu. Sitnina, "Militarizatsiya kosmosa: novaya global'naya ugroza" [The militarization of space: a new global threat], *Voprosy Istorii*, No. 11 (1985); R. Sagdeev, "Era kosmonavtika—znachit: era cheloveka!" [The era of cosmonautics means the era of mankind], *Kommunist*, No. 5 (March 1986). The relative symmetry of Soviet interpretations was at least in part the result of censorship restrictions favoring pro-cooperation analyses. Below the surface, based on interviews conducted with leading Soviet space experts in Moscow during the late 1980s, the situation was more complicated, involving a significant (though minority) pessimist (or self-described realist) contingent.

[84] Gavrilov and Sitnina, "Militarizatsiya kosmosa," p. 94.

[85] See Jessup and Taubenfeld, *Controls for Outer Space and the Antarctic Analogy*; Arnold W. Frutkin, *International Cooperation in Space* (Englewood Cliffs, N.J.: Prentice-Hall, 1965); and Herbert F. York, *Race to Oblivion* (New York: Simon & Schuster, 1970). See also York's later book with discussion of space developments, *Making Weapons, Talking Peace: A Physicist's Odyssey from Hiroshima to Geneva* (New York: Basic, 1987).

more self-interested motives within industry and the armed services. They described problems such as difficult-to-stop military research programs, patterns of political deference to "expert" advice on technical subjects like space, and simply cagily disguised profit motives sold as the "national interest." Herbert York, former nuclear weapons scientist and defense department research and development director under President Eisenhower, identified interservice rivalries that drove many overly expensive and duplicative missile programs in the 1950s.[86] He quoted Eisenhower on the sometimes harmful effects of collaboration between the "military-industrial complex" and the "scientific-technological elite" in helping to drive these dynamics.[87] York found similar processes at work in the nuclear weapons complex and the related arms race. He wrote in 1976: "In short, the root of the problem has not been maliciousness, but rather a sort of technological exuberance that has overwhelmed the other factors that go into the making of overall national policy."[88] York recognized the risks of scientific fascination with weapons research and the tendency of such trends to lead occasionally to exaggerated perceptions of threat.[89] Similarly, national leaders—whether in Washington, Moscow, New Delhi, or Beijing—face difficult choices in complex national security debates over technology. York, though, believed such harmful deterministic processes could be subverted and short-circuited through collective political action and exposure of these phenomena. But as the space age wore on and as U.S.-Soviet relations moved from détente to renewed hostility and military buildups in the late 1970s and early 1980s, prospects for such developments seemed slim.

At around this time, another variation of technological determinist thinking emerged from European political economy thought regarding space, focusing on the theory of "collective" (or public) goods.[90] This framework viewed spacefaring nations as self-interested rational actors making decisions according to shifting economic and strategic calculations. Drawing on Garrett Hardin's famous 1968 article about the "tragedy of the commons,"[91] which had focused

[86] York, *Making Weapons, Talking Peace*, p. 173.

[87] Ibid., p. 125.

[88] Herbert F. York, *The Advisors: Oppenheimer, Teller, and the Superbomb* (Stanford, Calif.: Stanford University Press, 1976), p. xiii.

[89] See York, *Making Weapons, Talking Peace*.

[90] As John Conybeare defines this concept, "A public good is one which has the property of nonappropriability . . . and indivisibility . . . since consumption by one person does not reduce the amount available to anyone else." See John A. C. Conybeare, "International Organization and the Theory of Property Rights," *International Organization*, Vol. 34, No. 3 (Summer 1980), p. 327.

[91] See Garrett Hardin, "The Tragedy of the Commons," *Science*, 162 (1968). Hardin's article used the analogy of cooperative sheep grazing on historical British common grounds and pointed out

attention on the harmful environmental implications of technological change, overcrowding, and failed human management, Swedish analyst Per Magnus Wijkman[92] warned that pressure on states to defect from cooperative space regimes for commercial and military benefit could be expected to grow as the expansion of actors and activities increased the advantages of "enclosure" (or privatization) of space. Unfortunately, as space activity began to move toward multiple actors as the Europeans, Japanese, and others entered space, the prospect for continued cooperation seemed less favorable than during the bilateral U.S.-Soviet space race. On the other hand, as Wijkman argued, conditions of "interdependence" in space (such as involving collision avoidance) gave countries "strong incentives to agree to measures to keep interference at a mutually accepted level."[93] The periodic emergence of U.S.-Soviet restraint in space during the Cold War supported this view, suggesting that in games with repeated "plays," in which states can communicate and adjust their behavior, outcomes might become more favorable. The question after the Cold War was how to extend these lessons into a more advanced technological environment with a greater number of actors and possibly continued military tensions.[94] Likely areas of conflict included critical regions of low–Earth orbit used extensively by the military, locations in geostationary orbit, radio frequencies for satellites, and minerals on the Moon.[95]

Fortunately, trends during the early 1990s seemed to indicate declining national interest in military space weapons technologies. But by the late 1990s, analysts again began to focus greater attention on these issues, as space-based missile defenses returned to active consideration by the U.S. government. The Bush administration's active discussion of space-based kinetic-kill vehicles,

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the problems that eventually arose from increasing crowding and the presence of even a minority of selfish actors, eventually ruining this cooperation and leading to the grounds' enclosure. Hardin suggested a number of radical policy measures to prevent such international tragedies in the areas of pollution, overpopulation, and nuclear weapons.

[92] See Per Magnus Wijkman, "Managing the Global Commons," *International Organization*, Vol. 36, No. 3 (Summer 1982).

[93] Ibid., p. 535.

[94] As Kenneth Waltz argues, "The likelihood that great powers will try to manage the system is greatest when their number reduces to two." See Kenneth N. Waltz, *Theory of International Politics* (Reading, Mass.: Addison-Wesley, 1979), p. 198. The logic of Waltz's argument extended to space suggests that while meaningful cooperation may have occurred as part of superpower attempts to manage the nuclear world, post–Cold War multipolar conditions (in the presence of multiple states in space) are likely to make cooperative outcomes much more difficult.

[95] On these debates, see Andrew Brearley, "Mining the Moon: Owning the Night Sky?" *Astropolitics*, Vol. 4, No. 1 (Spring 2006).

space-based lasers, and even possible Global Strike weapons renewed interest in the technological determinist school. For most of these analysts, including Lupton (1998), Hays (2002), and O'Hanlon (2004),[96] these dynamics were neither good nor bad, but simply inevitable. The questions then became, what to do about them and, perhaps, how to manage them once they arrived? Although the most recent technological determinists in the space security field do not use a collective goods approach, their arguments are generally consistent with its assumptions and concerns.

Hays foresees a gradual process of weaponization, arguing that "as current political and technological challenges are surmounted . . . it is likely that space . . . will become weaponized and will emerge as an important RMA [Revolution in Military Affairs]."[97] Similarly, the Brookings Institution's Michael O'Hanlon draws implicitly on this notion of gradual, technologically influenced change to make the case for a middle ground in the current space debate, saying, "Extreme positions that would either hasten to weaponize space or permanently rule it out are not consistent with technological realities and U.S. security interests."[98] He and others in this school urge caution on the United States and others to avoid the *aggressive* arming of space, such as that advocated by some space nationalists. This position resonates with many military officers who see space threats on the horizon but also see the desirability of trying to prevent and manage future conflicts, including through possible negotiations with other space powers.[99]

In this context, U.S. Air Force Colonel John Hyten's approach to the challenges of technological pressures in space offers some more optimistic prospects: "If we negotiate openly with the nations of the world; if we allow our industry to exploit space fully and become the unquestioned leader of the information age; and if we develop the means and methods to deal effectively with inevitable conflicts in space, perhaps the new ocean to which President Kennedy referred could remain a 'sea of peace.'"[100]

Thus, according to current technological determinists, management arrangements may be possible but will rely on favorable structural conditions,

[96] Lupton, *On Space Warfare*; Hays, *United States Military Space*; and Michael E. O'Hanlon, *Neither Star Wars nor Sanctuary: Constraining the Military Uses of Space* (Washington, D.C.: Brookings Institution, 2004).

[97] Hays, *United States Military Space*, p. 3.

[98] O'Hanlon, *Neither Star Wars nor Sanctuary*, p. 21.

[99] On this perspective, see Col. (USAF) John E. Hyten, "A Sea of Peace or a Theater of War? Dealing with the Inevitable Conflict in Space," in Logsdon and Adams, *Space Weapons*.

[100] Ibid., p. 251.

communications, and political bargaining. To understand these factors and their possible role in space security, we need next to examine the final and most recent school of thought: social interactionism.

Social Interactionism

In the 1980s, with the Cold War beginning to wind down, some political scientists and space analysts began to focus on the possibility of long-term cooperative links in space, even among rival states. The warming of U.S.-Soviet relations and the demise of the Strategic Defense Initiative seemed to indicate a loss of steam for competitive approaches to space security and the diminution of military-led tendencies. New cooperative ventures seemed possible. But the Clinton administration's seeming disinterest in global institutionalist remedies to space insecurities, seen in its failure to propose any new space treaties, suggested that more ad hoc cooperation and management mechanisms might become the norm instead.

Social interactionists rejected the notion of the inevitability of space weapons, given the availability of policy tools among space-faring states to interact with one another, bargain, and prevent the deployment of harmful weapons, which could damage other priorities they have in space. Outcomes, however, were seen as contingent and sometimes imperfect given the nature of political realities. Paul Stares, one of the school's early representatives, observed in 1985 that "ASAT arms control cannot eliminate the threat to space systems, only bound it."[101] But, he continued, "the different approaches to the control of ASAT weapons can work synergistically: the shortcomings of one agreement can to a large extent be remedied by the provisions of another."[102] Stares concluded by suggesting the development of a "rules of the road" approach as one possible remedy.

A number of advocates of this general approach emerged in the mid-1980s among analysts who studied the U.S.-Soviet arms control process. Considerable research up to this time in the international relations field had explored related concepts of cognitive change (or learning) at the individual,[103]

[101] Paul B. Stares, *Space and National Security* (Washington, D.C.: Brookings Institution, 1987), p. 172.

[102] Ibid.

[103] For example, see Robert Jervis, *Perception and Misperception in International Politics* (Princeton, N.J.: Princeton University Press, 1976); Richard E. Neustadt and Ernest R. May, *Thinking in Time* (New York: Free Press, 1986); Steven Kull, *Minds at War: Nuclear Reality and the Inner Conflicts of Defense Policymakers* (New York: Basic, 1988); and Deborah Welch Larson, *Origins of Containment* (Princeton, N.J.: Princeton University Press, 1985).

organizational,[104] and state[105] levels. As space analysts had observed, some of these types of behavior had also occurred regarding space, in one form or another. John Lewis Gaddis, for example, described the emergence of a "tacitly agreed upon satellite reconnaissance regime" between the two superpowers as a significant accomplishment made possible by extensive communication, the small number of actors, and the transparency of space.[106] Steven Weber's study of anti-satellite and other arms control attempts in the 1960s and 1970s offered a somewhat more tentative conclusion, pointing out that the two superpowers "did not learn smoothly or in a patterned way."[107] Instead, he identified "lumpy" learning that tended to be concentrated within critical periods when both sides were receptive to cooperative signals from the other. Part of the problem was that space security during the Cold War tended to be dominated by military definitions of security, which restricted the bounds of superpower learning.

Social interactionism requires knowing what will work in existing political and military conditions. For this reason, current representatives of this school do not immediately urge arms control treaties as the best solution, particularly for problems where rules of the road may be easier (and quicker) to obtain among the multiple players in space, some of which are no longer nation-states. At the same time, these analysts caution against current U.S. policies of hyping the space "threat," saying that such statements risk making weaponization a self-fulfilling prophesy. As Joan Johnson-Freese argues: "Relying exclusively on technology for security—in this case, space weapons—does not provide an asymmetric advantage; it creates a strategically unstable environment."[108] These

[104] For example, see Graham Allison, *Essence of Decision* (New York: Little, Brown, 1971); John Steinbruner, *The Cybernetic Theory of Decision* (Princeton, N.J.: Princeton University Press, 1974); James G. March and Johan P. Olsen, eds., *Ambiguity and Choice in Organizations* (Oslo, Norway: Universitetsforlaget, 1976); Chris Argyris and Donald A. Schon, *Organizational Learning: A Theory of Action Perspective* (Reading, Mass.: Addison-Wesley, 1978); and Ernst B. Haas, *When Knowledge Is Power: Three Models of Change in International Organizations* (Berkeley: University of California Press, 1990).

[105] For example, see William Zimmerman and Robert Axelrod, "The 'Lessons' of Vietnam and Soviet Foreign Policy," *World Politics*, Vol. 33, No. 1 (October 1981); Lloyd S. Etheredge, *Can Governments Learn? American Foreign Policy and Central American Revolutions* (New York: Pergamon Press, 1985); Joseph S. Nye, Jr., "Nuclear Learning and U.S.-Soviet Security Regimes," *International Organization*, Vol. 41, No. 3 (Summer 1987); and George W. Breslauer and Philip E. Tetlock, eds., *Learning in U.S. and Soviet Foreign Policy* (Boulder, Colo.: Westview Press, 1991).

[106] John Lewis Gaddis, "The Evolution of a Reconnaissance Satellite Regime," in Alexander L. George, Philip J. Farley, and Alexander Dallin, eds., *U.S.-Soviet Security Cooperation: Achievements, Failures, Lessons* (New York: Oxford University Press, 1988), p. 366.

[107] Steve Weber, *Cooperation and Discord in U.S.-Soviet Arms Control* (Princeton, N.J.: Princeton University Press, 1991), p. 288.

[108] Johnson-Freese, *Space As a Strategic Asset*, p. 243.

viewpoints posit a diametrically different understanding of history than that of space nationalists or technological determinists. Rather than portraying the United States as a victim of hostile historical processes, these critics assume that U.S. leaders can instead *influence* military trends in a purposeful manner through their interactions. As Michael Krepon argues, "By virtue of its leadership position in space commerce and military power, the United States now has unprecedented capacity to shape whether space becomes weaponized."[109] Krepon and Michael Katz-Hyman argue that "space, like military activities . . . on Earth, needs a code of conduct to promote responsible activities and to clarify irresponsible ones."[110] In promoting these concepts, Krepon and Katz-Hyman do not assume idealist-inspired value changes among actors, only adaptation to prevent harmful behavior. With increasing crowding in space, such action may be imperative to the continued use of various orbital regions. But if space includes a variety of new state and non-state actors, such cooperation may be difficult to accomplish.

One post–Cold War field of political science that has sought to examine prospects for learning among widely disparate actors is so-called social constructivism.[111] This successor of 1980's learning theory argues that regularized contacts and communication, particularly in an institutionalized setting, can promote common problem-solving and even gradually shared identity formation. In this regard, Alexander Wendt has coined the term "international state" to describe the process of collective-identity formation that takes place among countries under repeated interaction.[112] Such constructivist notions work well in explaining the eventual outcome in the Antarctic, where an "epistemic community"[113] of scientists helped to bring public opinion to bear on a set of negotiations that otherwise was moving toward radical commercialization, thus likely decimating the protective regime governing the Antarctic continent and its surrounding waters. But the applicability of social constructivism (as opposed to more limited social interactionism) to space is limited at present. Instead of witnessing the recent formation of strengthened collective norms and

[109] Michael Krepon (with Christopher Clary), *Space Assurance or Space Dominance? The Case Against Weaponizing Space* (Washington, D.C.: Henry L. Stimson Center, 2003), p. 88.

[110] Michael Krepon and Michael Katz-Hyman, "Irresponsible in Space," *Defense News*, February 5, 2007.

[111] On this literature, see Jeffrey T. Checkel, "The Constructivist Turn in International Relations Theory," *World Politics*, Vol. 50, No. 2 (January 1998).

[112] See Alexander Wendt, "Collective Identity Formation and the International State," *American Political Science Review*, Vol. 88, No. 2 (June 1994).

[113] An "epistemic community" can be defined as a group of experts, analysts, and like-minded officials joined by common beliefs about a body of technical knowledge in an area of public policy.

identities, certain treaties that embodied them have been under challenge in recent years. The U.S. withdrawal from the ABM Treaty in 2002 and China's 2007 ASAT test suggest that norms have not been as powerful in space as they have been in the Antarctic case. One reason may lie in the absence of public lobbying by influential figures—such as former astronauts—against space weapons. Another reason may be the much closer relationship of space to national security. For the United States, international preferences for limits on space defenses have been viewed by recent American officials as unacceptable intrusions on U.S. sovereignty and security. A further reason, however, may be an as-yet poor official understanding of the hazards to the space environment posed by space debris, an understanding that may now be changing given the negative repercussions of China's high-altitude ASAT test.

Toward a New Understanding of Space Security

What emerges from this review of the main conceptual roots of space policy analysis over the past fifty years is a mixed picture. Each of the schools analyzed offers some explanatory strengths, but each also has blind spots and weaknesses. In seeking a better means of structuring our thinking about space security's past and future, we instead return to the discussion of space security that opened this chapter, one that made reference to both man-made and natural threats. In that context, it might be useful to move space security analysis from its traditional focus on states and their militaries to the space environment itself. This shift encourages an emphasis on "softer" tools for achieving space security than military means and refocuses our attention on the "transboundary" environmental problems[114] represented by space radiation and debris.

Viewing space security from the perspective of self-interested actors seeking to protect their access to space in a gradually constricting collective goods environment may offer advantages over tying space security debates to nuclear and other "hard" security issues, which Cold War competition encouraged. Recent recognition of such problems as global warming, the depletion of fisheries, watershed shortages, and deforestation has brought new collective action to address challenges faced by un- or under-protected global commons. To date, space has figured only marginally in these discussions. But growing concerns about orbital debris may be a tipping point in pushing for more attention to such questions in space.

[114] On this category of global challenges, see Mostafa K. Tolba (with Iwona Rummel-Bulska), *Global Environmental Diplomacy: Negotiating Environmental Agreements for the World, 1973–1992* (Cambridge, Mass.: MIT Press, 1998).

Looking back across history for lessons, we can conclude that neither excessive pessimism nor excessive optimism is warranted for space security. The outcomes to date in space have been mixed in regard to cooperation and competition. Yet it is worth observing that surprising levels of restraint emerged during the first fifty years of space activity, despite a global context of political and military hostility. Making sense of these contradictory trends remains a work in progress. Changing the focus of traditional analysis regarding space may be fruitful, as a different lens sometimes brings a new and more accurate perspective to long-studied problems. In the next chapter, then, we consider what might be gained from viewing space security as an environmental management problem.