RULES FOR THE HEAVENS: THE COMING REVOLUTION IN SPACE AND THE LAWS OF WAR

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Great powers are increasing their competition in space. Though Russia and the United States have long relied on satellites for surveillance of rival nations' militaries and the detection of missile launches, the democratization of space through technological advancements has allowed other nations to assert greater control. This Article addresses whether the United States and other nations should develop the space-based weapons that these policies promise, or whether they should cooperate to develop new international agreements to ban them. In some areas of space, proposals for regulation have already come too late. The U.S.'s nuclear deterrent itself depends crucially on space: ballistic missiles leave and then re-enter the atmosphere, giving them a global reach without serious defense. As more nations develop nuclear weapons and intercontinental ballistic missile (ICBM) technology, outer space will become even more important as an arena for defense against weapons of mass destruction (WMD) proliferation. North Korea's progress on ICBM and nuclear technology, for example, will prompt even greater investment in space-based missile defense systems.

This Article makes two contributions. First, it argues against a growing academic consensus in favor of a prohibition on military activities in space. It argues that these scholars over-read existing legal instruments and practice. While nations crafted international agreements to bar WMDs in outer space, they carefully left unregulated reconnaissance and communications satellites, space-based conventional weapons, antisatellite systems, and even WMDs that transit through space, such as ballistic missiles. Second, this Article develops insights into space warfare with tools developed for the analysis of crisis bargaining between nations. It argues that states can use force in space for self-defense and to resolve international

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disputes with less harm than current strategies. Space weapons raise the same questions as other new technologies, but also realize the same benefits: greater precision, fewer casualties and destruction, and more effective crisis bargaining between states.

TABLE OF CONTENTS

I. INTRODUCTION

President Donald Trump's National Security Strategy set a new course by focusing on rebuilding the domestic economy as central to national security and aiming at "rival powers, Russia and China, that seek to challenge American influence, values, and wealth."[1] Critics observed that the White House seemed to reverse past presidents' emphases on advancing democracy and liberal values, by rejecting both reducing global warming and spreading free trade as national security goals, as well as elevating American sovereignty over international cooperation.[2]

Less noticed but perhaps equally as revisionist, the Trump Administration is reversing its predecessor's course on outer space. Even as American military and civilian networks increase their dependence on satellites, the Obama White House had deferred to European efforts to develop a "Code of Conduct" that

1. Donald J. Trump, *National Security Strategy of the United States of America* (Dec. 18, 2017), https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

2. Elliot Abrams, *The Trump National Security Strategy*, COUNCIL ON FOREIGN REL.: PRESSURE POINTS (Dec. 26, 2017), https://www.cfr.org/blog/trump-national-security-strategy.

would reduce the chances of armed conflict in space.[3] Rejecting these international norms, the Trump Administration instead relies on unilateralism: "any harmful interference with or an attack upon critical components of our space architecture that directly affects this vital U.S. interest will be met with a deliberate response at a time, place, manner, and domain of our choosing."[4]

Great powers are increasing their competition in space. Though Russia and the United States have long relied on satellites for surveillance of rival nations' militaries and the detection of missile launches, the democratization of space through technological advancements has allowed other nations to assert greater control.[5] In January 2019, China landed a probe on the far side of the moon and recently tested an anti-satellite weapon; meanwhile, India plans to launch constellations of cheap satellites for communications.[6] In June 2018, the United States recognized the growing importance of space as an arena for security competition by announcing the establishment of a new branch of the military—the United States Space Force—to join the Army, Navy, Air Force, Marines, and Coast Guard.[7] By February 2019, the Trump Administration signed Space Policy Directive-4, an executive order to create the first new branch of the U.S. Armed Forces since the end of World War II, over the initial objections of the Pentagon and military leaders as well as congressional skepticism.[8] This action reinforced acting Defense Secretary Patrick Shanahan's strong word of caution in the Defense Department's 2019 Missile Defense Review that "military superiority is not a birthright," that "the scale and urgency of change required to renew our conventional and missile overmatch should not be underestimated," and that space will play a particularly important role in support of missile defense.[9]

This Article addresses whether the United States and other nations should develop the space-based weapons that these policies promise, or whether they should cooperate to develop new international agreements to ban them. In some

3. Jack M. Beard, *Soft Law's Failure on the Horizon: The International Code of Conduct for Outer Space Activities*, 38 U. PA. J. INT'L L. 335, 376 n.171 (2017).

4. Trump, *supra* note 1, at 31.

5. *See* NATIONAL INTELLIGENCE STRATEGY OF THE UNITED STATES OF AMERICA 4 (2019), https://www.dni.gov/files/ODNI/documents/National_Intelligence_Strategy_2019.pdf.

6. Michael Martina, *China "Lifts Mysterious Veil" by Landing Probe on Far Side of the Moon*, REUTERS (Jan. 2, 2019, 10:57 PM), https://www.reuters.com/article/us-china-moon/china-lifts-mysterious-veil-by-landing-probe-on-dark-side-of-the-moon-idUSKCN1OX07Q; Vaishali Sharma, *Commercialization of the Indian Small Satellite Industry*, VIA SATELLITE, http://interactive.satellitetoday.com/via/may-2019/commercialization-of-the-indian-small-satellite-industry/.

7. DEP'T OF DEF. FINAL REPORT ON ORGANIZATIONAL AND MANAGEMENT STRUCTURE FOR THE NATIONAL SECURITY SPACE COMPONENTS OF THE DEPARTMENT OF DEFENSE at 3 (Aug. 9, 2018), https://media.defense.gov/2018/Aug/09/2001952764/-1/-1/1/ORGANIZATIONAL-MANAGEMENT-STRUCTURE-DOD-NATIONAL-SECURITY-SPACE-COMPONENTS.PDF.

8. Donald J. Trump, Text of Space Policy Directive-4: Establishment of the United States Space Force, PRESIDENTIAL MEMORANDUM (Feb. 19, 2019), https://www.whitehouse.gov/presidential-actions/text-space-policy-directive-4-establishment-united-states-space-force/; Jacqueline Klimas, Trump Going for Full-Blown Space Force, White House Memo Reveals, POLITICO (Nov. 29, 2018, 02:49 PM), https://www.politico.com/story/2018/11/29/space-force-military-branch-999528.

9. OFFICE OF SEC'Y DEF., MISSILE DEFENSE REVIEW, SECRETARY'S PREFACE AT I-II (2019), https://media.defense.gov/2019/Jan/17/2002080666/-1/-1/1/2019-MISSILE-DEFENSE-REVIEW.PDF.

areas of space, proposals for regulation have already come too late. The U.S.'s nuclear deterrent itself depends crucially on space: ballistic missiles leave and then re-enter the atmosphere, giving them a global reach without serious defense.[10] As more nations develop nuclear weapons and intercontinental ballistic missile ("ICBM") technology, outer space will become even more important as an arena for defense against weapons of mass destruction ("WMD") proliferation. North Korea's progress on ICBM and nuclear technology, for example, will prompt even greater investment in space-based missile defense systems.

This Article makes two contributions. First, it argues against a growing academic consensus in favor of a prohibition on military activities in space. It argues that these scholars over-read existing legal instruments and practice.[11] While nations crafted international agreements to bar WMDs in outer space, they carefully left unregulated reconnaissance and communications satellites, space-based conventional weapons, anti-satellite systems, and even WMDs that transit through space, such as ballistic missiles.[12] Second, this Article develops insights into space warfare with tools developed for the analysis of crisis bargaining between nations.[13] It argues that states can use force in space for self-defense and to resolve international disputes with less harm than current strategies. Space weapons raise the same questions as other new technologies, but also realize the same benefits: greater precision, fewer casualties and destruction, and more effective crisis bargaining between states.

This Article proceeds in four parts. Part II reviews the rapid gains made in space technology and describes the central place of satellites in both military and civilian networks. Part III evaluates the legal regime governing space activities, describes the legal theories proposed by different scholarly schools of thought, and critiques proposals to ban or delay new space technologies. Part IV places the military opportunities provided by new space technologies within a broader understanding of interstate competition. It argues that broader deployment of space weapons can reduce the destructiveness of war and the spread of armed conflict between nations and may even help secure global security against the rise of disorder and unconventional threats. It cautions, however, that the United States and other nations have an interest in limiting the development of space weapons that could destabilize the existing balance of power by creating a first-

10. John Yoo, *Military Use of Space is Coming, Trump Can Help America Prepare*, The Hill (Dec. 28, 2017, 9:44 AM), https://thehill.com/opinion/national-security/366663-military-use-of-space-is-coming-trump-can-help-america-prepare.

11. *See, e.g.*, Jackson Maogoto & Steven Freeland, *The Final Frontier: The Laws of Armed Conflict and Space Warfare*, 23 CONN. J. INT'L L. 165 (2007).

12. Earlier work examined space developments within the context of historical changes in the laws of war in JEREMY RABKIN & JOHN YOO, STRIKING POWER: HOW CYBER, ROBOTS, AND SPACE WEAPONS CHANGE THE RULES FOR WAR (2017), but did not take account of new developments such as the creation of the U.S. Space Force and new assessments of the growing competition in space.

13. A similar methodology is employed in Jide Nzelibe & John Yoo, *Rational War and Constitutional Design*, 115 YALE L.J. 2512 (2006); John Yoo, *Embracing the Machines: Rationalist War and New Weapons Technologies*, 105 CALIF. L. REV. 443 (2017).

strike advantage against a nuclear deterrent. Part V proposes ways in which international law might help advance these goals.

II. THE SPACE RENAISSANCE AND THE MILITARY

Developed nations are driving a renaissance in space technology, both civilian and military. This Part will first examine the rapid changes in space, such as broader access to space and increased military competition in orbit, as well as the U.S. response with the creation of a Space Force. It then analyzes the impact of these developments on the primary military space missions. Space support uses technology to increase the effectiveness of military activity on earth. Space control protects space assets to maintain their military advantages. Force application disables an opponent's use of space, or even directly attacks ground targets.[14] With economic rivals such as China and India, and rogue states like Iran and North Korea developing their own outer space programs, the importance of space technology to U.S. interests and international peace will only continue to rise.

A. Advancements in Space Technology

In recent years, rapid advancements in the civilian exploitation of space has received a great deal of public attention. The global positioning system ("GPS") is illustrative. GPS uses satellites in geosynchronous orbit to send signals to earth, allowing receivers to pinpoint their locations.[15] GPS's precision makes possible new forms of economic activity plus increases the efficiency of existing services. Ride-sharing uses GPS to allow drivers and passengers to coordinate rides.[16] Logistics and transportation companies use GPS to increase efficiency in the delivery of packages and items.[17] Apple, Google, and Microsoft offer mapping technology that allows users to easily navigate routes while simultaneously giving detailed information on the locations of nearby points of interest.[18] Airliners rely on GPS to fly, while trucking and railroad companies use it to track their vehicles.[19] The value of such enterprises is astonishing: just one ride-sharing company, Uber, operates in about 300 cities worldwide and in only five years reached an estimated value of more than $50 billion.[20]

Satellites provide civilian communication services that may surpass locational data in importance. A system of satellites transmits voice and data across the globe instantly.[21] While once limited to voice communications, satellites can

14. *See* BENJAMIN S. LAMBETH, MASTERING THE ULTIMATE HIGH GROUND: NEXT STEPS IN THE MILITARY USES OF SPACE 112 (2003).

15. RABKIN & YOO, *supra* note 12, at 196.

16. *Id.*

17. *Id.*

18. *Id.*

19. *Id.*

20. Douglas MacMillan & Telis Demos, *Uber Valued at More Than $50 Billion*, WALL ST. J. (July 31, 2015, 8:50 PM), https://www.wsj.com/articles/uber-valued-at-more-than-50-billion-1438367457.

21. RABKIN & YOO, *supra* note 12.

now upload and download internet data and video content at broadband speeds. DirecTV, for example, beams television shows and movies directly from space to users on the ground.[22] In 2015, AT&T paid $49 billion for the company.[23] Likewise, communications satellites allow automated teller machines to process withdrawals, cash registers to verify credit cards, and financial institutions to execute transactions quickly and reliably. The private space industry is now estimated to be a $330 billion commercial enterprise worldwide.[24] Private commercial actors generate $251 billion in revenue, with the rest coming from government spending.[25] The U.S. Department of Defense even relies on commercial satellites for about 40% of its communication systems.[26]

The idea of sending civilians into space is even beginning to take flight. Elon Musk's SpaceX has developed reusable rockets to transport cargo, which should dramatically lower the cost of lifting payloads into orbit.[27] By summer 2017, SpaceX had already launched three commercial Falcon 9 missions in less than two weeks and was on schedule to hit about twenty launches in a full year.[28] The company also announced that it had signed on its first private passenger, Japanese billionaire Yusaku Maezawa, to orbit the moon aboard its largest rocket, BFR, in 2023.[29] Meanwhile, Blue Origins has tested a reusable rocket to carry tourists on suborbital excursions and is developing a larger rocket that could further reduce launch costs.[30] Yet another startup, Virgin Galactic, has already begun selling seats for tourist voyages in space.[31]

These advances have become possible because of a steep reduction in the costs of space launches. According to economic studies, competition from new private high-tech startups such as SpaceX have driven the costs of space launches

22. *Id.*

23. *See* Thomas Gryta, *AT&T Closes $49 Billion DirecTV Buy*, WALL ST. J. (July 24, 2015, 3:42 PM), http://www.wsj.com/articles/at-t-closes-49-billion-directv-acquisition-1437766932.

24. RABKIN & YOO, *supra* note 12, at 196.

25. COMM. ON NAT'L SEC. SPACE DEF. & PROT., NATIONAL SPACE DEFENSE AND PROTECTION: PUBLIC REPORT 13 fig.1-1 (2016).

26. RABKIN & YOO, *supra* note 12, at 15.

27. Loren Grush, *SpaceX's Powerful Falcon Heavy Rocket Successfully Launched on its First Commercial Mission*, THE VERGE (Apr. 11, 2018, 11:39 AM), https://www.theverge.com/2019/4/10/18302235/spacex-falcon-heavy-arabsat-6a-rocket-landing-commercial.

28. Darrell Etherington, *SpaceX Successfully Launches Third Falcon 9 in Under 2 Weeks*, TECHCRUNCH (July 5, 2017, 6:44 PM), https://techcrunch.com/2017/07/05/spacex-successfully-launches-third-falcon-9-in-under-2-weeks/.

29. Andy Pasztor, *Elon Musk's SpaceX Says It Signed Up Its First Round-the-Moon Tourist*, WALL ST. J. (Sept. 14, 2018, 5:03 PM), https://www.wsj.com/articles/elon-musks-spacex-says-it-has-signed-up-its-first-round-the-moon-tourist-1536898342; *see also* Andy Pasztor & Anne Steele, *SpaceX's First Moon Tourist Is a Japanese Billionaire*, WALL ST. J. (Sept. 18, 2018, 3:42 AM), https://www.wsj.com/articles/spacex-announces-first-lunar-tourist-for-2023-mission-1537237536.

30. Calla Cofield, *Beyond Space Tourism: Jeff Bezos Sees Many Uses for Blue Origin Rocket*, SPACE.COM (Apr. 12, 2017), https://www.space.com/36437-blue-origin-many-uses-new-shepard-spacecraft.html.

31. Mike Wall, *Virgin Galactic's Historic Space Trip Heralds a Coming Age of New US Human Spaceflight Leaps*, SPACE.COM (Dec. 14, 2018), https://www.space.com/42737-virgin-galactic-human-spaceflight-milestone.html.

down by more than 90% over the last five years.[32] Competition has reduced the costs of commercial satellites themselves by a factor of almost 100.[33] "Low-cost launches allow for deployment of low-cost satellites with shorter life expectancies, lowering the barrier for commercial, military, and scientific space activities," concludes a Goldman Sachs research report.[34] "Without this high barrier to entry, the space economy may undergo an era of creative destruction."[35]

Space has also become an integral, yet unseen, element of combat on earth. Reconnaissance satellites detect missile launches, force deployments, and weapons research facilities.[36] Communications satellites provide the high-speed data network that allows the U.S. Armed Forces to act together, faster, from generals issuing commands to pilots controlling drones.[37] GPS also provides the locational data with which U.S. military units can locate and fire on an enemy precisely.[38] The fast-tempo military operations of the 2003 invasion of Iraq, like the earlier triumph in the 1991 Persian Gulf War, relied upon space-based reconnaissance, communication, and locational data.[39] Similarly, military drones depend on satellites to locate targets, conduct surveillance on enemy movements, and direct fire.[40]

According to a former deputy Secretary of Defense, "Space systems enable our modern way of war. They allow our warfighters to strike with precision, to navigate with accuracy, to communicate with certainty, and to see the battlefield with clarity."[41] It should come as no surprise that U.S. expenditures on military space technology continue to grow. In 2016, for example, the U.S. Department of Defense's space security programs accounted for an estimated 69% of global space defense-related expenditures.[42]

The future may hold even more advances in store. Both China and the United States have tested weapons to destroy enemy command, control, and communications satellites.[43] The United States is also developing a global strike system that will use GPS and hypersonic ballistic missiles that will pass through space to hit targets anywhere in the world within an hour.[44] Defense Department

32. Robert Borourjerdi et al., WHAT IF I TOLD YOU …, GOLDMAN SACHS EMERGING THEME RADAR, 6 (Dec. 2, 2015), http://www.goldmansachs.com/our-thinking/pages/macroeconomic-insights-folder/what-if-i-told-you/report.pdf.

33. *Id.*

34. *Id.*

35. *Id.*

36. John Yoo, *Winning the Space Race*, HOOVER INSTITUTION (Oct. 15, 2018), https://www.hoover.org/research/winning-space-race.

37. Yoo, *supra* note 10.

38. *Id.*

39. *Id.*

40. *Id.*

41. William J. Lynn III, *A Military Strategy for the New Space Environment*, 34 WASH. Q. 7, 7 (2011).

42. CENAN AL-EKABI, EUROPEAN SPACE POLICY INSTITUTE, REP. 61, SPACE POLICIES, ISSUES, AND TRENDS IN 2015-2016, at 13 (2016).

43. *See* 2019 MISSILE DEFENSE REVIEW, *supra* note 9, at 19–20.

44. U.S. Dep't of State, *Conventional Prompt Global Strike* (Apr. 8, 2010), https://2009-2017.state.gov/t/avc/rls/139913.htm; *see also* AMY F. WOOLF, CONG. RESEARCH SERV., R41464, CONVENTIONAL PROMPT GLOBAL STRIKE AND LONG-RANGE BALLISTIC MISSILES: BACKGROUND AND ISSUES 1 (2019).

planners have considered the idea of orbital platforms that could conduct bombardments from space that could replace tactical nuclear weapons, but with a narrow blast radius and without harmful radiation.[45]

Space-based weapons may play an even more important role for defensive operations, as potential adversaries continue to invest in their missile capabilities and increasingly integrate offensive missile tactics into their coercive threats, military exercises, and war planning.[46] After withdrawing from the Anti-Ballistic Missile Treaty in 2002, the United States has developed a limited national missile defense system.[47] It seeks to intercept missiles in flight using space-based detectors, ground-based radar, and ground-launched interceptors.[48] A more effective missile defense system, however, would target ICBMs in their initial boost phase, when the missiles are at their most vulnerable. Such a system would rely even more on space systems for detection, targeting, and as platforms for anti-missile weapons.

The Defense Department's 2019 Missile Defense Review revealed that development of a space-based sensor layer and boost-phase defense system may be in the not-too-distant future.[49] Citing the evolving security environment, the Defense Department is undertaking a "new and near-term examination of the concepts and technology for space-based defenses to assess the technological and operational potential of space-basing."[50] Without the hindrance of territorial limitations, space-based sensor and laser technology could increase the effectiveness of intercepting offensive missiles, reduce the overall number of interceptors needed, and destroy missiles before reaching their target. In contrast to land-based sensors, which require consent from foreign states to stage the sensors, basing sensors or defensive interceptors in space would allow nations to place the technology anywhere needed to achieve its objective.[51]

This territorial freedom, however, underscores the importance of establishing clear rules of engagement in space before such technology is developed and other nations race to do the same. Anti-satellite missiles can make an opponent's space-based communication networks easier to disable than purely ground-based systems. Directed beam or radiation weapons could cripple GPS, which could paralyze transportation networks. Likewise, losing reconnaissance satellites could blind the U.S.'s strategic monitoring and degrade its operational and tactical abilities. Space also invites asymmetric warfare because anti-satellite attacks

45. REPORT TO THE COMMISSION TO ASSESS UNITED STATES NATIONAL SECURITY SPACE MANAGEMENT AND ORGANIZATION 69 (2001).

46. 2019 MISSILE DEFENSE REVIEW, *supra* note 9, at III–IV.

47. *Id.* at 28–29.

48. For discussion of the legal issues, see John Yoo, *Politics as Law?: The Anti-Ballistic Missile Treaty, the Separation of Powers, and Treaty Interpretation*, 89 CALIF. L. REV. 851, 858 (2001) (reviewing FRANCES FITZGERALD, WAY OUT THERE IN THE BLUE: REAGAN, STAR WARS AND THE END OF THE COLD WAR (2001); John Yoo, *Treaty Interpretation and the False Sirens of Delegation*, 90 CALIF. L. REV. 1305, 1305 (2002).

49. 2019 MISSILE DEFENSE REVIEW, *supra* note 9, at IX, XIV.

50. *Id.* at XI.

51. *Id.* at 36–37.

could even the technological odds against western powers that have become dependent on information-enhanced operations. Unsurprisingly, protecting space assets has become an important national security mission for the United States and other nations.[52] As the nation most dependent on space-based military and civilian networks, the United States may have the most to lose.[53]

American national security leaders are already preparing for the spread of space warfare. "We will be threatened in space. And we need to be prepared for that," Brigadier General John Shaw of the U.S. Strategic Command declared in a speech to a symposium on "space warfighters" in 2017.[54] At that same symposium, the Commander of Air Force Space Command, Gen. John Raymond, disclaimed any interest in starting a war in space, but expressed full desire to be ready. "We're not interested in getting into that fight. Nobody wins that fight—but we are interested in being prepared for it," he said.[55] Congressional hearings have brought these concerns into the public view. Before the Senate Armed Services Committee, the Commander of U.S. Strategic Command, Gen. John Hyten, testified: "we have to build an offensive capability to challenge their capabilities in space."[56] Senator Ted Cruz agreed with the opinions of the generals that "we must prepare for a conflict that extends into space."[57]

In March 2018, these concerns developed into the Trump Administration's "America First National Space Strategy." The strategy announced that the United States would build upon "America's pioneering spacefaring tradition" and prioritize national security in the space domain.[58] Viewing space as a "warfighting domain, just like . . . land, [and] air, and sea,"[59] the Trump Administration's strat-

52. *Id.* at III.

53. John Yoo, *Winning the Space Race*, AEI (Oct. 15, 2018), https://www.aei.org/articles/winning-the-space-race/.

54. Gen. John Shaw, Deputy Dir., U.S. Strategic Command Global Operations, Address at the 33rd Space Symposium: The Space Warfighters Luncheon (Apr. 4, 2017), http://www.stratcom.mil/Media/Speeches/Article/1151579/33rd-space-symposium-the-space-warfighters-luncheon/.

55. Gen. John Raymond, Commander, Air Force Space Command, Keynote Address at the 33rd Annual National Space Symposium (Apr. 4, 2017), http://www.afspc.af.mil/About-Us/Leadership-Speeches/Speeches/Display/Article/1155805/national-space-symposium-2017-keynote-address/.

56. *Hearing Before the S. Comm. on Armed Servs.* (2017) (statement of Gen. John Hyten, Commander, U.S. Strategic Command), https://archive.org/details/CSPAN3_20170404_133100_General_John_Hyten_Calls_for_Increased_Funding_for_U.S._Strategic_Command.../start/6840/end/6900.

57. Vice Admiral Charles A. Richard, Deputy Commander, U.S. Strategic Command, Address at the Center for Strategic and International Studies Headquarters: Space Security: Issues for the New U.S. Administration (Mar. 22, 2017), http://www.stratcom.mil/Media/Speeches/Article/1156594/space-security-issues-for-the-new-us-administration/.

58. *President Donald J. Trump Is Unveiling An America First National Space Strategy*, THE WHITE HOUSE FACT SHEETS: INFRASTRUCTURE & TECHNOLOGY (Mar. 23, 2018) [hereinafter *National Space Strategy*], https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-unveiling-america-first-national-space-strategy/.

59. *Remarks by Vice President Pence on the Future of the U.S. Military in Space*, THE WHITE HOUSE: REMARKS (Aug. 9, 2018, 11:17 AM) [hereinafter *Remarks by Vice President Pence*], https://www.whitehouse.gov/briefings-statements/remarks-vice-president-pence-future-u-s-military-space/.

egy affirms that "any harmful interference with or attack upon critical components of our space architecture . . . will be met with a deliberate response at a time, place, manner, and domain of our choosing."[60]

Central to achieving these goals is the creation of a sixth military branch, the United States Space Force. On June 18, 2018, at a meeting of the National Space Council, President Trump formally directed the Defense Department to begin preparations to establish a Space Force as a wholly separate branch of the Armed Forces.[61] Initial public reaction to the announcement indicated mixed support, with several past and present military leaders questioning its value in light of bureaucratic hurdles.[62] Nevertheless, in a statement delivered at the Pentagon on August 9, 2018, Vice President Mike Pence compared the needs that precipitated the birth of the modern Air Force in the mid-twentieth century to the emerging threat of the new "battlefield" that is space.[63] The Department of Defense followed with a report detailing immediate steps the Department could make to protect the Nation's vital interests in space.[64] These actions include establishing a Space Development Agency, a Space Operations Force, and a U.S. Space Command devoted to improving and evolving space warfighting.[65] Continuing this trend, the Trump Administration's Space Policy Directive-4, signed in February 2019, took the symbolic step of directing the creation of a legislative proposal to establish the Space Force as a sixth military branch, but within the Department of the Air Force.[66] Because Congressional approval is ultimately required to formally establish the Space Force as a wholly separate military branch, full implementation is uncertain and, if approved, would occur in phases.[67] As a separate military branch within the Department of the Air Force, the Space Force would operate similar to the Marine Corps' relationship with the Navy.[68]

60. *National Space Strategy*, *supra* note 58.

61. U.S. DEP'T OF DEFENSE, REP. TO CONGRESSIONAL DEFENSE COMMITTEES: FINAL REPORT ON ORGANIZATIONAL AND MANAGEMENT STRUCTURE FOR THE NATIONAL SECURITY SPACE COMPONENTS OF THE DEPARTMENT OF DEFENSE 6 (Aug. 9, 2018) [hereinafter FINAL REPORT], https://media.defense.gov/2018/Aug/09/2001952764/-1/-1/1/ORGANIZATIONAL-MANAGEMENT-STRUCTURE-DOD-NATIONAL-SECURITY-SPACE-COMPONENTS.PDF.

62. Andy Pasztor & Gordon Lubold, *Pentagon Had Spurned U.S. Space Force, Prompting Trump's Decree*, WALL ST. J. (June 22, 2018, 10:55 AM), https://www.wsj.com/articles/pentagon-had-spurned-space-force-prompting-trumps-decree-1529679336.

63. *Remarks by Vice President Pence*, *supra* note 59.

64. *See* FINAL REPORT, *supra* note 61, at 3.

65. *Id.* at 4.

66. *Presidential Memorandum, Text of Space Policy Directive-4: Establishment of the United States Space Force*, THE WHITE HOUSE (Feb. 19, 2019), https://www.whitehouse.gov/presidential-actions/text-space-policy-directive-4-establishment-united-states-space-force/.

67. *Id.* A legislative proposal for the authorities needed to establish the U.S. Space Force as the sixth branch of the Armed Forces will be submitted with the President's Budget for FY 2020 to support consideration in the FY 2020 National Defense Authorization Act.

68. *See* Corey Dickstein, *Trump Signs Directive That Would Place Space Force Within Air Force*, MILITARY.COM (Feb. 19, 2019), https://www.military.com/daily-news/2019/02/19/trump-signs-directive-would-place-space-force-within-air-force.html.

The Trump Administration's space plan identifies four guiding principles: (1) build more resilient space architectures; (2) strengthen deterrence and warfighting options; (3) improve foundational capabilities, structures, and processes; and (4) foster conducive domestic and international environments, to include regulatory reform and bilateral and multilateral engagements.[69] After nearly twenty-four years of dormancy, the Trump Administration revived the National Space Council in 2017 and set its sights to the sky by signing three Space Policy Directives within the first two years.[70] This includes Space Policy Directive-3, a document that outlines National Space Traffic Management Policy, an important concern as space increasingly becomes more "congested and contested," and reliance on space-based technologies and capabilities continue to grow for governmental and commercial ventures alike.[71] Left unchecked, unfettered growth in space would ultimately hinder the "safety, stability, and sustainability of U.S. space operations," as the Defense Department already tracks more than 20,000 objects in orbit.[72] Looking to the future, U.S. policy should reflect the value of innovation in space and recognize the importance of space to the economic prosperity and safety of the nation.

B. Military Uses in Space

New technology will spur a more intensive use of space, while lowered cost will expand access to more nations. This will make space available for military as well as civilian competition. This Section explains the different military uses of space and how new technological developments may affect them.

Strategists divide military space missions into four areas. The first, space support, refers to the launching of missiles and the management of satellites in orbit.[73] The second, force enhancement, seeks to enhance the effectiveness of earth operations. These missions include the use of space for passive surveillance and support of the military on the ground. The very first satellites, for example, performed a critical surveillance role in the strategic competition between the United States and the Soviet Union.[74] Spy satellites replaced dangerous aerial reconnaissance flights in providing intelligence on the size of rival nuclear stockpiles and military deployments. Later systems provided the superpowers with an early warning system to detect the launch of ballistic missiles. These programs,

69. *National Space Strategy*, *supra* note 58.

70. *See Space Policy Directive-3: National Space Traffic Management Policy*, THE WHITE HOUSE (June 18, 2018), https://www.whitehouse.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/.

71. *Id.*

72. *Id.*

73. Yoo, *supra* note 53.

74. *See, e.g.*, JEFFREY T. RICHELSON, AMERICA'S SECRET EYES IN SPACE: THE U.S. KEYHOLE SPY SATELLITE PROGRAM 7–9 (1990); JEFFREY T. RICHELSON, AMERICA'S SPACE SENTINELS: DSP SATELLITES AND NATIONAL SECURITY 4 (1999).

some scholars believe, helped maintain strategic stability between the superpowers and even aided progress in arms control.[75] Satellites created "national technical means" of verification: the capability to detect compliance with arms control treaties without the need to intrude on another nation's territory.[76] Space systems reduced the chances of human error by providing massive amounts of information to decision-makers regarding the activities of other nations.[77] According to this account, surveillance satellites have provided the means for nations to trust each other enough to reduce their nuclear weapons stockpiles.[78]

U.S. development of space-based technologies for the second mission, force enhancement, has heralded what strategists have labeled a "revolution in military affairs."[79] GPS technology allows the United States to deploy military units with great precision, synchronize combat maneuvers more exactly, and more clearly identify friend and foe. Space sensors and dense communications networks allow swift, pinpoint targeting of enemy units, which effectively multiplies the effectiveness of U.S. military force. On twenty-first century battlefields, the U.S. uses satellite information to locate enemy positions, deploy on-station air or ground forces, and fire munitions to destroy targets in less destructive ways.[80] Satellites also provide an intelligence advantage by intercepting rivals' electronic emissions to learn their plans or to interfere with their operations.

The 2003 invasion of Iraq provides a glimpse of the future. In that conflict, the United States used GPS to create a system called "Blue Force Tracker," which provided the exact locations of U.S. and enemy units, on land and sea. Even in the midst of a sandstorm from March 25–28, 2003, American bombers used the system to identify and destroy multiple Iraqi targets without harming friendly forces.[81] During the course of the Iraq invasion, the United States launched thousands of GPS-guided joint direct attack munitions ("JDAMs") with an error margin of as little as five meters.[82] The integration of information, communication, and precision force no doubt led to the incredibly low rate of U.S. casualties in the conflict compared to the rapid destruction of the main Iraqi battle force.

75. *See, e.g.*, THOMAS GRAHAM JR. & KEITH A. HANSEN, SPY SATELLITES AND OTHER INTELLIGENCE TECHNOLOGIES THAT CHANGED HISTORY 37 (2007).

76. *See, e.g.*, Melvin R. Laird, Memorandum for Assistant to the President for National Security Affairs, Subject: Revelation of the Fact of Satellite Reconnaissance in Connection with the Submission of Arms Limitation Agreements to Congress (June 8, 1972), http://nsarchive.gwu.edu/NSAEBB/NSAEBB231/doc02.pdf.

77. Yoo, *supra* note 53.

78. *See, e.g.*, GRAHAM & HANSEN, *supra* note 75.

79. For a popular work, see MAX BOOT, WAR MADE NEW: TECHNOLOGY, WARFARE, AND THE COURSE OF HISTORY, 1500 TO TODAY 7–16 (2006). For a more specialized work, see MICHAEL HOROWITZ, THE DIFFUSION OF MILITARY POWER: CAUSES AND CONSEQUENCES FOR INTERNATIONAL POLITICS 214–25 (2010). For the classic work on the link between economic innovation and war, see WILLIAM H. MCNEILL, THE PURSUIT OF POWER: TECHNOLOGY, ARMED FORCE, AND SOCIETY SINCE A.D. 1000 363–84 (1982).

80. Yoo, *supra* note 53.

81. JOAN JOHNSON-FREESE, SPACE AS A STRATEGIC ASSET 96 (2007).

82. MICHAEL E. O'HANLON, NEITHER STAR WARS NOR SANCTUARY: CONSTRAINING THE MILITARY USES OF SPACE 3 (2004).

Constellations of satellites provide the network of command, control, communications, information, and reconnaissance necessary for enhanced military operations to succeed. Supporters of this revolution in military affairs, which include former Defense Secretary Donald Rumsfeld, expect that these space-based intelligence and communication systems, combined with joint services action on land, sea, and air, will allow the U.S. military to fight more effectively with fewer resources—in other words, to boost the productivity of the American soldier.[83]

The third and fourth space missions focus on space itself. The third, "space control," seeks to freely use space to one's benefit while denying it to opponents—a concept similar to air superiority, but in orbit.[84] As early as 2001, a special national commission on space warned that the U.S. had become so dependent on satellites that it could be vulnerable to a "Space Pearl Harbor."[85] An electromagnetic pulse explosion could disable the electronics of U.S. satellites, or an attack on the communication links to space could blind the U.S. military and prevent it from sending critical orders.[86] Space control thus begins with defense. To achieve space superiority, a nation must first harden command, control, communications, and reconnaissance satellites to prevent enemy interference. It includes shielding satellite components, improving their ability to maneuver to escape attack, disguising their location, and even arming satellites or their escorts.[87]

One of the earliest forms of space control is the U.S. national missile defense system. It relies upon satellites to track ballistic missile launches and help guide ground-launched kill vehicles.[88] Ballistic missiles travel in three phases: boost (when the missile launches), mid-course (when the missile separates from the booster rocket and coasts through space), and the terminal (when the warhead re-enters the atmosphere).[89] Satellites provide early warning, tracking, and guidance for interceptor missiles located in Alaska and California to strike missiles in the midcourse phase. U.S. Northern Command brought this layered defense system online in 2006 in response to North Korea's testing of ballistic missiles,

83. Claudia Grisales, *With Congressional Blessing, Space Force is Closer to Launch*, NPR (Aug. 11, 2019, 7:00 AM), https://www.npr.org/2019/08/11/743612373/with-congressional-blessing-space-force-is-closer-to-launch.

84. In 2006, the head of the U.S. Air Force Space Command testified before Congress that his "top priority is to ensure Space Superiority," which "is akin to Air Superiority." *Department of Defense Authorization for Appropriations for Fiscal Year 2006: Hearings on S. 1042 Before the S. Comm. on Armed Servs*, 109th Cong. 26 (2005) (statement of Gen. Lance W. Lord, USAF); *see also* BENJAMIN S. LAMBETH, MASTERING THE ULTIMATE HIGH GROUND: NEXT STEPS IN THE MILITARY USES OF SPACE 105 (2003), https://www.rand.org/content/dam/rand/pubs/monograph_reports/2005/MR1649.pdf.

85. U.S. DEP'T OF DEF., REPORT OF THE COMMISSION TO ASSESS UNITED STATES NATIONAL SECURITY SPACE MANAGEMENT AND ORGANIZATION 22 (2001), https://aerospace.csis.org/wp-content/uploads/2018/09/RumsfeldCommission.pdf. The Commission was headed by Donald Rumsfeld, who became Secretary of Defense shortly after the study's report and was no doubt supportive of its calls for a reform of U.S. space programs.

86. *Id.* at 28.

87. JOHNSON-FREESE, *supra* note 81, at 91–93.

88. *See* MISSILE DEF. AGENCY, FACT SHEET: THE BALLISTIC MISSILE DEFENSE SYSTEM 2 (2016), https://www.mda.mil/global/documents/pdf/bmds.pdf.

89. *Id.* at 1–2.

even though its accuracy remained doubtful.[90] The Terminal High-Altitude Area Defense ("THAAD") system, the Navy's Aegis cruiser, and the Army's Patriot anti-missile batteries use the same data to attack missiles in the most difficult terminal phase.[91]

To stop ballistic missiles in their earlier, boost phase, the U.S. Defense Department is conducting research and development on systems even more dependent on control of space. Research begun under the Reagan Administration's Star Wars program and it promised a significant advance to the U.S. national missile defense system.[92] It envisioned space-based platforms that can both detect and destroy ballistic missiles while in their initial, boost phase, when they are most vulnerable.[93] It would use space-based lasers, which remain the only viable method to destroy ballistic missiles during their initial launch.[94] Such space-based systems offer far greater range than ground, naval, or air anti-missile units, and the ability to act earlier in the territory of other countries. Although space-based antimissile interceptors remain in the future, the Trump Administration is already seeking a multibillion investment in a satellite sensor system to enable a more effective, layered anti-missile defense.[95]

Such forms of active defense can blend space control into the fourth mission: "space force." Technology, for example, that can bring down a ballistic missile can easily provide the means to destroy objects in space. Space force seeks to develop weapons systems that can strike targets on earth or in orbit from space itself.[96] U.S. national security policy already appears to support greater development of such weapons.[97] "Our nation may find it necessary to disrupt, degrade, deny or destroy enemy space capabilities in future conflicts," U.S. Space Command declared in the wake of the September 11, 2001 terrorist attacks.[98] The Trump Administration's 2017 national security strategy similarly intoned that it views unfettered access to and freedom to operate within space of paramount importance, such that any attempt to harmfully interfere with or attack components of the U.S.'s space architecture would be met with a "deliberate response."[99] This position has only been strengthened by the language in the 2019

90. JOAN JOHNSON-FREESE, HEAVENLY AMBITIONS 77–78 (2009). *See generally* Robert Powell, *Nuclear Deterrence Theory, Nuclear Proliferation, and National Missile Defense*, 27 Int'l Security 86 (2003).

91. *See* MISSILE DEF. AGENCY, *supra* note 88, at 2.

92. Lesley Kennedy, *Why Reagan's 'Star Wars' Defense Plan Remained Science Fiction*, HISTORY (Jan. 22, 2019), https://www.history.com/news/reagan-star-wars-sdi-missile-defense.

93. *Id.*

94. JOHNSON-FREESE, *supra* note 81, at 134.

95. *See* Sandra Erwin, *Trump Unveils Missile Defense Review, Promises Funding for Space Sensors in 2020*, SPACENEWS (Jan. 17, 2019), https://spacenews.com/trump-unveils-missile-defense-review-promises-funding-for-space-sensors-in-2020/.

96. LAMBETH, *supra* note 84, at 112–13; BOB PRESTON ET AL., SPACE WEAPONS: EARTH WARS 23–27 (2002), http://www.rand.org/content/dam/rand/pubs/monograph_reports/2011/RAND_MR1209.pdf.

97. *See* Erwin, *supra* note 95.

98. U.S. Space Command, *Preface to* O'HANLON, *supra* note 82.

99. THE WHITE HOUSE, NATIONAL SECURITY STRATEGY OF THE UNITED STATES OF AMERICA 31 (2017), https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

Missile Defense Review, which reiterated "exploitation of space" as a "more effective, resilient and adaptable" missile defense posture to known and unanticipated threats."[100]

American dependence on space-based systems, for its startling leaps in military effectiveness, has not gone unnoticed by rivals. Chinese strategists discuss countering U.S. superiority in conventional and nuclear weapons by disabling American satellites and thereby preventing American forces from communicating and coordinating so successfully.[101] While China has steadily advanced its civilian space program, going so far in 2018 as to land a probe on the dark side of the moon, it has also developed the technologies necessary for anti-satellite weapons.[102] In 2007, China destroyed one of its own weather satellites in low earth orbit—the same region used by commercial satellites—with a ground-launched missile.[103] "For countries that can never win a war with the United States by using the methods of tanks and planes, attacking an American space system may be an irresistible and most tempting choice," Chinese analyst Wang Hucheng has written, in a much-noticed comment.[104]

Though China's ASAT test sparked international controversy, Beijing had only been following in the footsteps of the Cold War superpowers. The United States had carried out a primitive anti-satellite weapon test as early as 1959 by firing on a U.S. satellite from a high-altitude plane.[105] The following year, the U.S. developed a ground-based system to launch interceptors into orbit to explode nearby Soviet satellites.[106] During the Eisenhower, Kennedy, and Johnson Administrations, the U.S. often drafted anti-ballistic missile systems into an anti-satellite role as well.[107] The Soviet Union followed with anti-satellite weapons of similar design.[108] While this research and development ended with the signing of the Anti-Ballistic Missile Treaty of 1972, it restarted in the 1990s.[109] After the 2007 Chinese test, the U.S. tested a sea-launched anti-missile weapon to destroy a malfunctioning satellite.[110] As its rivals began to copy American force enhancement and space control strategies, the U.S. naturally sought anti-satellite weapons to restore its advantage.

ASAT weapons may become even more common due to the vulnerability of satellites and the reduction in costs of accessing space. It is easier for kinetic weapons to hit satellites, which generally fly predictable, easily-detected orbits,

100. 2019 MISSILE DEFENSE REVIEW, *supra* note 9, at XI.

101. *See* DAVID C. GOMPERT & PHILIP C. SAUNDERS, THE PARADOX OF POWER: SINO-AMERICAN STRATEGIC RESTRAIN IN AN AGE OF VULNERABILITY 59 (2011).

102. Sarah Pruitt, *China Makes Historic Landing on 'Dark Side' of the Moon*, HISTORY (Jan. 3, 2019), https://www.history.com/news/china-plans-historic-landing-on-dark-side-of-the-moon.

103. JAMES C. MOLTZ, THE POLITICS OF SPACE SECURITY: STRATEGIC RESTRAIN AND THE PURSUIT OF NATIONAL INTERESTS 296–97 (2d ed. 2011).

104. JOHNSON-FREESE, *supra* note 81, at 197 (quoting Wang Hucheng).

105. MOLTZ, *supra* note 103, at 100.

106. *Id.* at 100–01.

107. *Id.* at 101–21.

108. *Id.* at 156–57.

109. *Id.* at 259–60.

110. *Id.* at 300–01.

than ballistic missiles.[111] Ground-based or airborne lasers can interfere with or even destroy the sensors on a satellite. Micro-satellites—tiny objects that can be more easily and efficiently launched into space than their large, complicated counterparts—could give nations the ability to launch a cloud of attacking satellites to collide with a space target.[112] Even the debris from an explosion or collision could pose a further threat to sophisticated satellites.[113] The 2007 Chinese ASAT test created a cloud of 35,000 particles speeding along at 16,000 miles per hour.[114]

Space-based weapons may not only use force in the heavens, but from the heavens. Space may eventually provide an effective means of power projection that does not depend on deploying air, ground, or naval units in foreign territory or in vulnerable waters. After the Chinese ASAT test, Senator Jon Kyl and the Pentagon recommended a Space-Based Test Bed program, which would develop a space-based missile defense system to complement the existing ground-based system.[115] Such a system could easily turn to shooting down other satellites, or countering anti-satellite attacks, in addition to ballistic missiles in midflight. Experimental research has already begun to explore the possibility of deploying chemical lasers on satellites that could strike ground targets.[116] The most ambitious, but still conceptual, would use satellites to drop tungsten rods, which would then accelerate to a speed of 36,000 feet per second and impact a target with the force of a penetrating nuclear weapon.[117] Similar technology would arm a cruise vehicle either in high orbit or in space, that could fire a variety of projectiles at earth or space targets.[118] These projects have decades to go before they might come to fruition.[119]

Space control and force application demand a greater exercise of power than air or naval superiority. In times of war, the United States may seek to control certain strategic areas, such as the air over Iraq or the seas next to Taiwan. But it takes time to deploy assets to those areas and any degree of control that is achieved is retained only for the duration of the conflict. In peacetime, the United States cannot station enough air and naval units in those areas necessary for complete force superiority. Satellites, however, allow deployments of broader geographic scope and longer duration. A constellation of space weapons, for example, would circle the globe for years.[120]

111. Bruce M. DeBlois et al., *Space Weapons: Crossing the U.S. Rubicon*, 29 INT'L SECURITY 50, 56 (2004).

112. JOHNSON-FREESE, *supra* note 90, at 90–91.

113. *See* JOHNSON-FREESE, *supra* note 81, at 133.

114. BRIAN WEEDEN, 2007 CHINESE ANTI-SATELLITE TEST FACT SHEET 2 (2010).

115. JON KYL, CHINA'S ANTI-SATELLITE WEAPONS AND AMERICAN NATIONAL SECURITY (2007).

116. JEREMY RABKIN & JOHN YOO, STRIKING POWER: HOW CYBER, ROBOTS, AND SPACE WEAPONS CHANGE THE RULES FOR WAR 202 (2017).

117. *See* Jonathan Shainin, *Rods from God*, N.Y. TIMES (Dec. 10, 2006), https://www.nytimes.com/2006/12/10/magazine/10section3a.t-9.html.

118. *See id.*

119. JOHNSON-FREESE, *supra* note 90, at 68.

120. *Id.*

Some argue that these technological developments are necessary because space-faring nations will treat space as they would any other area for great power competition. "The reality of confrontation in space politics pervades the reality of the ideal of true cooperation and political unity in space, which has never been genuine, and in the near term seems unlikely," writes Everett Dolman in *Astropolitik*.[121] Because of the pattern of history and strategy, he argues, "policymakers should be prepared to deal with a competitive, state-dominated future in space."[122] The United States certainly has taken such concerns to heart. In the decade ending in 2008, for example, the United States increased its space budget from $33.7 billion to $43 billion in constant dollars.[123] All of the increase in spending went to Defense Department space programs, which increased by 50%.[124] Today, funding for space programs continues to be a priority, as NASA's budget has grown steadily by $3.85 billion from 2013 to 2018 and the Air Force expects to spend $44.3 billion on new space systems in the next five years.[125] This represents an 18% increase over the previous five-year plan and is still not representative of all United States expenditures for "national security space"—a figure that is unquestionably larger but difficult to pinpoint precisely since it is not listed as a specific line item on the Defense Department's budget and includes classified expenditures unavailable to the public.[126]

Both the Bush and Trump Administrations appear to have adopted a space superiority strategy. In its 2006 National Space Policy, the former began by committing to "the exploration and use of outer space by all nations for peaceful purposes," and it immediately declared that "peaceful purposes allow U.S. defense and intelligence-related activities in pursuit of national interests."[127] The United States further made clear that it had a right of free passage in space, and that any interference would be a violation of its rights.[128] Because space systems are "vital to its national interest," the U.S. would protect its freedoms in space

121. EVERETT C. DOLMAN, ASTROPOLITIK: CLASSICAL GEOPOLITICS IN THE SPACE AGE 2 (2002).

122. *Id.*

123. *See* Tamar A Mehuron, *2009 Space Almanac: The US Military Space Operation in Facts and Figures*, A.F. Mag., Aug. 2009, at 54.

124. *Id.*

125. CONG. RESEARCH SERV., R43419, NASA APPROPRIATIONS AND AUTHORIZATIONS: A FACT SHEET (2019), https://fas.org/sgp/crs/space/R43419.pdf; Colin Clark, *Air Force Space Budget Up $1.5B; Teague 'Cautiously Optimistic' on OCX DAB Meet*, BREAKING DEF. (May 24, 2017, 5:57 PM), https://breakingdefense.com/2017/05/air-force-space-budget-up-1-5b-teague-cautiously-optimistic-on-ocx-dab-meet/; Sandra Erwin, *Air Force is Spending More on Space, but Modernization Path Still a Big Question*, SPACE NEWS (Mar. 16, 2018), https://spacenews.com/air-force-is-spending-more-on-space-but-modernization-path-still-a-big-question/.

126. Erwin, *supra* note 125. For many years the most accurate way to determine national security space funding was through the annual Aeronautics and Space Report of the President. In 2013, however, the estimating methodology changed and spending for intelligence programs in DOD and the Office of the Director of National Intelligence were omitted. Without account of space intelligence spending and classified programs, the Federal Space Activities Budget underestimates total spending. *See, e.g.*, *Aeronautics and Space Report of the President: Fiscal Year 2017 Activities, Appendix D-2, Federal Space Activities Budget*, at 217, https://history.nasa.gov/presrep2017.pdf.

127. Dep't of Homeland Security, U.S. National Space Policy (Aug. 31, 2006), https://fas.org/irp/offdocs/nspd/space.pdf.

128. *Id.*

and "dissuade or deter others from either impeding those rights or developing capabilities intended to do so."[129] The 2006 policy even promised to "take those actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities hostile to U.S. national interests."[130] Control of space was similar to control of the other global commons: "Freedom of action in space is as important to the United States as air power and sea power."[131]

III. SPACE AND THE LAWS OF WAR

Advances in space technology, and the accompanying increase in nation-state competition, are provoking a legal response. As early as 1967, the Outer Space Treaty ("OST") had declared as its purpose "to promote international cooperation in the peaceful exploration and use of outer space."[132] The OST forbids WMDs based in orbit and bans military installations or operations on the moon, asteroids, and planets.[133] Prominent scholars argue that the 1967 treaty and subsequent international instruments effectively prohibit any use of space for military purposes, even those that are not aggressive in nature.[134] They further argue that the U.N. Charter's ban on the use of force, except for self-defense or in accord with Security Council authorization, further limits the militarization of outer space.[135] Concurring, the U.N. General Assembly has repeatedly passed resolutions "to prevent an arms race in outer space."[136]

This Part will argue that these claims misread the formal international legal instruments governing the heavens. It will present the formal legal instruments governing outer space and then evaluate the arguments of governments, policymakers, and scholars that international and domestic law prohibit military exploitation. It will conclude by criticizing these theories for placing hope above the legal texts and the understandings of the nations that signed them. It argues that nations placed certain forms of military activity off limits in the heavens, but also deliberately refused to regulate most weapons contemplated today.

129. *Id.* at 1–2.

130. *Id.* at 2.

131. *Id.* at 1.

132. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies art. X, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 206 [hereinafter Outer Space Treaty].

133. *Id.* art. IV.

134. BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 515–22 (1997).

135. *See, e.g.*, Jackson Maogoto & Steven Freeland, *The Final Frontier: The Laws of Armed Conflict and Space Warfare*, 23 CONN. J. INT'L L. 165, 181–82 (2007).

136. *See, e.g.*, G.A. Res 59/65 (Dec. 17, 2004); G.A. Res. 36/97C, at 71 (Dec. 9, 1981).

A. The International Law of Outer Space

Ever since nations launched the first satellites into orbit in the 1950s, nations have sought to limit military activities in space.[137] But despite the wishes of international organizations, legal scholars, and many governments, actual state practice has resisted significant regulation. This Section will discuss the history and development of laws regulating space. It will then survey current legal theories that aim to either promote or curtail the missions discussed in Part II, including positivist theories that claim current law to have already outlawed military space activities, as well as realist arguments that deterrence itself will prove an effective regulator. Despite a range of proposals to expand international humanitarian law using soft law or international institutions, they have all failed to gain traction with the United States and other rising space powers, leaving space, with the exception of the OST, largely unregulated.

As Walter McDougall observed in his history of the U.S. space program, space became an arena for superpower competition soon after the start of the Cold War.[138] Government spending on civilian and military programs spurred rapid progress in launch and satellite technology.[139] Within less than a quarter century, the United States advanced from primitive ballistic missiles to the 1969 Apollo 11 moon landing.[140] During this period of rapid technological progress, neither the United States nor the Soviet Union could reach agreement on basic questions. Moscow, for example, held the view that nations enjoyed sovereignty over the space above their territory, just as they did with airspace.[141] During the Eisenhower years, the United States considered space to be a potential battlefield and conducted significant research into anti-satellite, ABM, and space-based weaponry.[142]

In the 1960s, however, the superpowers began to explore reciprocal limits on their space activities. Nuclear weapons testing in the upper atmosphere had demonstrated that radiation would quickly spread into outer space and threaten both manned missions and satellites.[143] In 1963, the U.S. and U.S.S.R. signed the first arms control agreement to touch on space activities, the Partial Test Ban Treaty, which banned nuclear testing underwater, in the air, or in space.[144] As space exploration continued, American and Soviet leaders realized that exploiting space for weapons deployment could provoke an expensive arms race.[145] They also worried that space-based weapons might interfere with the satellites

137. CHENG, *supra* note 134, at 514–18.

138. WALTER A. MCDOUGALL, . . . THE HEAVENS AND THE EARTH: A POLITICAL HISTORY OF THE SPACE AGE 8–9, 177–94 (1985).

139. *Id.* at 79.

140. *See generally id.*

141. *Id.* at 233–97.

142. *See id.* at 136–230.

143. *Id.*

144. Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, Aug. 5, 1963, 480 U.N.T.S. I-6964, https://treaties.un.org/doc/Publication/UNTS/Volume%20480/volume-480-I-6964-English.pdf.

145. *Id.*

that monitor each other's nuclear forces, and thus destabilize the strategic balance.[146]

Joined by the world's other major powers, the U.S. and Soviet decision to cooperate culminated in the 1967 OST. It declares that outer space, including the moon and other celestial bodies, must be used for "exclusively peaceful purposes."[147] It forbids "the establishment of military bases, installations and fortifications, the testing of any type of weapons and the conducting of military maneuvers on celestial bodies."[148] It declares that no nation can claim territorial sovereignty in space.[149] Closer to Earth, it prohibits the placement of weapons of mass destruction in orbit.[150]

Despite these provisions, the OST remains limited. Most significantly, it did not match its declaration of purpose that the uses of outer space must be peaceful with a complete ban on military operations.[151] The United States has long maintained that "peaceful purposes" does not preclude the use of space for self-defense.[152] Under this reading, nations can deploy military systems in space to engage in reconnaissance or even to counter the offensive operations of other nations. Even as it signed the OST, for example, the United States deployed early warning and intelligence gathering satellites aimed at the Soviet Union and Communist China.[153] Nations that today deploy satellites for reconnaissance, such as Russia, China, India, France, the United Kingdom, Israel, Canada, and Japan, among others, seem to agree with this practice by their military use of space.[154] According to one space scholar, "rather than de-militarizing space, Article IV [of the OST] significantly de-weaponizes the space domain, as national militaries have used outer space for military purposes since the beginning of the space age."[155]

146. *Id.*

147. Outer Space Treaty, *supra* note 132, art. IV.

148. *Id.*

149. *Id.* art. II.

150. *Id.* art. IV. Terrestrial arms control would take another two decades to catch up to the OST's outright prohibitions on arms. While the Strategic Arms Limitations Talks temporarily set ceilings on nuclear weapons, it was not until 1988's Intermediate Nuclear Forces that Moscow and Washington agreed to eliminate a class of nuclear arms (a development now in doubt with the Trump Administration's January 2019 announcement that the United States would withdraw from the INF Treaty). Treaty between the United States of America and the Union of Soviet Socialist Republics on the Elimination of Their Intermediate-Range and Shorter-Range Missiles, Dec. 8, 1987, 11 Disarmament 150. It was not until the Strategic Arms Reduction Treaty I agreement of 1991, after the fall of the Berlin Wall and the end of the Soviet Union, that the U.S. and Russia undertook deep reductions in their arsenals. Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms, July 31, 1991, 16 U.N. Disarmament Y.B. 450.

151. *See* Outer Space Treaty, *supra* note 132.

152. *See* U.S. National Space Policy, *supra* note 127.

153. Kevin C. Ruffner, *CORONA:, America's First Satellite Program*, CIA (1995), https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/corona.pdf.

154. CHRISTOPHER D. JOHNSON, THE OUTER SPACE TREATY, *in* THE OXFORD RESEARCH ENCYCLOPEDIA, PLANETARY SCIENCE 13, 21 (2018).

155. *Id.*

Nevertheless, some scholars believe that these uses of space violate international law.[156] They rely on the treaty's opening declaration that "the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries," and that outer space is "the province of all mankind."[157] But this statement of peace comes in a preamble that does not contain any binding legal obligations. U.N. General Assembly resolutions seek the same goal. In 1988, for example, the General Assembly passed a resolution calling for "general and complete disarmament under effective international control" so that "outer space shall be used exclusively for peaceful purposes" and "not become an arena for an arms race."[158] The resolution passed 154 to 1—the United States was the sole vote against.[159] But subsequent U.N. resolutions cannot cast a backward gloss, just as post-enactment legislative history cannot change the meaning of a statute.

Scholars further argue that the United States and other spacefaring nations still must obey Article 2(4) of the United Nations Charter, which prohibits nations from using force to threaten the territorial integrity or political independence of others.[160] Others, such as David Koplow and Freese-Johnson, worry that a narrow reading of the OST's restrictions could allow a new arms race to start in outer space.[161] Indeed, Article III of the OST declares that all space activity must be "in accordance with international law, including the Charter of the United Nations."[162] Because the U.N. Charter outlaws war, so too does the OST. Under this view, nations could only use space for self-defense or when authorized by the U.N. Security Council.

The U.N. Charter, however, has not ended armed conflict on earth. The OST, for example, could not prohibit a nation's right to use force in self-defense. As Article 51 declares: "Nothing in the present Charter shall impair the inherent right of individual or collective self-defense if an armed attack occurs against a Member of the United Nations."[163] Nations have waged many wars since the coming into force of the U.N. Charter based on claims of self-defense.[164] The OST could not override the U.N. Charter's recognition of a nation's fundamental right to defend itself.

156. *See, e.g.*, CHENG, *supra* note 134, at 513–22.

157. Outer Space Treaty, *supra* note 132, art. I.

158. G.A. Res. 43/70, Prevention of an Arms Race in Outer Space, at 71 (Dec. 7, 1988).

159. *Prevention of an Arms Race in Outer Space: Resolution*, U.N. DIGITAL LIBRARY (Dec. 7, 1988), https://digitallibrary.un.org/record/281412?ln=en.

160. *See generally* Ram S. Jakhu, Cassandra Steer & Kuan-Wei (David) Chen, *Conflicts in Space and the Rule of Law*, SPACE POLICY, Jan. 2016.

161. JOHNSON-FREESE, *supra* note 81, at 108–09; David A. Koplow, *An Inference about Interference: A Surprising Application of Existing International Law to Inhibit Anti-Satellite Weapons*, 35 U. PA. J. INT'L L. 737, 758 (2014).

162. Outer Space Treaty, *supra* note 132, art. III.

163. U.N. Charter art. 51.

164. CHRISTINE CHINKIN & MARY KALDOR, INTERNATIONAL LAW AND NEW WARS (2017), https://www.cambridge.org/core/books/international-law-and-new-wars/selfdefence-as-a-justification-for-war-the-geopolitical-and-war-on-terror-models/9338749E5B4FB77BDB17E4CE68D4239A/core-reader.

The OST might not even preclude more recent, welfare-maximizing armed conflicts. After the end of the Cold War, nations still have resorted to war in cases other than for self-defense.[165] While they may have abandoned their nineteenth and twentieth century goals of territorial conquest, they continue to use force to change regimes, end humanitarian crises, pursue terrorist groups, and prevent WMD proliferation.[166] This practice leaves a wide berth for the use of force, and, as many commentators have observed, runs counter to a narrow reading of the text of the U.N. Charter.[167] If nations expand their understanding of the scope of permissible armed conflicts, the availability of space-based military systems will grow as well. If the concept of self-defense, for example, expands from anticipatory to preventive uses of force, nations will be able to use weapons in space more often. As I have argued elsewhere, nations are already following a practice of preventive armed conflict even as scholars and governments argue over its legality.[168]

The OST does not attempt to rewrite the U.N. Charter's framework for the use of force. A treaty certainly could go beyond the U.N. Charter's prohibition on aggression by ordering a complete demilitarization of space, even including self-defense measures. The Treaty, however, does anything but that. To be sure, Article III specifically states that spacefaring nations shall follow "international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding."[169] By specifically incorporating the Charter, however, the treaty acknowledges the international law framework that has permitted—although always subject to controversial and conflicting interpretations—the use of force many times since the end of World War II. Indeed, it would make little sense to infer that the United States in particular would understand the OST's language here to bar military activity in space at a time when it was interpreting the same language—the U.N. Charter's protection of a right to self-defense—to justify the Vietnam War.[170]

Regardless of whether states may use force narrowly or broadly under conventional international law, the OST itself does not alter the *jus ad bellum* rules of when nations may decide to initiate war. Instead, the OST places *jus in bello* limits on how nations can use space once a war has already begun. It requires equal access for all countries to outer space and forbids "national appropriation by claim of sovereignty" of space or any of the celestial bodies.[171] Article IV

165. *See id.*

166. *See* WALTER A. MCDOUGALL, PROMISED LAND, CRUSADER STATE: THE AMERICAN ENCOUNTER WITH THE WORLD SINCE 1776 172–98 (1997); JOHN YOO, POINT OF ATTACK: PREVENTATIVE WAR, INTERNATIONAL LAW, AND GLOBAL WELFARE 107–29 (2014).

167. *See, e.g.*, YOO, POINT OF ATTACK, *supra* note 166, at 10–16; Thomas M. Franck, *What Happens Now?: The United Nations After Iraq*, 97 AM. J. INT'L L. 607, 608 (2003); Lori F. Damrosh & Bernard H. Oxman, Editors' Introduction, *Agora: Future Implications of the Iraq Conflict*, 97 AM. J. INT'L L. 553, 553 (2003).

168. YOO, POINT OF ATTACK, *supra* note 166, at 133–53.

169. Outer Space Treaty, *supra* note 132, art. III.

170. On the U.S. justification for the Vietnam War under international law, see JOHN NORTON MOORE, *Part Three: International Law and the Indo-China War*, *in* LAW AND THE INDO-CHINA WAR 351–530 (1972).

171. Outer Space Treaty, *supra* note 132, art. II.

clearly forbids the placement of nuclear weapons or other WMD in orbit, on the Moon or planets, or in outer space.[172] Article IV also forbids the "establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers" on celestial bodies.[173] The Treaty requires spacefaring nations to assist others in distress, to allow them access to their moon or planetary installations, and to "be guided by the principle of cooperation and mutual assistance."[174]

Nations have generally obeyed these prohibitions. But the OST's textual lacunae permit significant military operations. For example, the agreement does not prohibit weapons from passing through space between two terrestrial locations. Ballistic missiles, therefore, do not violate the treaty. The superpowers must have read the treaty text this way in order to permit the ground and sea-launched ICBMs that they had already deployed at the time.[175]

By its silence, the ban on orbital WMDs also leaves a great deal of room for nations to deploy military assets in space. For example, nations can insert conventional or even exotic weapons into orbit, such as missiles with non-nuclear warheads, kinetic hit-to-kill interceptors, and even lasers and particle-beams, so long as they do not use WMD technology. Even the ban on WMD in orbit does not prohibit all possible uses of WMD in space, only those stationed in orbit. Similarly, the OST's ban on locating military bases on planets, moons, and other celestial bodies allows nations to establish their own weapons platforms in space, so long as they remain artificial. The treaty entirely neglects orbital weapons for use against terrestrial targets, or vice versa. The superpowers, for example, would have to resort to another, separate agreement to forbid space-based ABM defenses. Again, the treaty's clear ban on WMD weapons in orbit implies that all other weapons remain unregulated.

Similarly, the OST remains silent on the use of space as a commons from which to operate military support networks for terrestrial operations, perhaps the most important new use of space. Satellites provide the communication networks for command and control of a worldwide network of U.S. military units, for example, and they feed the information for effective reconnaissance, target selection, and feedback.[176] By their practice, nations do not appear to believe that the OST forbids such uses of space. If military support is permissible, it is further not clear why the treaty text would forbid direct military operations in space against other targets in orbit, so long as they are part of a war that is legal under the U.N. Charter or the customary international law of self-defense. Such an understanding would permit military operations in space that serve a defensive purpose, such as blinding the satellites of a nation launching a clear war of aggression. Such an understanding would also allow self-defense measures to be launched from space toward ground targets. If guiding missiles to a target does

172. *Id.* art. IV.
173. *Id.*
174. *Id.* art. IX.
175. RABKIN & YOO, *supra* note 12, at 207.
176. *Id.* at 196–204.

not violate the U.N. Charter, defending nations should be able to launch those missiles from space instead.

If disarmament were truly the treaty's purpose, it would have contained a universal ban on all military activities in space. It only lists, however, piecemeal prohibitions. The specific provisions on WMD, or on military bases on the Moon, or against sovereignty over space, belie any intent to universally ban all military activity. Otherwise, the treaty could have been much shorter and concise. Scholars compare the 1967 OST to the 1959 Antarctic Treaty, which demilitarized the continent.[177] But Article I of the Antarctic Treaty contains a broader prohibition: "Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons."[178] The Antarctic Treaty does not limit its reach only to specific parts of the continent, or prohibit only specific types of weapons, as does the OST. Reading the OST in comparison to similar treaties highlights the limited nature of its arms control regulations.

The OST marked the high point in legal cooperation in space. In the years since détente, the United States has moved away from arms limits toward the open pursuit of national interests. With his Strategic Defense Initiative ("SDI"), President Ronald Reagan launched a program to develop space-based weapons against ICBMs.[179] When critics charged that SDI would violate the ABM Treaty, the Reagan Administration argued that research and development would not run afoul of the agreement. Left virtually unmentioned was the OST.[180] Afterward, in the 1990s, the Clinton Administration continued missile defense research, though at a lesser pace.[181] With the end of the Cold War, the U.S. and Russia cooperated on various space science and manned missions, but the U.S. also resisted broad legal regulation of space.[182] In its 1996 National Space Policy, for example, the Clinton Administration continued U.S. support for "passage through and operations in space without interference" and the "fundamental right" to "acquire data from space."[183] While these traditional U.S. policy goals recognized the equal right of all nations to free navigation of space and to engage in commercial activity in orbit, they also rejected treaty-based limits on U.S. military activities in space.

177. Antarctic Treaty art. I, Dec. 1, 1959, 402 U.N.T.S. 71; *see, e.g.*, NAT'L RES. COUNCIL, EXPLORATION OF ANTARCTIC SUBGLACIAL AQUATIC ENVIRONMENTS: ENVIRONMENTAL AND SCIENTIFIC STEWARDSHIP 105 (2007).

178. Antarctic Treaty, *supra* note 177, 402 U.N.T.S. art. I.

179. *See* Yoo, *Politics as Law?*, *supra* note 48, at 851–52.

180. *Id.* at 854–64.

181. *Id.* at 901–14.

182. RABKIN & YOO, *supra* note 12, at 209.

183. White House Nat'l Sci. & Tech. Council, *Fact Sheet: U.S. National Space Policy* 1 (Sept. 19, 1996), http://history.nasa.gov/appf2.pdf.

U.S. realism in space reached new heights during the Bush Administration. In January 2001, a special congressional commission called for a rapid U.S. military buildup in space.[184] Chaired by soon-to-become Secretary of Defense Donald Rumsfeld, the commission observed that mankind had fought in air, water, and on land and that conflict in space was "a virtual certainty."[185] It warned of a "Space Pearl Harbor" because of the U.S. reliance on satellites for reconnaissance, communications, and early warning.[186] The commission called for the development of superior space capabilities that could "negate the hostile use of space against United States interests" by using "power projection in, from and through space."[187] It found that treaties and law did not prohibit a wide variety of military space operations. "There is no blanket prohibition in international law on placing or using weapons in space, applying force from space to earth or conducting military operations in and through space."[188] After the September 11, 2001 terrorist attacks, followed by the Afghanistan and Iraq wars, the United States began to put the commission's proposals into effect by generously funding the research and development of new space weapons.[189]

The United States complemented this new approach to space by removing legal restrictions on military space activities. In early 2002, the Bush Administration withdrew from the Anti-Ballistic Missile treaty, which had blocked full deployment of a system integrating ground-based interceptors with a space-based sensor network.[190] Congress responded by increasing funding for national missile defense by 62% in one year.[191] In 2005, General Lance Lord, Commander of the U.S. Air Force's Space Command, expressed the Bush Administration's approach to space: "Space superiority is the future of warfare. We cannot win a war without controlling the high ground, and the high ground is space."[192]

As we have discussed, missile defense systems enjoy the capabilities necessary to destroy satellites as well. In its 2006 revised National Space Policy, the Bush Administration made even more clear its hostility to legal limits on U.S. space activities: "The United States will oppose the development of a new legal regime or other restrictions that seek to prohibit or limit U.S. access to space."[193] The 2006 Policy also specifically rejected arms control proposals for space. "Proposed arms control agreements or restrictions must not impair the rights of the United States to conduct research, development, testing, and operations or other activities in space for U.S. national interests."[194] In February 2008, the United

184. *See generally* REPORT OF THE COMMISSION TO ASSESS UNITED STATES NATIONAL SECURITY SPACE MANAGEMENT AND ORGANIZATION, *supra* note 85.

185. *Id.* at 100.

186. *Id.* at 22.

187. *Id.* at xi, xvi.

188. *Id.* at 37.

189. MOLTZ, *supra* note 103, at 267–75.

190. *Id.* at 269.

191. *Id.* (funding rose from $4.8 billion in 2001 to $7.8 billion in 2002).

192. Michael N. Schmitt, *International Law and Military Operations in Space*, 10 MAX PLANCK Y.B. U.N. L. 89, 90 (2006) (quoting General Lance Lord).

193. U.S. National Space Policy, *supra* note 127, at 2.

194. *Id.*

States tested a sea-based missile defense system to destroy a malfunctioning intelligence satellite in orbit.[195]

While the Obama Administration took steps to reject its predecessor's foreign policies, it did not advance a different understanding of space. At first glance, the Obama White House's 2010 national space policy appeared to reject Bush Administration realism. Its first principle declared: "It is the shared interest of all nations to act responsibly in space to help prevent mishaps, misperceptions, and mistrust."[196] While making clear that "the United States considers the sustainability, stability, and free access to, and use of, space vital to its national interests," the 2010 policy also declared that, "[s]pace operations should be conducted in ways that emphasize openness and transparency to improve public awareness of the activities of government, and enable others to share in the benefits provided by the use of space."[197] The White House ordered agencies to "identify areas for potential cooperation," "develop transparency and confidence-building measures," and preserve "the space environment and the responsible use of space."[198] Unlike the Bush Administration's quest for freedom of operation in space, the Obama policy adopted an apparently positive attitude toward new international regimes. "The United States will consider proposals and concepts for arms control measures if they are equitable, effectively verifiable, and enhance the national security of the United States and its allies."[199]

The Obama Administration's actions, however, belied these aspirations. Despite its promises of greater cooperation, the Obama space policy continued important elements of the U.S. approach to space security. It declared that "peaceful purposes" in the OST and international law "allows for space to be used for national and homeland security activities."[200] While rejecting any claim to sovereignty in space, the United States continued to demand "the rights of passage through, and conduct of operations in, space without interference."[201] Finally, the Obama Administration continued to reserve the right to use force to defend American interests in space. "The United States will employ a variety of measures to help assure the use of space for all responsible parties, and, consistent with the inherent right of self-defense, deter others from interference and attack."[202] It further reserved the right to use force to "defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them."[203] During the Obama years, the United States did not subject its military operations in space to any new legal constraints, nor did

195. Philip Coyle & Victoria Samson, *Missile Defense Malfunction: Why the Proposed U.S. Missile Defenses in Europe Will Not Work*, 22 ETHICS & INT'L AFF. 3 (2008).

196. Office of the Pres., *National Space Policy of the United States of America* 3 (June 28, 2010), https://history.nasa.gov/national_space_policy_6-28-10.pdf.

197. *Id.*

198. RABKIN & YOO, *supra* note 12, at 211.

199. *National Space Policy of the United States of America*, *supra* note 196, at 7.

200. *Id.* at 3.

201. *Id.*

202. *Id.*

203. *Id*

it enter into any new international agreements involving space—unlike its efforts with Iran, which culminated in the Iran nuclear deal, or climate change, which resulted in the Paris Accords.[204]

Circumstance may have prevented the Obama Administration from significantly changing U.S. space policy. Nations began to compete more vigorously in orbit. China developed anti-satellite weapons and launched a manned spaceflight program, which included plans to land on the Moon.[205] By 2010, China matched the U.S. in number of space launches, deployed a Chinese GPS, and boosted its military satellite network.[206] India also began an ambitious space program with the launch of a military satellite and plans for anti-satellite weapons.[207] In 2008, Japan enacted a new law authorizing military use of space, which included an early warning system for missile launches and military reconnaissance satellites.[208] Even less developed nations joined the spacefaring club. In 2009, Iran demonstrated a working knowledge of ballistic missiles by placing a primitive communications satellite into orbit.[209] In 2016, North Korea succeeded in placing a satellite in orbit in violation of U.N. Security Council Resolutions.[210]

Legal efforts to contain this growing competition failed. In 2008, Russia and China proposed a treaty to prevent the placement of any weapons in outer space.[211] Their draft declared that states would not "place in orbit around the Earth any objects carrying any kinds of weapons" and that they would not "resort to the threat or use of force against outer space objects."[212] In seeking to change international law with a treaty on these points, both nations implicitly agreed that existing rules permit orbiting space weapons. In response to U.S. criticism, Beijing and Moscow further acknowledged that existing international law did not

204. *See* James Griffiths et al, *Iranian leader announces partial withdrawal from nuclear deal*, CNN (May 8, 2019, 4:02 PM), https://www.cnn.com/2019/05/08/middleeast/iran-nuclear-deal-intl/index.html?no-st=1567542775 (describing the current state of the Iran deal); Valerie Volcovici, *House backs Paris agreement in first climate bill in a decade*, REUTERS (May 2, 2019, 11:48 AM), https://www.reuters.com/article/us-usa-climate/house-backs-paris-agreement-in-first-climate-bill-in-a-decade-idUSKCN1S81OI (describing recent developments related to U.S. involvement in the Paris Accords).

205. Sirui Zhu, *China's Long March to Space*, REUTERS (Aug. 20, 2019), https://graphics.reuters.com/SPACE-EXPLORATION-MOON/0100B0BH0NZ/index.html.

206. MOLTZ, *supra* note 103, at 316–17.

207. Sanjeev Miglani & Krishna N. Das, *Modi hails India as military space power after anti-satellite missile test*, REUTERS (Mar. 27, 2019, 2:26 AM), https://www.reuters.com/article/us-india-satellite/modi-hails-india-as-military-space-power-after-anti-satellite-missile-test-idUSKCN1R80IA.

208. Manuel Manriquez, *Japan's Space Law Revision: the Next Step Toward Re-Militarization*, NTI (Jan. 1, 2008), https://www.nti.org/analysis/articles/japans-space-law-revision/.

209. Fredrik Dahl & Parisa Hafezi, *Iran launches satellite; U.S. expresses concern*, REUTERS (Feb. 2, 2009, 10:54 PM), https://www.reuters.com/article/us-iran-satellite-idUSTRE5120NN20090203.

210. Mike Wall, *North Korea Launches Satellite to Space*, SPACE.COM (Feb. 8, 2016), http://www.space.com/31860-north-korea-satellite-launch.html.

211. Draft of Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects, China-Russ., Feb. 29, 2008, U.N. Doc. CD/1839.

212. Conference on Disarmament, Letter dated Feb. 12, 2008 from the Permanent Rep. of the Russian Federation and the Permanent Rep. of China to the Conference on Disarmament addressed to the Secretary-General of the Conference transmitting the Russian and Chinese texts of the draft "Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects (PPWT)" introduced by the Russian Federation and China, at 2–3, U.N. Doc. CD/1839 (Feb. 29, 2008).

prohibit anti-satellite weapons based on the ground, sea, or air.[213] They also conceded that international law did not ban ground-based laser weapons or jamming systems aimed at space targets.[214] Their treaty would only establish a new prohibition on space-based weapons, such as a missile defense network or a global strike capability.[215]

European nations, meanwhile, attempted to gather support for a set of rules to govern space. In 2008, the European Union issued a draft "Code of Conduct for Outer Space Activities" that sought to guarantee "freedom for all states, in accordance with international law and obligations, to access, to explore, and to use outer space for peaceful purposes without harmful interference."[216] It urged members to refrain from the damage or destruction of any space objects, except when justified by threat to human life or health, to reduce space debris, or by the U.N. Charter or self-defense.[217] The Code of Conduct, however, made clear that it was not legally binding.[218] It instead focused its efforts on voluntary transparency measures, such as sharing data on launches and space activity.[219] Even with these light obligations, the United States and other major spacefaring powers refused to join the Code.[220] Nonetheless, the European Code of Conduct is revealing in the same manner as the Russo-China draft treaty—it would be unnecessary if international law already banned the object of its text.

While both the Chinese-Russian proposal and European Union draft attempted to build upon the OST, states explicitly made clear that they were unwilling to completely demilitarize space. This is consistent with the actions of these states in the last half-century, as well as the actions of the United States. Without any binding treaties, except the minimal obligations of the OST, international law permits a wide variety of military activities in space. Despite the

213. Conference on Disarmament, Letter dated Feb. 12, 2008 from the Permanent Rep. of the Russian Federation and the Permanent Rep. of China to the Conference on Disarmament addressed to the Secretary-General of the Conference transmitting the Russian and Chinese texts of the draft "Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects (PPWT)" introduced by the Russian Federation and China, at 2, U.N. Doc. CD/1839 (Feb. 29, 2008) ("Noting that the existing agreements . . . are unable to effectively prevent the placement of weapons in outer space and an arms race in outer space . . . .").

214. And, indeed, such weapons continue to be developed. *See, e.g.*, Kyle Mizokami, *France Is Making Space-Based Anti-Satellite Laser Weapons*, POPULAR MECH. (July 25, 2019), https://www.popularmechanics.com/military/weapons/a28509615/france-anti-satellite-weapon/.

215. Conference on Disarmament, Letter dated Aug. 18, 2009 from the Permanent Rep. of China and the Permanent Rep. of the Russian Federation to the Conference on Disarmament addressed to the Secretary-General of the Conference transmitting answers to the principal questions and comments on the draft "Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force Against Outer Space Objects (PPWT)" introduced by the Russian Federation and China and issued as document CD/1839 dated Feb. 29, 2008, at 3, U.N. Doc. CD/1872 (Aug. 18, 2009); MOLTZ, *supra* note 103, at 310.

216. EUROPEAN UNION, *Draft International Code of Conduct for Outer Space Activities*, at 3, (Mar. 31, 2014), https://eeas.europa.eu/sites/eeas/files/space_code_conduct_draft_vers_31-march-2014_en.pdf.

217. *Id.* at 6.

218. *Id.* at 3.

219. *Id.* at 8–9.

220. Marcus Weisgerber, *U.S. Wants Changes to EU Space Code of Conduct*, SPACENEWS (Jan. 12, 2012, 6:23 PM), https://spacenews.com/18667us-wants-changes-to-eu-space-code-of-conduct/.

consistent actions of states, however, legal scholars have continued to propose new extensions of international law that seek to curtail military options in space.

B. Legal Theory in Space

International law scholars have devoted relatively little attention to space security. Out of the limited literature that exists, however, several theories have emerged about the current legal regime and whether nations can strengthen it to prevent a destabilizing arms race. This Section surveys the prevailing theories. Most of them argue that the existing legal regime fails to effectively address the security concerns that arise from unilateral military activity in space. These arguments are often accompanied by proposals for extending the reach of the existing regime through a variety of legal mechanisms and multilateral fora.

Legal analyses of space security commonly begin with the OST. Scholars almost unanimously recognize that it imposes minimal legal obligations.[221] First, as argued above, the treaty only bans WMDs in orbit, leaving a great deal of room for conventional weapons, space support, anti-satellite, and orbiting bases.[222] The Treaty's other clauses use vague, general language, which allows significant room for unilateral interpretation by the states themselves.[223] Second, at fifty years old, the OST cannot account for the political and technological changes that have taken place over the past several decades, especially the reduction in launch costs and the end of the bipolar superpower world.[224] There are now a number of players that have emerged in space including not just near-peer competitors to the U.S., such as Russia and China, but also destabilizing regimes like Iran and North Korea "who might value the destruction of an adversary's space asset over preservation of their own."[225] Third, states designed the OST to be inherently flexible in order to allow states to respond adequately to threats to their own security interests.[226] By design, it resists hard limits on state military activity.

Major states have decided to leave military activities in space essentially unregulated. "Countries have legally obligated themselves only to refrain from the particular weapons behaviors that they did not want to—or did not have the capacity to—undertake anyway," Professor David Koplow concludes.[227] As a result, legal scholars have focused on proposing space security regimes that could replace the OST with a combination of treaties and customary international

221. Loren Grush, *How an international treaty signed 50 years ago became the backbone for space law*, THE VERGE (Jan. 27, 2017, 11:14 AM), https://www.theverge.com/2017/1/27/14398492/outer-space-treaty-50-anniversary-exploration-guidelines.

222. *See supra* text accompanying notes 171–76.

223. P.J. Blount, *Renovating Space: The Future of International Space Law*, 40 DENV. J. INT'L L. & POL'Y 515, 520 (2011).

224. *Id.*

225. *Id.*

226. *Id.* at 526–27.

227. David A. Koplow, *An Inference about Interference: A Surprising Application of Existing International Law to Inhibit Anti-Satellite Weapons*, 35 U. PENN. J. INT'L L. 737, 768 (2014).

law.[228] Koplow, for example, argues that much military activity in space is illegal. He argues that certain provisions of existing arms control treaties can supplement the OST and the U.N. Charter to prevent destabilizing activity.[229] Stable outer space requires only better enforcement of existing norms. Realists, by contrast, argue that stability will arise only through deterrence, or even hegemonic supremacy, rather than treaties.[230] Most scholars in the field fall somewhere in between these opposites. Most fear that the current legal regime cannot prevent a dangerous arms race. As a result, they urge some mixture of international humanitarian law principles, new soft law measures, and international institutions to impose a new arms control regime on space-faring states.[231]

Beginning with the most restrictive interpretation of current law, Koplow argues that certain military activity in space is already banned by "little-noticed shards" of existing bilateral and multilateral arms control agreements.[232] The "shards" that Koplow refers to are national technical means ("NTM") provisions in existing arms control treaties.[233] Space-based NTM shored up the stability of the international order during the Cold War by giving the great powers a reliable means to verify whether other nations lived up to arms control limits. Successive international agreements continued to incorporate NTM.[234] These NTM provisions have two key features: first, they approve the use of NTM satellites for verification, and second, they prohibit "interference" with their operations.[235] Koplow argues that "prohibited interference" must "embrace actions that would destroy, significantly damage, or capture another state's monitoring or communications satellite."[236] It should also include, he writes, "less catastrophic actions" such as temporarily disabling or interfering with a satellite's operations.[237]

228. For the claim that the treaties and customary law of international humanitarian law should govern space, see, for example, Michel Bourbonnière, *Law of Armed Conflict (LOAC) and the Neutralisation of Satellites or* Ius in Bello Satellitis, 9 J. CONFLICT & SEC. L. 43 (2004); for a broader discussion of customary international law and space, see Tare C. Brisibe, *Customary International Law, Arms Control and the Environment in Outer Space*, 8 CHINESE J. INT'L L. 375 (2009).

229. Koplow, *supra* note 227, at 825–27.

230. *See, e.g.*, DOLMAN, *supra* note 121, at 5–6; Surya Gablin Gunasekara, *Mutually Assured Destruction: Space Weapons, Orbital Debris, and the Deterrence Theory for Environmental Sustainability*, 37 AIR & SPACE L. 141, 142–43 (2012).

231. *See, e.g.*, Blount, *supra* note 223, at 532 ("It is important that the law adapt to the changed circumstances. Luckily, international space law is not in a state of decrepitude wherein it must be torn down. Instead it can be renovated to work with the new, updated architecture.").

232. Koplow, *supra* note 227, at 737–38.

233. *Id.* at 738–39.

234. *Id.* at 781–93. The treaties that Koplow cites as containing NTM provisions include, inter alia, the Anti-Ballistic Missile Treaty, the Interim Agreement on Strategic Offensive Arms, the 1987 Intermediate Nuclear Forces Treaty, a host of bilateral agreements between the U.S. and the U.S.S.R., and a number of multilateral treaties such as the 1990 Treaty on Conventional Forces in Europe, the Comprehensive Nuclear Test Ban Treaty. Some of these are no longer, or are not yet, legally operative.

235. *Id.* at 791.

236. *Id.* at 793.

237. *Id.* at 793–94.

Koplow's definition would prohibit any military activity that produces a significant amount of space debris because it would inevitably interfere with NTM satellites.[238]

There are a number of problems with the view that existing law bans most military activity. As Koplow acknowledges, few treaties create enough NTM provisions to establish a comprehensive restriction, and China (among other states) is not a party to the major arms control treaties.[239] Perhaps most fatally, it is virtually inconceivable that existing state parties to these treaties would abide by such a significant arms limitation that was not clearly understood at the time of signing. As Koplow recognizes, "[i]nternational law arises from the consent of states, and unless the leading players voluntarily agree to accept a commitment restricting ASAT activities, it cannot be effective."[240]

Realists, on the other hand, object to any restraint on military activities in space, even those of the OST. Realists argue instead that deterrence will prevent a destructive arms race in space. Surya G. Gunasekara, for example, argues that the risk posed by increasing orbital debris will deter excessive military activity.[241] A debris-laden outer space will have "catastrophic consequences" for space-faring states, particularly those that rely heavily on space for military and civilian uses, "due to both the danger it poses to satellites and space missions and the liability imposed by international legal space structure."[242] Countries with extensive space assets, like the U.S., will thus have significant incentives to "refrain from using space weapons, which cause substantial amounts of debris" simply because such activities could destroy a common resource that benefits those states.[243]

Other realist strategists focus on the importance of pre-emptive or even preventive deterrence. They argue that the U.S. can effectively deter destabilizing space threats from rivals by advancing its defensive capabilities in space.[244] They point out that every environment—land, air, water, and now space—has become an arena for combat.[245] Satellites have already enhanced combat operations by coordinating ground, air, and sea fighting. But the U.S.'s dependence on space-enhanced precision warfare also makes it more vulnerable to attack. As former Defense Department official Steven Lambakis wrote in 2007, "the proliferation of space technologies offers foreign governments and nonstate entities unparalleled opportunities to enhance diplomatic and military influence over the U.S.

238. *Id.* at 793.
239. *Id.* at 815.
240. *Id.* at 818.
241. Gunasekara, *supra* note 230, at 27.
242. *Id.* at 16.
243. *Id.* at 32.
244. John Yoo, *Winning the Space Race*, 54 STRATEGIKA 4, 6 (2018).
245. *Id.*

and strike with strategic effect."[246] "We will be challenged in space," he observes, "simply because it makes military sense to do so."[247]

Some strategists have gone farther to argue not just in favor of protecting U.S. space assets but also seeking U.S. space supremacy. Because great power competition has already spread to space, the United States should capitalize on its early lead to control the ultimate high ground. According to Everett Dolman, the U.S. should withdraw from the OST and deploy weapons in space. "Who controls low-Earth orbit controls near-Earth space. Who controls near-Earth space dominates Terra. Who dominates Terra determines the destiny of humankind," Dolman argues.[248] By deploying a system of anti-satellite weapons first, the United States can deny other nations access to space.

Between the poles of international lawyers and realist strategists, many observers believe that stability requires gap-filling to arrest the military use of space. They worry that "space hegemonists" will trigger an arms race that will ultimately waste resources and degrade the commercial benefits of space.[249] Not only do these systems consume enormous sums, due to the costs of lifting these weapons into space, but they are also relatively easy to defeat. Embarking on a military buildup will only result in a stalemate or expose vulnerable U.S. space systems to effective attack. If nations were to use such weapons, they could impose catastrophic costs on peaceful uses of space: debris could collide with civilian satellites, while electromagnetic pulses from nuclear explosions would destroy electronics. Fear of losing space systems might even encourage nations to attack on earth first or to make critical errors of judgment.

Some scholars seek to forestall this ruinous competition by applying principles of International Humanitarian Law ("IHL") to space.[250] They base their hopes on the OST's proclamation that "all activities in outer space shall be conducted in accordance with international law."[251] Manfred Lachs, author of the foundational work on outer space law, argued that space is not a lawless area because once nations begin to interact, even in space, international law applies.[252] Based on this assumption, Professors Dale Stephens and Cassandra Steer have attempted to identify principles of IHL to apply in the space domain.[253] Even

246. Steven Lambakis, *Missile Defense from Space*, HOOVER INSTITUTION (Feb. 1, 2007), http://www.hoover.org/research/missile-defense-space.

247. STEVEN LAMBAKIS, ON THE EDGE OF EARTH: THE FUTURE OF AMERICAN SPACE POWER 137 (2001).

248. DOLMAN, *supra* note 121, at 8.

249. *See, e.g.*, Bruce DeBlois et al., *Space Weapons: Crossing the U.S. Rubicon*, 29 INT'L SECURITY 50, 54–55 (2004).

250. *See, e.g.*, Jackson Maogoto & Steven Freeland, *From Star Wars to Space Wars—The Next Strategic Frontier: Paradigms to Anchor Space Security*, 33 J. AIR & SPACE L. 10 (2008); Jackson Maogoto & Steven Freeland, *The Final Frontier: The Laws of Armed Conflict and Space Warfare*, 23 CONN. J. INT'L L. 165, 179–85 (2007); Robert A. Ramey, *Armed Conflict on the Final Frontier: The Law of War in Space*, 48 A.F. L. REV. 1, 4–5 (2000); Dale Stephens & Cassandra Steer, *Conflicts in Space: International Humanitarian Law and Its Application to Space Warfare*, 40 MCGILL ANNALS AIR & SPACE L. 1 (2015).

251. Stephens & Steer, *supra* note 250, at 11.

252. MANFRED LACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 14 (1972).

253. Stephens & Steer, *supra* note 250, at 11–12.

though no international agreement other than the OST expressly addresses space *jus in bello* rules, they argue that "undoubtedly customary international law and relevant general principles of law would apply to regulate such armed conflict."[254] They point to the International Court of Justice's ("ICJ") application of the principles of proportionality, distinction, and necessity to the question of nuclear weapons as an example. International institutions will "assimilate legal principles to fill apparent voids whenever encountered, especially in the context of armed force," because to propose a lawless frontier "goes against the progressive thrust and reasoning underpinning the historic trajectory of IHL."[255] Simply stating that international law should apply, however, does not identify why it applies, which rules should apply, or how they should operate in the unique environment of outer space.

Other scholars advocate for international institutions to produce a new space consensus expressed in new international agreements. These scholars argue that international cooperation is critical to achieving stability in space. James Moltz of the U.S. Naval Postgraduate School, for example, believes that nations can learn to overcome the prisoners' dilemma of arms competition through mutual trust and learning.[256] These scholars contend that nations must agree to new agreements that prohibit space-based weapons and that share the commercial benefits of space navigation.[257] They point to the OST as an example of a cooperative attitude toward space that could point the way toward future agreements prohibiting the military from the Moon and the planets or banning whole classes of weaponry. They also take heart from the diversion of Cold War competition away from militarization and toward civilian and scientific exploration.

These theorists propose several different forums for shaping norms. Johnson-Freese, for example, puts her faith in U.N. disarmament bodies to develop new rules and ultimately new agreements to stop an arms race.[258] But, as Ram S. Jakhu points out, U.S. opposition has hamstrung the ability of these institutions to impose any meaningful restraints on military space activity.[259] He instead argues in favor of a new, alternative forum outside of the U.N. that is comprised of "lawyers, technical experts, military practitioners and relevant observers" in order to clarify and restate the law.[260] Jack Beard similarly urges the creation of a new institution that is perceived as apolitical, such as a specialized research agency that approaches space militarization "from an applied technical perspective focusing on solving problems facing those working and operating in the space field."[261]

254. *Id.* at 11.
255. *Id.* at 9–10.
256. MOLTZ, *supra* note 103, at 60–61.
257. *See, e.g.*, JOHNSON-FREESE, *supra* note 90, at 141–45.
258. *Id.* at 119–32.
259. Jakhu, Steer & Chen, *supra* note 160 (manuscript at 18–19).
260. *Id.* at 19.
261. Jack M. Beard, *Soft Law's Failure on the Horizon: The International Code of Conduct for Outer Space Activities*, 38 U. PA. J. INT'L L. 335, 381–82 (2017).

Proposals range widely in their actual substance. The most restrained versions advocate for various types of "soft law" in order to help develop international norms.[262] This includes increased transparency and confidence-building measures, such as those already urged by the U.N. or set forth in the European Code of Conduct. Jakhu proposes the creation of a Manual on International Law Applicable to Military Uses of Outer Space, like the recently developed Tallinn Manual on International Law Applicable to Cyberwarfare.[263] Proponents of this soft law approach point to the many advantages of using soft law to create international norms. Soft law does not require state ratification, so it can be implemented immediately.[264] More importantly, supporters argue that it can "impact . . . the international law-making process by providing the premise on which customary international law may develop."[265] Other scholars object that the problem with such "informal and tailored" mechanisms of governance is that they fail "to include considerations of national power and . . . [thus] risk the emergence of serious security-related problems that such soft organizations are incapable of handling."[266] As Moltz acknowledges, there is very little oversight and no clear mechanism for punishing cheaters in the absence of definitive rules and formal enforcement institutions.[267] This perhaps explains why all of the extant soft law on space activities, such as the European Code of Conduct, has had a minimal effect on state practices. Accordingly, critics of this soft law approach fear that the imposition of nonbinding, nonspecific aspirational rules will simply create confusion in the international community, which could risk "greater insecurity and more tension in the volatile domain of space."[268]

Given the potential drawbacks of soft law, some scholars favor international agreements that impose hard, binding commitments. Inspired by "the model of the 1959 Antarctic Treaty," some argue for a flat prohibition against any military uses of space.[269] Such a ban would obviously have the "virtue of clarity," but it is neither politically possible nor strategically desirable.[270] Further, given the importance of space to the military operations of most space-faring states, such a proposal borders on the utopian.[271] Others offer a more moderate approach. Nina Tannenwald envisions two basic agreements that she believes

262. *Id.* at 345–58.

263. Jakhu, Steer & Chen, *supra* note 160, at 2.

264. A. Ferreira-Snyman, *Selected Legal Challenges Relating to the Military Use of Outer Space, with Specific Reference to Art. IV of the Outer Space Treaty*, 18 POTCHEFSTROOM ELECTRONIC L.J. 488, 517 (2015).

265. *Id.*

266. JAMES C. MOLTZ, CROWDED ORBITS: CONFLICT AND COOPERATION IN SPACE 183 (2014).

267. *Id.*

268. Beard, *supra* note 261, at 373.

269. Nina Tannenwald, *Law Versus Power on the High Frontier: The Case for a Rule-Based Regime for Outer Space*, 29 YALE J. INT'L L. 363, 413 (2004).

270. *Id.*

271. *Id*. "For the foreseeable future, a regime promoting a purely nonmilitary approach to outer space would likely be purely aspirational, lacking clear definitions or compliance measures, since the dominant space powers are unlikely to agree to a specified regime that eliminates passive military activities. Thus, such a regime may have little effect on the activities of the space powers, leading to what many non-spacefaring nations would perceive as a discriminatory regime. Though it may remain the aspiration of some groups of states, total demilitarization of space appears unlikely." *Id.* at 414.

would be politically more palatable. First, nations should sign a ban on deployment of weapons in space, and, second, they should prohibit interference with "highly vulnerable" space assets.[272] Recognizing that states may be motivated by their self-interest in minimizing orbital debris, Beard argues for a multilateral ban that prohibits low-orbit ASAT testing.[273] Such agreements may be more plausible because they already accord with state self-interest, their directives would be narrow and specific, and it would be relatively easy for parties to detect defection.

Many space policy analysts hope that the E.U. Code of Conduct will somehow coalesce into a comprehensive international legal regime to demilitarize space. While the Obama Administration did not formally sign the Code, it provided diplomatic support.[274] A new species of space regulator seeks to use such international agreements and cooperation to head off a destructive competition among the great powers for space supremacy. "The United States has by choice and by overconfidence bordering on folly embarked upon a course that relies primarily on technology, including space weapons, to protects its space assets, rather than diplomacy and cooperation, which had been the cornerstones of U.S. policy until the Reagan administration," argues Johnson-Freese.[275] "The world is on the precipice of a new arms race in outer space," warns Koplow.[276]

Observers warn against the broader "militarization of space." Strategist Michael O'Hanlon, for example, argues that the United States should seek agreement with other nations to ban the basing of weapons in space and to limit the development of ASAT weapons.[277] Johnson-Freese declaims the Bush Administration's 2006 policy as "a blanket claim to hegemony in space rather than a reasonable demand that we, like any nation, be allowed to traverse the skies in our own defense."[278] She argues that military leaders exaggerate the threat from space in order to justify more aggressive weaponization of space. But it won't work. "Relying exclusively on [space weapon] technology for security," she writes, "does not provide an asymmetric advantage: it creates a strategically unstable environment."[279]

Critics question whether the benefits of space weapons are worth the cost of strategic instability.[280] National missile defense, for example, may prove physically incapable of preventing ballistic missiles from reaching the United States. Instead of improving U.S. safety, an imperfect system might encourage nations

272. *Id.* at 416.

273. Beard, *supra* note 261, at 419–20.

274. For a description of the politics surrounding the European Code of Conduct, and criticism of its status as informal, "soft" law, see generally Beard, *supra* note 261.

275. JOHNSON-FREESE, *supra* note 90, at x; *see also* MICHAEL KREPON & CHRISTOPHER CLARY, SPACE ASSURANCE OR SPACE DOMINANCE?: THE CASE AGAINST WEAPONIZING SPACE 30–40 (2003).

276. David A. Koplow, The Fault is Not in Our Stars: Avoiding an Arms Race in Outer Space 1 (October 23, 2017) (unpublished), https://ssrn.com/abstract=3058132.

277. O'HANLON, *supra* note 82, at 23.

278. JOHNSON-FREESE, *supra* note 90, at 102.

279. JOHNSON-FREESE, *supra* note 81, at 243.

280. *Id.* at 243–45.

to strike before the U.S. can deploy a more secure safety net. American ASAT weapons may push other nations to develop their own, which would have a greater negative effect on the U.S. because of its heavier reliance on reconnaissance and communications satellites. Space weapons might be especially destabilizing because of the reliance by nuclear powers on satellites to detect ballistic missile launches. The possibility that an enemy might blind U.S. satellites could encourage decisionmakers to use force earlier than they otherwise might because of a lack of information. Anti-satellite weapons themselves might share this "use it or lose it" feature. Because satellites are vulnerable—many remain unarmored, for example, because increasing their weight increases the cost of their launch—satellite-based weapons themselves could be susceptible to early attack. Nations might choose to use their space-based weapons before they are destroyed by far cheaper, less sophisticated ASAT systems.

In sum, legal scholars and strategists urge a diverse set of proposals with respect to international regulation of space security. Their positions range from those who advocate a strategy of affirmative space supremacy to those who believe that many military activities are already illegal. The majority of scholars argue in favor of increased international agreements and regulations but have struggled to articulate the principles that underlie these proposals or how they could effectively operate in the current political climate.[281] The next Part discusses the nature of armed conflict in space and discusses why more regulation could prove counter-productive to the larger goal of reducing harm in interstate relations.

IV. THE FUTURE OF SPACE CONFLICT

This Part advances a positive argument justifying U.S. use of certain types of space weapons. Part II has described the advancement of technology to the point where space satellites provide the informational backbone for real-time, precision warfare. Technology has also brought the world closer to space-based weapons that can destroy satellites, ballistic missiles, and ground targets. Part III argued that existing international law places minimal limits on space weaponry, other than the OST's WMD prohibition and its placement of the moon and planets off-limits. Other than the OST, spacefaring nations have resisted any new restrictions on their space activities.

This Part argues that the United States should not agree to any further prohibition or regulation of space weapons. Rather than increase the likelihood of war, space-based systems reduce the probability of destructive conflicts and limit both combatant and civilian casualties. Satellites perform the critical function of reconnaissance, particularly in observing WMD arsenals and the movements of conventional forces. Such national technical means of verification reduce the chances that war will break out due to misunderstanding of a rival's deployments or misperception of another nation's intentions. Space-based communications

281. *See, e.g.*, Tannenwald, *supra* note 269, at 420.

abilities support the location of targets for smart weapons on the battlefield, which lower harm to combatants and civilians during war. Space-based weapons may bring unparalleled speed and precision to the strategic use of force that could reduce the need for more harmful, less discriminate conventional weapons that spread greater destruction across a broader area.

This Part will first explain why regimes governing terrestrial zones are ill-suited for space, as well the unique characteristics of space, such as military reliance on civilian satellites, which make the adaptation of prior legal systems difficult. Even in the absence of regulation, however, space weapons can reduce war and advance humanitarian goals by allowing more opportunities for states to credibly signal their military capabilities and deter rival challenges. They could also enable attacks that occur with more precision and reduced casualties. Finally, this Part will argue that the current rules for war, rooted in the Additional Protocols to the Geneva Conventions, hampers the benefits provided by space weapons, such as increased humanitarian intervention, and that a system focused on deterrence may better accommodate this new technology, as well as recommendations as to what weapons and limits the United States should adopt.

A. Space and Great Power Competition

Space already serves as an arena for great power competition. Nations should continue to use space weapons in limited circumstances as a strategic mechanism to coerce other nations, which will lead to more peaceful resolutions of crises. But there is an important caveat: because of the importance of satellites to strategic early-detection systems, nations should carefully limit their deployment of anti-satellite weapons. Nations should also carefully manage offensive weapons to prevent their first-strike capabilities from destabilizing the strategic balance of power.

Space presents difficult challenges because of its unique characteristic as a global commons. Analogizing space to other environments has important consequences for regulation. Some, for example, have compared space to the discovery of the New World in 1492, opened by voyages of discovery and subject to claims of sovereignty.[282] But while it has territory, in the form of the moon, planets, and asteroids, nations currently do not have the technology and resources to establish a continuous presence on these bodies. Space also shares some of the characteristics of airspace. Air and space craft fly above territory for both security and trade. As is the practice with aircraft, nations could require spacecraft to obtain permission to enter their space and launch missiles at satellites that enter without authorization. But space is far vaster than airspace. It currently seems impossible to exclude other nations from specific parts of space, unlike the way in which the United States can prevent the aircraft of other nations from entering its airspace. While the Soviet Union, at first, sought to apply the rules of airspace

282. Taylor Stanton Hardenstein, *In Space, No One Can Hear You Contest Jurisdiction: Establishing Criminal Jurisdiction on the Outer Space Colonies of Tomorrow*, 81 J. AIR L. & COM. 251, 258 (2016).

to outer space, by the 1960s it accepted that territory did not vest ownership of the space above.[283]

For many decades, the most common analogy for space was the high seas, especially in its combination of commerce and military expansion. Like the high seas, any nation could use military or civilian craft to travel through space free from interference.[284] Nations could not control space, just as they cannot control the high seas, but they could engage in military patrols and exploit resources. Popular culture appealed to this idea. The television classic *Star Trek* named its ship the U.S.S. Enterprise, made its hero James T. Kirk a Captain, and placed it under the command of a Starfleet.[285] But space does not have land for bases, mankind has no space colonies or trade routes, and nations have no fleets that patrol space. "It is very easy to make the obvious Mahan analogy on 'control of the sea' and talk blithely and superficially of 'control of space,'" strategist Herman Kahn once observed. "The analogy was never really accurate even for control of the air, and . . . it seems to be completely misleading for space."[286]

Another relevant comparison is to a different type of global commons: Antarctica. The Antarctic Treaty clearly inspired the OST.[287] Nations claimed sovereignty over parts of the continent, and even stationed troops there during World War II.[288] But, like space, Antarctica's harsh conditions made permanent outposts and commercialization unreasonable.[289] In 1961, nations entered a treaty placing Antarctica off-limits to all military activity, even for self-defense.[290] Some scholars look to the Antarctic Treaty to point the way for further developments in space law.[291] But they also recognize that military and commercial activity can find a more friendly home in space than in Antarctica. Even today, the frozen continent has not become an arena for serious interstate competition over security or resources.[292] Space, by contrast, provides the means for the most effective reconnaissance of strategic targets and the sensor and communications networks behind modern enhanced military operations. Space also provides the medium for critical commercial networks, such as data transmission to GPS location services.

These differences suggest that comprehensive space arms control will not succeed. At first glance, the bans on stationing WMD in orbit or establishing military bases on the celestial bodies indicate that space could provide fertile

283. *See* M.J. Peterson, *The Use of Analogies in Developing Outer Space Law*, 51 INT'L ORG. 245, 255 (1997).

284. *Id.* at 252–60.

285. RABKIN & YOO, *supra* note 12, at 216.

286. HERMAN KAHN, ON THERMONUCLEAR WAR 486 (1960), *quoted in* Moltz, *supra* note 103, at 19.

287. *See* MOLTZ, *supra* note 103, at 20–23; PHILLIP JESSUP & HOWARD J. TAUBENFELD, CONTROLS FOR OUTER SPACE AND THE ANTARCTIC ANALOGY (Leland M. Goodrich & Philip C. Jessup, eds., 1959).

288. RABKIN & YOO, *supra* note 12, at 216.

289. *Id.*

290. *Id.*

291. MOLTZ, *supra* note 103, at 20–23.

292. RABKIN & YOO, *supra* note 12, at 216.

ground for further interstate cooperation. But the early treaty regime could succeed because the technology available in 1967 could not practically exploit space. Nations then did not have the resources and technical ability to build military installations on the Moon or the planets.[293] A half-century after the signing of the OST, no nation has succeeded in building a base on the Moon; indeed, no human has visited the Moon since the last Apollo mission in 1972.[294] Ground-based ballistic missiles provide nuclear deterrence at a fraction of the cost of orbital WMD, while submarine-launched missiles have less vulnerability. Much like the Antarctic Treaty, the OST limited arms bans could succeed because they did not demand that the great powers relinquish any significant military capabilities.

But the technological barriers that supported the OST have eroded. As Part II described, advances in rocket design, satellites, and communications have made the exploitation of space easier and more effective. The arsenals of the nuclear powers already depend on the ability of ICBMs to travel through space, making unlikely any new agreement to completely ban all WMDs in space. Satellites provide the backbone for high-tempo, precision warfare. Both superpowers developed anti-satellite weapons during the Cold War, and in the 2000s both the United States and China successfully tested ASAT systems.[295] The United States already uses space assets to assist ground-based interceptors; the next step could deploy an ABM system wholly in space, where it could attack ICBMs soon after launch. An expanded ban on military conduct would require nations to give up far more advantages than in 1967.

A ban would force nations to give up space weapons that could serve as a more precise, less destructive means of coercion against other states. A U.S. anti-satellite weapon, for example, could destroy a single satellite used by a rival to support conventional ground operations. During the Afghanistan and Iraq wars, the U.S. did not destroy commercial satellites even though they could have provided the enemy with information regarding U.S. troop movements.[296] Instead, it purchased all of the available commercial satellite resources. But in a future conflict against an opponent with its own space network, the U.S. would have to disable satellites to achieve the same advantage. The U.S. could also use ASAT weapons to engage in the measured escalation of a conflict by temporarily or permanently disabling surveillance satellites. To put even more pressure on its opponents, the U.S. could attack a single space-based node of a military or government telecommunications network to degrade its reliability. Such steps would risk no casualties, compared to conventional attacks on terrestrial facilities that provide reconnaissance or communications.

293. *Id.* at 216–27.

294. *Apollo 17 (AS-512)*, SMITHSONIAN NATIONAL AIR AND SPACE MUSEUM: APOLLO PROGRAM, https://airandspace.si.edu/explore-and-learn/topics/apollo/apollo-program/landing-missions/apollo17.cfm (last visited Nov. 30, 2019).

295. RABKIN & YOO, *supra* note 12, at 217.

296. *Id.*

As with other precision weapons, space weapons could provide nations with more options that can coerce an enemy with less loss of life. Nations, for example, could attack other satellites that provide communications for the civilian government. The U.S., for example, transmits military communications and data over civilian satellite networks. In the 1991 Gulf War, commercial satellites carried about 25% of U.S. military communications, a figure that rose to 85% in the 2003 invasion of Iraq.[297] Other nations similarly rely on commercial space services, such as communications, weather, and remote sensing, provided by companies located in Canada, France, India, Israel, and Russia.[298] Attacking these targets would not pose difficulties under the laws of war. Military use of civilian systems renders them liable to attack.[299]

A harder question arises over whether nations can use force against civilian space systems that may have no military function. It may be difficult, if not impossible, to classify certain satellites as purely military or purely civilian. Nations can go onto the commercial market and purchase surveillance or communications data from civilian providers.[300] But suppose the U.S. engaged an opponent with satellites that perform a primarily civilian function, but could also provide support for the military. China, for example, is deploying its own version of the U.S. GPS and already has deployed weather satellites.[301] While these satellites could provide locational services for a host of civilian uses, they also could help China locate U.S. carrier battle groups in East Asian waters or direct attack aircraft and missiles. The dual-use character of these satellites renders them legitimate targets, particularly in a contest between military powers with the capability to conduct information-enhanced operations. Once the conflict passes, nations could restore the full functioning of their satellite systems. Warfare need not aim to permanently destroy space assets; it need only deny access for the period of the conflict.

B. Space Weapons and Interstate Bargaining

Leading scholars, however, criticize such scenarios out of fear that space weapons would encourage conflict. Johnson-Freeze, for example, argues that the Bush Administration's development of ABM and ASAT systems threatened to

297. BOB PRESTON, PLOWSHARES AND POWER: THE MILITARY USE OF CIVIL SPACE 132 (1994), *cited by* Nina Tannenwald, *Law Versus Power on the High Frontier: The Case for a Rule-Based Regime for Outer Space*, 29 YALE J. INT'L L. 363, 383 (2004).

298. Nina Tannenwald, *Law Versus Power on the High Frontier: The Case for a Rule-Based Regime for Outer Space*, 29 YALE J. INT'L L. 363, 383 (2004).

299. *Id.* at 372.

300. During the 2003 Iraq War, for example, Baghdad could have purchased imaging services from corporations based in multiple countries. These providers would have allowed Iraq to substitute civilian products for its own lack of aerial or space reconnaissance of U.S. troop movements. In response, the U.S. could have chosen to disable any satellites capable of providing reconnaissance to the Iraqis of U.S. troop movements or could have jammed the ground station control over the satellites. A less destructive approach could demand that the corporations refuse to sell their services to Iraq in return for a payment.

301. *See* Paul B. Larsen, *International Regulation of Global Navigation Satellite Systems*, 80 J. AIR L. & COM. 365, 370 (2015).

spark an arms race.[302] Moltz praises the Obama Administration for encouraging multilateral space cooperation to forestall competition in space.[303] Such arguments mirror criticism of other new weapons technologies, such as robotic and cyber weapons. International officials and scholars fear that these new technologies will reduce the costs of war and hence encourage its use in international politics. Philip Alston, a United Nations special human rights expert, argues against drones because "they make it easier to kill without risk to a State's forces."[304] Scholars call on nations instead to live up to the OST's declaration of "the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes."[305]

But nations are unlikely to agree to treaties to limit these technologies until they are more certain of their impact on war and the balance of power.[306] Moreover, these new methods of warfare may serve wider humanitarian concerns that are more significant than the legality of killing off-battlefield terrorists. If space weapons can strike with more precision, they will reduce death and destruction among both combatants and civilians. If a nation uses space weapons to disrupt the financial or transportation networks of their rivals, it will advance its ability to coerce the enemy with far less bloodshed and far less risk. Nations will see little virtue in the alternative of restricting themselves to conventional warfare that endangers the lives of more of their own troops.

Space weapons could reduce the overall human cost of war, while a ban could have the opposite effect. Anti-satellite weapons do not directly kill anyone, because the targets themselves have no human crews. Anti-ballistic missile systems have the same feature because they destroy unmanned ICBMs. The operators of both sit at a remove of hundreds if not thousands of miles away.[307] Precision ASAT or ABM weapons will also reduce civilian and collateral harm by restricting combat to uninhabited space.[308] The effect of a ban on space weapons does not happen in a vacuum; if nations still use force to pursue their goals, they will turn to more destructive and less precise alternatives, with the result that armed conflict will become more harmful.

Space weapons could play an even more significant systemic role in international relations than simply reducing the destructiveness of conflicts after they have begun. A rational bargaining approach to war suggests that such weapons could help nations settle their disputes without resort to wider armed conflict.

302. JOHNSON-FREESE, *supra* note 81, at 9–10.

303. *See* James Clay Moltz, *The Changing Dynamics of Twenty-First-Century Space Power*, STRATEGIC STUDIES QUARTERLY, Spring 2019, at 74.

304. Philip Alston (Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions), *Study on Targeted Killings*, GAOR, Rep. of the Human Rights Council on Its Fourteenth Session, at 24, U.N. Doc. A/HRC/14/24/ADD.6 (May 28, 2010), http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.Add6.pdf.

305. *United Nations Treaties and Principles on Outer Space*, U.N. DOCS ST/SPACE/11 (Oct. 2002).

306. *See* RABKIN & YOO, *supra* note 12, at 57–62.

307. THE CENTER FOR ARMS CONTROL AND NON-PROLIFERATION, *Fact Sheet: Ballistic vs. Cruise Missiles*, https://armscontrolcenter.org/wp-content/uploads/2017/04/Ballistic-vs.-Cruise-Missiles-Fact-Sheet.pdf (last visited Nov. 30, 2019).

308. *See* RABKIN & YOO, *supra* note 12, at 213.

We can illustrate with the model developed by Robert Powell and James Fearon to explain why rational nations still engage in costly conflicts, which some legal scholars have used to analyze the laws of war.[309] Rational states will seek to defend their security against competitors or gain new resources near their territories. They will seek to reduce harms to their populations from pollution, drugs, terrorism, or disease. Disputes will arise when nations collide in pursuing these rational self-interests. Two nations may both want the same territory or resources, or one might want to engage in economic activity that causes harms in another.

Rational states should choose a negotiated settlement over armed conflict to resolve their disputes. Both sides would be better off by agreeing to a settlement and avoiding the deadweight costs of war. A rational peace settlement should mirror the balance of forces between the two nations. Suppose Nation A is locked in a dispute with Nation B, and that Nation A has the stronger military. If Nation A threatens to use force, Nation B must decide whether to withdraw or resist. A war will give either Nation A or Nation B control of the disputed resource or territory, but the outcome is uncertain.

Both nations have an expected value of going to war. That value is the expected benefit of a conflict (a function of the probability that it will prevail in any conflict times the value of controlling the territory) minus the expected cost of fighting.[310] A more powerful nation, therefore, will have a higher expected value of going to war, because its probability of winning is greater (and hence its expected benefit is greater). If Nation A's expected value of winning is higher than its expected costs, it should go to war. But Nation B will have a lower expected value, because its probability of winning will be the inverse of Nation A's probability.[311] Nation B should withdraw because Nation B would likely lose a conflict and also suffer the costs of fighting.

If perfect information exists, both nations should agree to a settlement rather than reach the same result through conflict. An agreement will result in the same outcome, but both Nation A and Nation B will avoid the deadweight costs of fighting. Both nations are better off, because the agreement will mirror the likely outcome of the armed conflict (Nation A win), without the harms of war.[312]

But several obstacles can prevent this peaceful settlement. While nations may act irrationally or hold idiosyncratic values, the main point here is rational nations might still go to war. Asymmetric information can prevent nations from accurately estimating important variables. Nation A, for example, will know the

309. *See* James D. Fearon, *Rationalist Explanations for War*, 49 INT'L ORG. 379, 379–80 (1995); Robert Powell, *Bargaining in the Shadow of Power*, 15 GAMES & ECON. BEHAV. 255 (1996); Robert Powell, *War as a Commitment Problem*, 60 INT'L ORG. 169 (2006); Robert Powell, *The Inefficient Use of Power: Costly Conflict with Complete Information*, 98 AM. POL. SCI. REV. 231 (2004). For applications to the legal context, see Nzelibe & Yoo, *supra* note 13, at 2528; Yoo, *supra* note 13, at 489.

310. Yoo, *supra* note 13, at 491. This is similar to Learned Hand's formula for tort liability. *See* United States v. Carroll Towing Co., 159 F.2d 169, 173 (2d Cir. 1947).

311. Nation A's and Nation B's probability of winning must add up to 100%. In our hypothetical, if nation A enjoys a 70% probability of prevailing in an armed conflict, nation B must have a 30% chance.

312. Yoo, *supra* note 13, at 491.

value it places on disputed territory. It will also know its own military capabilities and political resolve. But it will have imperfect information about Nation B's military strength and political will. Without this knowledge, leaders cannot accurately measure the other side's probability of winning and the expected benefits and costs from conflict. Getting these variables wrong could prevent the parties from negotiating a settlement and instead going to war.[313]

Both nations could solve this problem by credibly revealing their military capabilities and political support. Bluffing, however, undermines the ability of nations to communicate credible information. If Nation A, for example, successfully exaggerates its military resources, it can trick Nation B into underestimating the latter's probability of winning a conflict. Bluffing allows Nation A to seize a greater share of the benefits of a peace agreement. Nations have a strong incentive to bluff to win a better outcome than they should receive, but they—and the international system as a whole—would benefit over the longer term if there were a way for all nations to credibly communicate information. A similar problem besets litigation. Litigants will encounter uncertainty about the facts and law of a case, which will create an obstacle to a settlement. The domestic legal system solves this problem with discovery, which ensures that parties share truthful information about the facts, under threat of judicial sanction.[314] Because of the lack of a supranational government with coercive enforcement powers, nations do not have available a legal procedure equivalent to discovery.

Some international relations scholars believe that costly signaling can provide an alternate means to credibly communicate information. Diplomatic threats or political demands do not send much information because they cost little. Coercive measures short of war, however, can reveal the military capabilities and political resolve that determine the odds of winning. A nation not only might issue a demand but also deploy heavily armed troops to a disputed border. Dispatching military forces sends a costly signal because it uses resources, places units at risk, and threatens a spiral of escalation. The more expensive the signal, the more credible the information. Escalating threats of force can send progressively more costly signals because more deployments consume even more resources that a state would be less likely to waste if it were bluffing.

"Audience costs" provide another means of communicating information credibly.[315] Audience costs refer to the political costs incurred by political leaders who make a threat of force and then fail to carry it out.[316] Such moves will have more credibility because the leaders risk political losses at home by sending

313. *Id*. at 492.

314. *See, e.g.*, Robert D. Cooter & Daniel L. Rubinfeld, *An Economic Model of Legal Discovery*, 23 J. LEGAL STUD. 435, 449–50 (1994); Robert D. Cooter & Daniel L. Rubinfeld, *Economic Analysis of Legal Disputes and Their Resolution*, 27 J. ECON. LITERATURE 1067, 1075, 1078 (1989).

315. John Yoo, *Rational Treaties: Article II, Congressional-Executive Agreements, and International Bargaining*, 97 CORNELL L. REV. 1, 28 (2011).

316. James D. Fearon, *Domestic Political Audiences and the Escalation of International Disputes*, 888 AM. POL. SCI. REV. 577, 579–80 (1994); James D. Fearon, *Signaling Foreign Policy Interests: Tying Hands Versus Sinking Costs*, 41 J. CONFLICT RESOL. 68, 69 (1997); Kenneth A. Schultz, *Do Democratic Institutions Constrain or Inform?: Contrasting Two Institutional Perspectives on Democracy and War*, 53 INT'L ORG. 233, 236 (1999).

it. Leaders, for example, can make threats of war and send military forces into a disputed area. But if they back down, their domestic political standing will suffer. Theorists argue that audience costs encourage democratic leaders to be more selective in choosing wars and more committed to avoiding defeat.[317]

Beyond the challenge of imperfect information, commitment problems may pose an even greater obstacle to peaceful dispute settlement. Nations may prove reluctant to reach an agreement because they cannot compel compliance. In an anarchic international system defined by weak institutions, however, nations cannot depend on a supranational body to compel compliance to a settlement.[318] These problems become even more acute in disputes over territory or resources. A change in possession of the resource could itself shift the balance of power underlying a settlement by giving one side an advantage for future conflicts through an improved strategic position or greater resources.[319] If Nation A were to cede population or territory in a peace settlement, for example, it might fear that a strengthened Nation B would renege and seek an even better deal. It might decline to make such a deal in the first place.

Space weapons could help nations overcome some of these problems. Most importantly, they can improve signaling between nations and increase the prospects of a peaceful settlement. Space weapons could inflict varying levels of harm in between economic, nonviolent measures and those that put lives at risk. Nations, for example, can use ASAT weapons to temporarily disable an opponent's communications or surveillance networks without loss of life. They could even destroy satellites outright or use space-based weapons to strike ground targets. Nations could also use space weapons defensively to send signals. They could deploy an anti-missile shield to defend against ICBM or other forms of long-range attack. Space weapons give nations the ability to send more credible signals by providing more discrete levels of force against a broader range of targets.

Banning or limiting space weapons would have the opposite effect. It would narrow the range of targets. This could force nations to use blunter methods to send signals that pose a greater risk of damage and death. Rather than disable an opponent's communications satellites, for example, a nation might have to destroy manned command and control facilities on the ground. Instead of deploying an ABM system, a nation might consider a preventive attack on an enemy's ICBM launch sites. Reducing the types of targets and limiting the means to attack them increases the odds of war by giving nations fewer options to reveal private information about capability and resolve. The more steps up an escalatory ladder, on the other hand, the more opportunity to jump off before reaching a full-blown war.

317. Bruce Bueno de Mesquita et al., *An Institutional Explanation of the Democratic Peace*, 93 AM. POL. SCI. REV. 791, 799–801 (1999).

318. For leading applications of realist principles to international law, see ANDREW T. GUZMAN, HOW INTERNATIONAL LAW WORKS: A RATIONAL CHOICE THEORY (2008); ERIC A POSNER & ALAN O. SYKES, ECONOMIC FOUNDATIONS OF INTERNATIONAL LAW 163–224 (2013).

319. Joseph M. Grieco, *Anarchy and the Limits of Cooperation: A Realist Critique of the Newest Liberal Institutionalism*, 42 INT'L ORG. 485, 487 (1988); Robert Powell, *Crisis Stability in the Nuclear Age*, 83 AM. POL. SCI. REV. 61, 70 (1989).

Conflicts can result because rivals have uncertain information about their opponents. The Cuban Missile Crisis, for example, could have resulted in direct war because the superpowers could not rely on information about each other's intentions.[320] The U.S. did not know whether the Soviet Union might launch its medium range nuclear missiles, while the U.S.S.R. did not know whether the United States might destroy the missile sites or even invade Cuba.[321] During the crisis, President John F. Kennedy even looked for guidance to Barbara Tuchman's *The Guns of August*, which claimed that the great powers had miscalculated their way to war.[322] Kennedy decided to gradually escalate the American response to the Soviet deployment of MRBMs in order to communicate U.S. resolve to force nuclear weapons out of Cuba, but also to give Moscow the opportunity to reach a peaceful settlement of their differences.[323] The United States sent armed aircraft over Cuban airspace, mobilized regular armed forces for an invasion, imposed a naval "quarantine" of Cuba, and raised the alert status of its nuclear forces.[324] Eventually the superpowers reached a deal: the U.S.S.R. withdrew its MRBMs from Cuba while the U.S. removed similar missiles from Turkey and, according to some, secretly pledged not to invade Cuba.[325]

Space weapons could provide the opportunity for an even greater menu of credible signals. Without space, great powers might have to signal credibly by choosing among air and missile strikes on manned targets, blockades, or ground assaults. With space, nations could choose less destructive steps such as attacking satellites networks, launching precision attacks against ground targets, deploying defensive ABM systems, or using satellites to enhance the precision and speed of ground operations. Less provocative measures could avoid a rapid escalation of hostilities. American leaders, for example, currently favor air strikes as a means of placing pressure on another government.[326] They could choose to target an enemy's space assets instead, which removes the element of combat deaths and reduces the scope of destruction. Even if leaders wish to attack ground targets, space weapons provide certain advantages. With air attack, U.S. doctrine first calls for neutralizing enemy anti-aircraft defenses and achieving air superiority. Air superiority is also seen as a necessary precondition for successful ground and naval operations.[327] Both tasks call for destroying manned missile and air bases and shooting down enemy manned aircraft. Space-based weapons, however, could allow strikes against enemy targets without risking pilots, and

320. The Cuban Missile Crisis is well described in GRAHAM ALLISON & PHILIP D. ZELIKOW, ESSENCE OF DECISION: EXPLAINING THE CUBAN MISSILE CRISIS (2d ed. 1999).

321. *Id.* at 78–129.

322. *E.g.*, RONALD CARPENTER, RHETORIC IN MARTIAL DELIBERATIONS AND DECISIONMAKING 85 (2004); ERNEST MAY & RICHARD NEUSTADT, THINKING IN TIME: THE USES OF HISTORY FOR DECISIONMAKERS 15 (1986).

323. CARPENTER, *supra* note 322, at 63–108.

324. *Id.* at 79–108.

325. *Id.* at 108.

326. Philip Alston (Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions), *Study on Targeted Killings*, U.N. Doc. A/HRC/14/24/Add.6, at 7 (May 28, 2010).

327. *Air Superiority 2030 Flight Plan*, U.S. AIR FORCE (May 2016), http://www.af.mil/Portals/1/documents/airpower/Air%20Superiority%202030%20Flight%20Plan.pdf.

therefore removing the need to destroy a nation's air defense system and manned aircraft.

Rational nations should peacefully settle their disputes and avoid the deadweight loss of war. A bargain will reflect their relative power positions, which create each side's expected values from a conflict. In order to reach a deal, they must reveal their military capabilities and political will, which requires them to send credible signals. More types of force, at varying levels of harm, provide nations with a greater spectrum of more finely tuned gradations of coercion. Attacks on space-based systems can provide ways for nations to use limited, coercive force against each other without causing the death and destruction of terrestrial combat. Space weapons provide nations with greater ability to reveal reliable information about their abilities and intentions, and thus create more room for negotiation.

V. SPACE WEAPONS AND INTERNATIONAL STABILITY

This Part will address benefits to the international system that might arise from adopting a nonregulatory approach to space weapons. Arms control advocates commonly portray space weapons as threatening an arms race that would destabilize the balance of power among nations.[328] The benefits of a ban on space weapons, therefore, would outweigh any gains from signaling outlined in the last Section. This Part responds by discussing the benefits to international stability that could arise on the other side of the ledger. Section A describes how space weapons might reduce the obstacles to the provision of the public good of international security, while Section B addresses the changes in the laws of war that would make space weapons more effective. Section C argues that deterrence provides a more accurate model for understanding the impact of space weapons on the strategic balance, and if properly deployed they could further buttress stability, rather than undermine it.

A. Public Goods and Space Weapons

Space weapons can provide capabilities to help secure international stability on a larger scale. They can be used to help prevent humanitarian crises similar to the Rwandan genocide or allow states safer methods of preemptive action to stop aggressors. Just as a strict application of current international law principles can hinder the ability of nations to resolve individual disputes, a ban on space weapons could have the same effect on efforts to stabilize the international system.

Space weapons could allow nations to undertake wars that they should fight, but otherwise might not because of the costs. As John Stuart Mill said, "War is an ugly thing, but not the ugliest of things."[329] Going to war first can prevent greater harms to the U.S., a region, or the world. If Great Britain and France had invaded Germany in 1939 after Hitler's attack on Poland, they might

328. Koplow, *supra* note 276, at 23.

329. JOHN STUART MILL, THE CONTEST FOR AMERICA 31 (1862).

have spared Western Europe from World War II. Israel's 1981 strike on Iraq's Osirak nuclear reactor and its 2007 bombing of a Syrian nuclear facility also met this test—imagine if the regimes of Saddam Hussein or Bashar Assad had successfully acquired the atomic bomb.[330] A nation should have the right to launch a preemptive attack to stop greater aggression.

Space weapons could provide nations with the means to intervene earlier, at lower cost, and with greater precision against looming threats. Such weapons, for example, could allow nations to launch preventive strikes against hardened targets where the odds of high casualties might otherwise deter an operation. Suppose Israel and the United States decided against a strike on Iran's nuclear research facilities because of Tehran's anti-aircraft capabilities and the chances of high civilian casualties. Israeli and American leaders, however, might launch an attack by advanced space weapons because of the zero chance of pilot losses, the higher likelihood of eliminating the facilities, and lower chances of civilian casualties. Destroying Iran's nuclear program today might avoid much worse consequences in the future, such as a wide-scale U.S. attack, including the suppression of air defenses, achieving air superiority, or even ground assault, to destroy Iran's nuclear weapons and production facilities.

Space weapons might also provide the means to engage in uses of force that increase overall global welfare. States have used force for goals that benefit the world as well as themselves. In the nineteenth century, for example, the British Navy ended the Atlantic slave trade and protected free navigation and commerce on the high seas.[331] The United States used its naval and air superiority in the twentieth century to similar effect. Both countries did not act out of pure altruism, but their national interests also benefited the world. If space weapons can lower the costs for the use of force, it could allow nations to more easily maintain today's liberal international system.

Public goods theory predicts that free-riding will discourage nations from undertaking expensive actions to maintain international order. The great powers will undersupply goods such as freedom of the seas or fighting terrorism because all nations receive the benefits, but only the nations that intervene pay the costs.[332] Compare the need for international security with that of domestic security. The market cannot provide national defense because it is nonrivalrous (one person's consumption does not reduce that of another) and nonexclusive (the government cannot prevent those who do not pay from consuming the good). Because of this market failure, the state must provide national defense and must impose a mandatory tax to pay for it. Unlike domestic society, however, the international system has no government to provide security and no power to tax

330. On Syria, see Leonard S. Spector & Avner Cohen, *Israel's Airstrike on Syria's Reactor: Implications for the Nonproliferation Regime*, ARMS CONTROL TODAY, https://www.armscontrol.org/act/2008-08/features/israel's-airstrike-syria's-reactor-implications-nonproliferation-regime (last visited Nov. 30, 2019).

331. *See* Chaim D. Kaufmann & Robert A. Pape, *Explaining Costly International Moral Action: Britain's Sixty-Year Campaign Against the Atlantic Slave Trade*, 53 INT'L ORG. 631, 659 (1999).

332. YOO, *supra* note 166, at 117–28.

free-riders to pay for it. Instead, nations might supply security as a positive externality when they pursue their security interests, but this will be rare because it will only capture part of the benefits.

Such measures may become more important because current challenges to international stability no longer arise solely from interstate armed conflicts. Although nation-states continued to engage in armed conflicts in the post-WWII period, they did so at lower rates than in past.[333] Nuclear weapons may have deterred another full-scale European or Asian conflict, or the U.S. and U.S.S.R. rivalry may have suppressed regional conflict between lesser powers. Even when the great powers fought, they commonly contended with weaker nations that engaged in asymmetric, guerrilla warfare.[334] Instead, wars have become increasingly internal. The second half of the twentieth century witnessed more civil wars between a government and rebels or between multiple groups contesting for power.[335] Casualty figures reflect the changing nature of war. Since 1945, battle deaths from interstate wars have fallen by an entire order of magnitude compared to any century since the end of the Thirty Years War.[336] Unfortunately, deaths from internal civil wars have skyrocketed. Of the approximately 40 million deaths from war between 1945–2000, about 80% came from internal armed conflicts.[337]

Rather than wars between the great powers, the post-Cold War period has ushered in a rise of internal conflicts, or between the great powers and smaller, authoritarian nations, which have prompted insurgencies and guerrilla fighting.[338] Insurgencies are more widespread, can persist for years, if not decades, and their success may not depend on the capture of territory and population.[339] The average length of today's civil wars, for example, runs about sixteen years, and at their highpoint in the mid-1990s there were forty-four ongoing civil wars affecting an amazing one-quarter of all nations in the world.[340] Guerrillas often do not wear uniforms or operate in conventional armed units on a discrete battlefield. Instead, they conceal themselves within the civilian population to make it more difficult to detect and attack them. Their methods may include launching attacks from civilian locations, such as residential complexes, schools, hospitals, and even places of worship.[341] They may use unconventional weapons,

333. *Id.* at 193.

334. *Id.* at 40–41.

335. James D. Fearon, *Why Do Some Civil Wars Last Longer than Others?*, 41 J. PEACE RES. 275, 275 (2004).

336. Jeremy Rabkin & John Yoo, *A Return to Coercion: International Law and New Weapon Technologies*, 42 HOFSTRA L. REV. 1187, 1215 (2014).

337. James D. Fearon & David Laitin, *Ethnicity, Insurgency, and Civil War*, 97 AM. POL. SCI. REV. 75, 75 (2003); YOO, *supra* note 166, at 32.

338. Fearon & Laitin, *supra* note 337, at 77, 79.

339. Fearon, *supra* note 335, at 283–84.

340. *Id.*; *see also* Fearon & Laitin, *supra* note 337, at 88.

341. *The 2014 Gaza Conflict: Factual and Legal Aspects*, ST. ISR. 73–100 (May 2015), https://mfa.gov.il/ProtectiveEdge/Documents/2014GazaConflictFullReport.pdf.

such as improvised explosive devices disguised in civilian locations, or convert civilian transport, such as trucks, as weapons.[342]

Terrorist groups similarly inflict persistent violence, for political objectives, that do not fit the category of conventional interstate war. Al Qaeda carried out the September 11, 2001 attacks by hijacking airliners, with operatives disguised as civilians, and crashing them into civilian and military targets in New York and Washington.[343] But most al Qaeda attacks have fallen to a level below its most notorious attack—its agents have bombed a bus in London, a nightclub in Bali, and a train in Spain—in terms of violence and casualties.[344] When confronted in conventional warfare on the Afghanistan battlefields, al Qaeda transformed into an insurgency based along the mountainous Afghan-Pakistan border.[345] ISIS, originally an al Qaeda offshoot, conducted an insurgency against the Iraqi government not much different than other internal armed conflicts.[346] But once the Syrian civil war created a power vacuum in the region, ISIS began to mimic a state in its control of territory and population and its provision of basic services such as water and energy.[347] As it has suffered battlefield defeats, however, ISIS has renewed unconventional attacks on London, Paris, Brussels, San Bernardino, and Nice through a loose network of affiliated terrorists.

These new conflicts show that the dividing line between war and peace, if there ever was one, has blurred. The rise of civil wars, insurgencies, and terrorism underscore that formal "war" represents an arbitrary point on a continuous spectrum of conflict. Terrorists and rebels aim to use force at lower levels on the spectrum than nation-states, and they do not restrict their attacks to military and political targets. Nonetheless, they use violence to achieve the same objectives as war, that of coercing their opponents for political reasons. Nations handcuff themselves when they refuse to match these lower levels of force with military force. Critics of responding in these ways raise the legal question whether an attack meets the standard of "an armed attack" under Article 51 of the U.N. Charter.[348] Without such an armed attack, the argument goes, the U.N. Charter does not recognize any national right to use force in self-defense. But regardless of whether small-scale attacks trigger the right to self-defense, nations in practice have responded with force at lower levels of intensity.

342. After its 2014 operation in the Gaza Strip, for example, Israel published persuasive photographic evidence of such uses of civilian locations and activities by the Hamas group. *Id.*

343. John Yoo, *The Legality of the National Security Agency's Bulk Data Surveillance Programs*, 37 HARV. J. L. & PUB. POL'Y 901, 902 (2014).

344. *TIMELINE – Major Attacks by Al Qaeda*, REUTERS (May 2, 2011, 7:14 AM), https://www.reuters.com/article/idINIndia-56711920110502.

345. *The U.S. War in Afghanistan: 1999-2019*, COUNCIL ON FOREIGN REL., https://www.cfr.org/timeline/us-war-afghanistan (last visited Nov. 30, 2019).

346. Megan Specia, *The Evolution of ISIS: From Rogue State to Stateless Ideology*, N.Y. TIMES (Mar. 20, 2019), https://www.nytimes.com/2019/03/20/world/middleeast/isis-history-facts-islamic-state.html.

347. *See Islamic State and the Crisis in Iraq and Syria in Maps*, BBC (Jan. 20, 2017), http://www.bbc.com/news/world-middle-east-27838034.

348. Alston, *supra* note 326, at 13.

Space weapons could help reduce the obstacles to such global welfare-enhancing measures. Strikes using space weapons or space-enhanced ground operations could lower the costs of a use of force for the great powers, and thus reduce the disincentives against intervention that could provide self-defense, preempt aggression, end a humanitarian disaster, or stop a terrorist group. In the case of the Rwandan genocide, for example, western leaders feared the casualties arising from any humanitarian intervention.[349] But if the United States and its allies could have used space-based weapons—alone or together with other high-technology systems such as drones—it could have inflicted costs on the Hutu government with greater precision and less risk of casualties. The lower cost of coercion would increase the chances that western nations would intervene in troubled areas, where the worst civilian casualties are now occurring.[350]

Understanding war as coercion identifies a positive role for new weapons. Coercion includes not just economic embargoes and blockades, but also recent uses of force such as the U.S. threat to bomb Syria for its use of chemical weapons or earlier attacks on Saddam Hussein's regime in the 1990s.[351] An older view of international law and politics had acknowledged a much wider range of occasions for the use of force and a wider range of legitimate targets than permitted by strict approaches to the U.N. Charter, which many scholars believe prohibits most uses of force except in self-defense or by Security Council authorization.[352] But if the international system benefits when great powers coerce other nations to stop actions that harm global welfare, we should seek to provide a place for space weapons that offer greater precision with less destruction in the use of force.

B. Reconceiving the Laws of War

While space weapons could reduce the overall harm of conflict, they would also require changes to the laws of war. The principle of distinction, for example, forbids combatants from intentionally attacking civilians or civilian assets.[353] But suppose one country could use space weapons to disable civilian infrastructure as a way to pressure another country to accept its demands. In the past, the chance of error of artillery, missiles, and gravity bombs would make it difficult, if not impossible, to hit nonmilitary, yet sensitive, targets without unintentionally killing nearby civilians or destroying civilian property. Destroying or disabling a

349. According to U.N. estimates, Western nations could have stopped the killing of about 1 million Rwandans with a deployment of about 10,000 troops. *See generally*, James Bennet, *Clinton in Africa: The Overview; Clinton Declares U.S., with World, Failed Rwandans*, N.Y. TIMES (Mar. 26, 1998), http://www.nytimes.com/1998/03/26/world/clinton-in-africa-the-overview-clinton-declares-us-with-world-failed-rwandans.html.

350. *See* YOO, *supra* note 166, at 161–78.

351. Rabkin & Yoo, *supra* note 336, at 1187, 1195.

352. *Id.* at 1196.

353. *See e.g.*, Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) art. 48, 51(2), 52(2), (June 8, 1977), 1125 U.N.T.S. 3., https://www.refworld.org/docid/3ae6b36b4.html.

satellite instead could interfere with a nation's communications or financial systems, with far less likelihood of loss of life. We should prefer this result over a strict application of the rule of discrimination that would require an attack on military or dual use facilities even if it causes more serious death and destruction.

In practice, nations at war have already broadened the acceptable scope of targets to include assets and networks that are primarily civilian. During the 1990s, for example, the United States and its allies carried out air attacks to coerce Iraq.[354] Allied air forces attacked not only Iraqi military bases, but also buildings in downtown Baghdad that housed political, intelligence, and military leaders.[355] There was little connection between destroying Iraqi military assets and buildings and enforcing Iraqi obligations to cooperate with WMD inspections, as required by the armistice that suspended the Persian Gulf War.[356] Legal commentators criticized these exercises for falling outside the definition of self-defense in the U.N. Charter.[357] During the Kosovo War, the United States and its NATO allies launched an air war to stop Serbia's threat to drive ethnic Albanians out of Kosovo.[358] NATO expanded its target sets beyond military forces to electric power stations, highways, bridges, and television broadcasting towers.[359] Again, the purpose of the attacks seemed clearly coercive. The United States and its NATO allies did not claim self-defense, nor did the United Nations Security Council provide authorization.[360]

Military lawyers have struggled to justify the attacks on civilian targets. They claim that transportation, communication, and power networks served both military and political functions as well as civilian.[361] Allied air forces used similar logic to justify attacks on industrial and agricultural facilities during World War II.[362] Under this reasoning, however, almost any civilian resource could qualify as a target, especially because the laws of war demand no minimum military use of a facility to justify an attack. Instead, nations should honestly admit that their militaries are employing force against civilian targets to pressure their enemies. During the Kosovo War, allied commanders fully understood that their strikes sought to coerce Serbia into a political settlement, rather than to destroy

354. The United Nations Security Council set out the terms of the cease fire in U.N. Security Council Resolution 687, S.C. Res. 687 (Apr. 3, 1991). On December 16, 1998, the United States and the United Kingdom responded to Iraq's suspension of cooperation with international inspectors with a seventy-hour bombardment of Iraq. *See* John Yoo, *International Law and the War in Iraq*, 97 AM. J. INT'L L. 563, 564–65 (2003).

355. Sean M. Condron, *Justification for Unilateral Action in Response to the Iraqi Threat: A Critical Analysis of Operation Desert Fox*, 161 MIL. L. REV. 115, 148–49 (1999).

356. *Operation Desert Fox*, DEP'T OF DEF., https://archive.defense.gov/specials/desert_fox/ (last visited Nov. 30, 2019).

357. Rabkin & Yoo, *supra* note 336 at 1196.

358. *See id.*

359. *See* Marc Weller, *Forcible Humanitarian Action: The Case of Kosovo*, *in* REDEFINING SOVEREIGNTY: THE USE OF FORCE AFTER THE COLD WAR 277, 300 (Michael Bothe et al. eds., 2005).

360. *See* John C. Yoo, *Kosovo, War Powers and the Multilateral Future*, 148 U. PA. L. REV. 1673, 1726 (2000).

361. For a leading effort, see W. Hays Parks, *Air War and the Law of War*, 32 A.F. L. REV. 1, 152–68 (1990).

362. *Id.* at 50–54.

discrete military targets.[363] U.S. General Michael Short, who commanded U.S. Air Forces at the start of the air war, acknowledged that the ultimate target was civilian morale:

> I felt that on the first night, the power should have gone off, and major bridges around Belgrade should have gone into the Danube, and the water should be cut off so that the next morning the leading citizens of Belgrade would have got up and asked, 'Why are we doing this?' and asked [Serb President] Milosevic the same question.[364]

Used in this way, space weapons could advance the larger goals of the laws of war without incurring the negative effects of attacks on civilians, manufacturing, and infrastructure. Space based weapons, for example, could temporarily disable power plants, electrical transmission facilities, or economically sensitive locations to pressure the population to withdraw support from a regime. Or they could destroy nodes, such as airport runways, railroad tracks, or highway intersections, to create transportation logjams. In the war against ISIS in Iraq and Syria, the United States and its allies attacked oil production and banks to undermine the terrorist group's financial infrastructure.[365] We should prefer such attacks to more direct strikes on military targets, if the latter involve a greater loss of life and destruction.

Space weapons also urge a different approach to the other standards governing the use of force: proportionality and necessity. As defined by the U.S. Department of Defense, proportionality requires that combatants weigh "the expected loss of life or injury to civilians, and damage to civilian objects incidental to the attack," against "the concrete and direct military advantage expected to be gained."[366] While proportionality forbids the intentional targeting of civilians, it does not prohibit civilian losses as a collateral effect of an attack on a military target.

While calling for a balancing of costs and benefits, proportionality is difficult. Military commanders must measure the value of a "military advantage," which includes not just territorial gains and inflicting losses on the enemy, but also larger strategic benefits, such as degrading command, control, communications, and transportation networks, preventing economic and political support from reaching the enemy's military, and pressuring the enemy leadership to surrender. Judgment of advantage would encompass not only the dollar value of

363. Rabkin & Yoo, *supra* note 336, at 1196–97.

364. Craig R. Whitney, *Air Wars Won't Stay Risk Free, General Says*, N.Y. TIMES, June 18, 1999, at A22. Two years later, Short insisted that each air strike was "targeting a valid military target," while morale effects were "a peripheral result"—without denying his awareness that air strikes could "make the Serb population unhappy with their senior leadership because they allowed this to happen." Michael Short, *Operation Allied Force from the Perspective of the NATO Air Commander*, 78 INT'L L. STUD. 19, 29 (2003).

365. Eric Schmitt, *U.S. Says Its Strikes Are Hitting More Significant ISIS Targets*, N.Y. TIMES (May 25, 2016), https://www.nytimes.com/2016/05/26/us/politics/us-strikes-isis-targets.html.

366. U.S. DEP'T OF DEF., LAW OF WAR MANUAL 195 (2015) [hereinafter LAW OF WAR MANUAL]. Although additional Protocol I of the Geneva Conventions attempts to subsume proportionality into a more general analysis of "distinction," leading powers such as the United Kingdom and the United States still apply the customary rule. *See, e.g.*, *id.* at 241-58; *see also* WILLIAM H. BOOTHBY, THE LAW OF TARGETING 94–97 (2012).

enemy resources destroyed, but also difficult measurements of tactical and strategic benefits. In its report on the 1991 Persian Gulf War, for example, the United States declared "balancing may be done on a target-by-target basis, as frequently was the case during Operation Desert Storm, but also may be weighed in overall terms against campaign objectives."[367] In the midst of battlefield conditions, commanders must then measure harm to civilians. While this might be possible with regard to physical assets, such as infrastructure, it would also require them to decide on the value of human life.[368]

Commentators admit that no predictable legal rules provide certainty. William Boothby, author of a leading work on the law of military targeting, relies on the idea that most "reasonable military commanders" would agree on most cases. At the same time, he admits that there is no "mathematical formula; there are no hard and fast rules and there is an inevitable element of subjectivity in the judgements associated with the rule."[369] In its 2015 Law of War Manual, the U.S. Defense Department admits that proportionality "does not necessarily lend itself to empirical analyses" and that instead it calls for "a highly open-ended legal inquiry, and the answer may be subjective and imprecise."[370] Proportionality forces nations to make ever more tenuous claims of military use of civilian infrastructure. Strikes on roads and highways become attacks on transportation routes used by the military. Civilian communication networks become part of an enemy's command and control systems. Factories that produce dual-use goods become legitimate targets.[371]

Understanding war as coercion simplifies proportionality. Rather than ask whether civilian casualties are excessive in relation to the military advantages, the law should simply ask whether all the consequences of an attack (military and civilian) justify the use of force. Some commentators have observed that standard understandings of proportionality lack an objective measure because of the dissimilar variables involved.[372] Law of war expert and former U.S. Defense Department official Hays Parks has even argued that proportionality has no content other than to establish that commanders are not intentionally targeting civilians without any military benefit.[373] Proportionality should simply ask whether

367. U.S. DEP'T OF DEF., FINAL REPORT TO CONGRESS: CONDUCT OF THE PERSIAN GULF WAR 611 (1992) [hereinafter FINAL REPORT TO CONGRESS].

368. As difficult a task this is in the context of domestic regulation, see Eric A. Posner & Cass R. Sunstein, *Dollars and Death*, 72 U. CHI. L. REV. 537, 537–38 (2005). It seems even more unworkable to ask commanders to set a price for an enemy civilian life and then balance it against military gains. *But see* MICHAEL NEWTON & LARRY MAY, PROPORTIONALITY IN INTERNATIONAL LAW 112–13 (2014).

369. Boothby, *supra* note 366, at 96–97.

370. LAW OF WAR MANUAL, *supra* note 366, at 245. As even the report of the ICTY Prosecutor observed in its review of the NATO bombing campaign in Kosovo: "One cannot easily assess the value of innocent human lives as opposed to capturing a particular military objective." *Id.* at 245 n.317.

371. For an example, see *id.* at 245 n.319.

372. *See, e.g.*, Stefan Oeter, *Methods and Means of Combat*, *in* THE HANDBOOK OF HUMANITARIAN LAW IN ARMED CONFLICT 105, 178–79 (Dieter Fleck ed., 1995); Aaron Xavier Fellmeth, *Questioning Civilian Immunity*, 43 TEX. INT'L L.J. 453, 489 (2008); Charles P. Trumbull IV, *Re-Thinking the Principle of Proportionality Outside of Hot Battlefields*, 55 VA. J. INT'L L. 521, 542 (2015).

373. Parks, *supra* note 361, at 174.

the costs of an attack significantly outweigh its benefits. Costs should include all military and civilian losses, while benefits should include all short-term and long-term benefits, such as tactical advantages in territory and positions gained, lives saved, and strategic progress toward winning the conflict.

Balancing overall costs and benefits of strikes should prove superior to current rules that justify collateral damage as proportional. Under the principle of "double effect," the dominant school of thought accepts harm to civilians, even if it is foreseeable, as long as it is not the intent of an attack.[374] Another theory would allow attacks on civilians who contribute to the war effort of a state conducting an unjust war.[375] Both justify civilian losses as unavoidable, though foreseeable, consequence of military attacks. But without a clear, measurable proportion required between military advantage and civilian harm, the current rule could produce more overall harm.

Under this Article's reformulated concepts of discrimination and proportionality, the precision of space weapons opens up a wider range of legitimate targets. These rules should make wars less destructive, and thus better approach the ultimate goals of the laws of war. For example, nations could use space-based weapons to quickly strike the critical nodes of an enemy's networks with small explosives. In their recent wars, the U.S. and its allies have destroyed roads, bridges, railways, and other transportation hubs.[376] Nations struggle to justify such attacks because the facilities involve some military use, or because they are adjacent to legitimate targets. Space-based or space-enhanced weapons could allow more precise and persistent attacks on these targets, but in ways that may not produce their permanent destruction. ASAT weapons, for example, could disable the communication, command, and control networks that manage an enemy's transportation networks. The laws of war as conventionally understood could well prohibit such attacks. But the laws should allow attacks on such targets if their destruction can bring the end of a dispute closer at a lower cost, without regard to which elements of that lower cost are filed in the military versus civilian accounting boxes.

Nations adopted such an approach with the most revolutionary military technology to emerge after World War II, one that became intertwined with the earliest space weapons: nuclear bombs.[377] During the Cold War, the superpowers aimed thousands of nuclear missiles at each other's major cities. Each warhead's destructive capacity guaranteed that an attack not only would have destroyed any

374. *See* Gabriella Blum, *The Laws of War and the "Lesser Evil"*, 35 YALE J. INT'L L. 1, 40 (2010).

375. JEFF MCMAHAN, KILLING IN WAR 219 (2009).

376. In the Gulf War, for example, the United States and its allies destroyed airport runways using cluster munitions. While these airports may have primarily hosted civilian traffic, U.S. generals argued that they could also serve military flights. Christopher M. Centner, *Ignorance is Risk: The Big Lesson from Desert Storm Air Base Attacks*, VI AIRPOWER J., 25, 28 (1992). In the Kosovo War, the United States attacked a tractor factory in Serbia because it also engaged in "manufacturing support or parts for tanks and [armored personnel carriers] as well as for civilian vehicles . . . ." LAW OF WAR MANUAL, *supr*a note 366, at 242 n.307 (quoting Statement of Rear Admiral Thomas Wilson, U.S. Dep't of Def. News Briefing (Apr. 22, 1999) (on file with U.S. Department of Defense).

377. LAW OF WAR MANUAL, *supra* note 366, at 33 n.146.

military assets in these cities, but also would have killed millions of civilians.[378] During the 1970s, the United States deployed about 1,000 ICBMs, and today it still deploys about 450.[379] It also still maintains a fleet of 14 Ohio-class ballistic missile submarines, which can fire missiles that could deliver, in total, a total of 2,688 nuclear warheads each about 24 times more destructive than Hiroshima.[380] These weapons threaten the destruction not just of military targets, but of an enemy's civilian population. Deterring a nuclear attack, however, justified the development of such weapons, which even the International Court of Justice has refused to prohibit.[381]

Precision weapons from space presses proportionality from the other direction. Space-based weapons offer the ability to advance war aims through pinpoint, but minimally destructive, strikes on civilian targets. If commanders can cripple enemy networks by disabling satellites, they can pressure the enemy's leadership to compromise in a dispute. Rather than destroy an airport, ASATs could disable the radar and communications systems needed to manage its flights. Rather than destroy a manufacturing factory, space-based weapons could destroy the power lines or transportation links necessary for its operations. If the strikes produce less overall harm than more destructive attacks on military targets, they better pursue the goal of the laws of war to reduce the destruction of war.

The Persian Gulf War of 1990–1991 illustrates the types of targets that space weapons could reach more effectively.[382] In a 1992 report, the U.S. Defense Department disclosed that its air campaign sought to "isolate and incapacitate the Iraqi regime."[383] In order to achieve that goal, the coalition air force focused on critical target sets: the first was leadership facilities; second, electricity production; and third, telecommunications, command, control, and communication nodes.[384] All of these targets involved strikes against civilian sites because of their dual use for both military and civilian activities. Leadership command facilities included "national-level political and military headquarters and command posts," where Saddam Hussein and his aides might be located.[385] The coalition destroyed "virtually the entire Iraqi electric grid" because electricity to military locations could be rerouted through civilian facilities.[386] It also struck "microwave relay towers, telephone exchanges, switching rooms, fiber optic

378. The Nagasaki and Hiroshima bombs, for example, exploded with forces of about fifteen and twenty kilotons, which killed an estimated 39,000–80,000 and 70,000–146,000 civilians respectively. Today's Minuteman III, the mainstay of the U.S. land-based ICBM arsenal, carries three warheads of 300–500 kilotons each; earlier versions carried warheads of about one kiloton in destructive power. *E.g.*, *Minuteman III*, CTR. FOR STRATEGIC AND INT'L STUD., https://missilethreat.csis.org/missile/minuteman-iii/ (last updated June 15, 2018).

379. *Missile*, NUCLEAR THREAT INITIATIVE, https://www.nti.org/learn/countries/united-states/delivery-systems/ (last updated June 2015).

380. *United States Navy Fact File: Fleet Ballistic Missile Submarines–SSBN*, U.S. NAVY, http://www.navy.mil/navydata/fact_display.asp?cid=4100&tid=200&ct=4 (last updated Jan. 29, 2019).

381. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 679, at 254 (July 8).

382. *See* discussion *infra* Section V.B.

383. FINAL REPORT TO CONGRESS, *supra* note 367, at 150–51.

384. *Id.* at 148.

385. *Id.* at 96.

386. *Id.*

nodes, and bridges that carried coaxial communications cables" because military communications passed through major switching facilities in Baghdad.[387] Bombing included civilian television and radio facilities because they too could carry military communications and political propaganda.[388]

Attacking these systems may have degraded Iraqi military operations. But they also had the effect of pressuring the Iraqi population, and particularly the regime elite supporting Saddam Hussein, by escalating the costs of continuing to fight. Space weapons may achieve this effect at even lower human and physical cost. In order to successfully destroy these targets, the U.S. Air Force and its coalition partners flew thousands of sorties, dropped tons of bombs, and destroyed entire buildings and networks.[389] The coalition had to return to these targets repeatedly because the Iraqis could rebuild them.[390] While the coalition attempted to use precision guided munitions where possible to reduce collateral damage, these attacks risked civilian lives at these locations. Space weapons could provide the ability to incapacitate these civilian facilities at lower cost. They could strike critical components of an electrical or communication grid without permanently destroying the entire network. They could continue to strike these targets from space, with greater accuracy, and without the need to fly continuous sorties and the air superiority operations that accompany them. The less production and transmission facilities ruined, the less casualties will result. Such weapons could achieve military goals with lesser harm, if they could extend their reach to civilian infrastructure.

Space weapons could have a similar effect on the idea of necessity for the selection of targets. The U.S. Defense Department defines necessity as "the principle that justifies the use of all measure needed to defeat the enemy as quickly and efficiently as possible," except those prohibited by the laws of war.[391] Lieber codified necessity similarly: "Military necessity, as understood by modern civilized nations, consists in the necessity of those measures, which are indispensable for securing the ends of the war, and which are lawful according to the modern law and usages of war."[392] Necessity allows "destroying and seizing persons and property," in the words of the U.S. Law of War Manual, or "all destruction of life or limb of armed enemies" in Lieber's words.[393] Military necessity, according to contemporary military lawyers, does not justify violation of other laws of war, especially the principles of discrimination and proportionality.[394] While vague when applied to military targets, necessity attempts to impose clarity by cordoning off civilian targets.

387. *Id.*

388. *Id.* at 149.

389. *Id.*

390. *Id.* at 203–04.

391. LAW OF WAR MANUAL, *supra* note 366, at 52.

392. Francis Lieber, *Instructions for the Government of Armies of the United States in the Field* Art 14 (War Dept 1863) [hereinafter Lieber's Code].

393. U.S. LAW OF WAR MANUAL, *supra* note 366, at 52; Lieber's Code, *supra* note 392, art. 15.

394. *See* U.S. LAW OF WAR MANUAL, *supra* note 366, at 53–55.

Precision weapons, such as those provided by space, reveals this bright-line rule to be counter-productive. Nations already rely on necessity to justify the destruction of large segments of an opponent's armed forces, military equipment and assets, and civilian resources that support them.[395] Necessity allows nonlethal measures to coerce enemies to yield. In the past, nations have used sieges and blockades, for example, to place pressure on each other.[396] Now, space weapons could inflict more precise harms that do not permanently kill or destroy, much like economic embargoes, by temporarily disabling communication networks and GPS. Strikes with space-based weapons could destroy key ground targets more precisely, and thus with less harm.

Critics of this approach would charge that it crosses the bright line between military and civilian targets. But modern militaries have already blurred this line with attacks on civilian networks that support enemy war efforts.[397] In fact, the necessity standard already anticipates such a calculus. It requires commanders to choose the means "to defeat the enemy as quickly and efficiently as possible."[398] This explicit cost-benefit test demands that leaders use the least costly means to produce a benefit, which should reduce the overall harms of war. The military goal may not be total victory, or unconditional surrender, but more likely the coercion of an opponent to settle the dispute on favorable terms. In these cases, space-based attacks on civilian networks could achieve a military goal with far less loss of life and destruction than a direct attack on an enemy's armed forces.

Using space weapons in a manner similar to robotic or cyber weapons would recognize the changing reality of war in the new century. In the twentieth century, the emergence of total war had already begun to blur the line between belligerents and civilians. War began to be understood as a conflict between peoples, not just governments.[399] Civilians could aid the effort of nations to wage war for months, if not years, through economic production and social organization devoted to the "war effort."[400] Commanders can target civilians who not just take an active part in hostilities, as allowed by the customary rules of war, but

395. Operating under the Lieber Code, for example, General William T. Sherman conducted his infamous March to the Sea in 1864–1865, which destroyed the South's ability to conduct and support war. In World War II, the United States again relied on necessity in carrying out the strategic bombing of German and Japanese cities. On August 9, 1945, President Truman explained the bombing of Nagasaki and Hiroshima: "We have used [the atomic bomb] in order to shorten the agony of war, in order to save the lives of thousands and thousands of young American lives." Harry S. Truman, Radio Report to the American People on the Potsdam Conference (Aug. 9, 1945), *in* PUBLIC PAPERS OF THE PRESIDENTS OF THE UNITED STATES: HARRY S. TRUMAN 203, 212 (U.S. Government Printing Office, 1961). For a thorough treatment, see WILSON D. MISCAMBLE, THE MOST CONTROVERSIAL DECISION: TRUMAN, THE ATOMIC BOMBS, AND THE DEFEAT OF JAPAN (Donald Critchlow ed., 2011), which refutes the atomic diplomacy theory of GAR ALPEROVITZ, THE DECISION TO USE THE ATOMIC BOMB (Vintage Books 1995).

396. *See* U.S. LAW OF WAR MANUAL, *supra* note 366, at 312.

397. *See, e.g.*, FINAL REPORT TO CONGRESS, *supra* note 367, at 149.

398. U.S. LAW OF WAR MANUAL, *supra* note 366, at 51.

399. *See, e.g.*, GEOFFREY BEST, WAR AND LAW SINCE 1945 51 (Clarendon Press 1994).

400. *See id.*

also "those objects which by their nature, location, purpose or use make an effective contribution to military action."[401] Twenty-first century conflicts blur the line even further with combatants who disguise their attacks by operating from within civilian populations or engage in asymmetric fighting that does not rise to the level of conventional warfare.[402] Nations can adapt to these developments by deploying precision weapons, enhanced by space networks, to inflict harm on new kinds of opponents in new kinds of conflicts that do not fit old paradigms. While unanticipated consequences will flow from changing the rules of war in these directions, it cannot be worse than the current state of affairs in which unconventional enemies can kill civilians with impunity and advanced nations find themselves with few tools to respond.

Specialists in outer space law will resist these arguments. They commonly argue that nations should obey international humanitarian law in their military space activities.[403] Even though no international agreement expressly addresses space *jus in bello* rules, aside from the OST's WMD ban, these scholars argue that "undoubtedly customary international law and relevant general principles of law would apply to regulate such armed conflict."[404] They point to the ICJ's application of the principles of proportionality, distinction, and necessity to the question of nuclear weapons as an example, as well as the OST's demand that all space activities follow international law.[405] International institutions will "assimilate legal principles to fill apparent voids whenever encountered, especially in the context of armed force," because to propose a lawless frontier "goes against the progressive thrust and reasoning underpinning the historic trajectory of IHL."[406]

Such reasoning, however, assumes that modern IHL should apply to space. Manfred Lachs long ago argued that outer space is not a lawless area because once nations begin to interact, even in space, international law applies.[407] Accepting that international law applies to space, however, does not supply the substantive rules. Nations need not automatically extend laws designed for terrestrial combat. Space weapons do not raise as direct a conflict with the central goal of the laws of war: protecting innocent civilian life. Combat in space poses little risk of killing human beings because of the near total reliance on remote-controlled spacecraft and robots to carry out operations. Neither military nor civilian astronauts have established any significant presence in orbit. Nations can easily avoid civilian casualties entirely by keeping off limits the only quasi-permanent

401. U.S. DEP'T OF THE ARMY & U.S. MARINE CORPS., THE COMMANDER'S HANDBOOK ON THE LAW OF LAND WARFARE 2–29 (2019).

402. *See id.* at 2–8.

403. *See, e.g.*, Maogoto & Freeland, *From Star Wars to Space Wars—The Next Strategic Frontier: Paradigms to Anchor Space Security*, *supra* note 250; Maogoto & Freeland, *The Final Frontier: The Laws of Armed Conflict and Space Warfare*, *supra* note 250; Ramey, *supra* note 250; Stephens & Steer, *supra* note 250, at 83.

404. Stephens & Steer, *supra* note 250, at 82.

405. *Id.* at 10.

406. *Id.* at 81–82.

407. MANFRED LACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 14–15 (Sijthoff Leiden 1972).

establishment, the International Space Station, and the few spaceflights manned by astronauts. The absence of human beings makes space an even better arena for the use of force than the Earth, as the likelihood of the collateral death of civilians is virtually zero.

Military operations in space would threaten civilians not directly, but through interference with satellite systems that support activity on the ground. An attack that disabled the GPS, for example, would not directly kill any civilians in space. But it would cause damage on the ground by paralyzing transportation networks, such as the air traffic control system, shipping, or even individual drivers. Attacking communications satellites could inflict costs on a civilian economy by halting financial transactions, impeding voice and data communications, and slowing the speed of the internet.

Reading the laws of war to prohibit such attacks would impede the resolution of disputes at lower costs. In a dispute, nations will seek to inflict certain amounts of harm to coerce opponents. Space allows nations to do this without directly killing combatants or civilians. Attacks on space assets produce an effect similar to the international sanctions of the late twentieth century and the naval blockades of the nineteenth century. While they increase the economic pain on an opponent, they do not directly kill or destroy—they only prevent a nation from taking advantage of trade and commerce. If nations can impose economic sanctions and enforce embargoes, they should have the right to disable space assets whether military or civilian.

We should prefer such an outcome to the alternatives. Nations impose economic sanctions because they seek to coerce without war. If international law banned sanctions because of the harm to civilians, nations would have to turn to more violent means in order to communicate their intentions in a dispute. Banning military activity in space would only divert nations in a dispute toward more violent forms of coercion as well. If nations cannot attack each other's satellite-based networks, for example, they may resort instead to conventional air or missile attacks on energy transmission and communication networks, or computing sites instead. These hostilities will cause greater death and destruction on the ground and increase the collateral damage on civilians. In strategic terms, space provides "celestial lines of communication."[408] Nations can coerce each other by applying force to disrupt those lines of communication, just as they would those on earth, but with dramatically reduced civilian harm.

C. Space Weapons and Strategic Balance

This Section addresses strategic concerns over space weapons. Even if space weapons make the use of force more precise and less destructive, they could also unsettle the balance of power between the great powers sufficiently to make war more, rather than less, likely. Critics of missile defense, for example, argue that it forces nations to expand their nuclear forces in order to be certain

408. *See* JOHN J. KLEIN, SPACE WARFARE: STRATEGY, PRINCIPLES AND POLICY 51–60 (Everett C. Dolman & John Sheldon eds., Routledge 2006).

that its deterrent effect remains effective.[409] Anti-satellite weapons could have a similar effect. If one nation were to use ASAT to destroy reconnaissance and early detection satellites, it might be able to blind an enemy during a crisis. Space-based conventional weapons might prove so swift and accurate that they could create a first-strike possibility against an opponent's nuclear arsenal. Competitors will respond by expanding the size of its forces and keeping them on a higher level of alert, which could cause a nuclear launch by mistake or in haste. This Section argues, however, that ASAT and space-borne weapons are just as likely, if not more so, to buttress international stability, rather than undermine it.

A cost-benefit approach suggests that the United States and its allies should develop an effective ABM system to prevent other nations from threatening a nuclear weapons attack. Even if an Iran or North Korea had only an imperfect command of nuclear and missile technology, the enormous destruction of even one successful strike—no matter how low the probability—would justify devoting significant resources for missile defense. The expected harm of such a strike equals the probability of a successful attack times the harm of a nuclear explosion. Some estimate the destruction of a single U.S. city via nuclear attack to amount to well over a trillion dollars.[410] Contrast that to a single non-nuclear attack on a single target, the September 11, 2001 strike on New York City's World Trade Center, for example, which caused an estimated economic and physical harm of $175 billion.[411] Moreover, a nuclear attack on an entire city would kill several orders of magnitude more civilians and destroy far more than the World Trade Center and its immediate environs.

The United States cannot meaningfully reduce the magnitude of harm of a nuclear bomb without significant and expensive civil defense measures that could involve the relocation of civilians and important institutions and the decentralization of the economy and urban centers. Washington would also have to allocate civil defense resources throughout the nation in a way that would equalize the expected costs of an attack. In other words, it would have to spend more to reduce the harms of a nuclear strike on the most valuable American cities and resources so that an attacker ultimately becomes indifferent to the targets selected—an expensive proposition.

Instead of investing the resources necessary to reduce the magnitude of harm of a nuclear attack, the United States instead can take measures to reduce its probability of success. A missile defense, moreover, would generate benefits that would accrue equally throughout the nation by preventing missiles from landing. The United States ought then to spend up to the expected harm of a nuclear attack by its rivals. Suppose, for example, that North Korea had a 10%

409. Willie Curtis, *National Missile Defense: A Retreat from Dr. Strangelove or How I Learn to Stop Worrying and Love Mad*, 36 NEW ENG. L. REV. 795, 796 (2002).

410. *See, e.g.*, Matthew Bunn, Anthony Wier & John P. Holdren, *Nuclear Threat Initiative, Controlling Nuclear Warheads and Materials: A Report Card and Action Plan* 15–16, 18 (2003), http://www.nti.org/e_research/cnwm/cnwm.pdf.

411. A nuclear attack would have more far-reaching effects than a conventional attack, such as the short and long-term effects of radiation on the land and survivors. For an early effort to estimate these harms, see HERMAN KAHN, ON THERMONUCLEAR WAR 40–95 (Princeton U. Press 1960).

chance of successfully striking the United States, and that the harm of a successful strike would be $1 trillion. The expected harm, therefore, is $100 billion. Thus, the United States ought to spend up to $10 billion on any system that can reduce the probability of a successful strike by 1%.

A space-based missile defense system could prove less costly and more effective than ground options. The existing U.S. ground-based system based in Alaska and California, the Ground-based Midcourse Defense System, has cost approximately $40 billion.[412] It seeks to destroy incoming warheads while they are in space and starting to descend back to earth.[413] It relies on a network of space, sea, and ground sensors to detect an enemy launch and then guide an interceptor fired from Alaska or California.[414] Striking a target at this stage is technically difficult because of the high speed of the warheads, the availability of counter-measures, and the difficulty of interception using another missile. Not surprisingly, the system has managed to destroy simulated targets in no more than 50% of the tests.[415]

Stationing a system in space would provide advantages over a ground-based missile defense system. It could focus on attacking a missile in its boost phase, shortly after launch, when it is physically vulnerable, easier to track, and simpler to destroy. Similarly, directed energy or laser weapons firing from satellites or high-altitude UAVs could allow the deployment of a missile defense at lower cost and greater reliability than current systems, which use expensive ground interceptors.[416] Accepting a legal prohibition on space-based weapons systems would force the United States to deploy a missile defense of greater expense and lower reliability.

The benefits of such a system would go beyond the protection of North America or Europe. An Iranian or North Korean nuclear capability could impose costs on the United States even if it were never used. Armed with nuclear weapons, the regimes in Tehran or Pyongyang would have a valuable tool of coercion that could disrupt the existing status quo in their regions. A regional nuclear power might believe itself invulnerable to invasion, which might encourage it to pursue more aggressive designs abroad or pursue more oppressive policies at home.[417] North Korea, for example, might seek to forcibly reunify with South Korea because it believes that the United States would not respond and risk nuclear war. Iran might use force against American allies such as Israel, Saudi Arabia, and Egypt, because it no longer fears U.S. conventional retaliation. Both nations would also hold a considerable advantage if they were to attack regional rivals that did not possess nuclear weapons.

412. *See* THOMAS KARAKO & IAN WILLIAMS, CTR. FOR STRATEGIC & INT'L STUD., MISSILE DEFENSE 2020: NEXT STEPS FOR DEFENDING THE HOMELAND xiv–xv, xxvii (2017), https://missilethreat.csis.org/missile-defense-2020/.

413. *See id.* at 121.

414. *See id.* at xvi–xv.

415. *Id.* at xxii.

416. *Id.* at 112–14.

417. *See* Robert Powell, *Nuclear Deterrence Theory, Nuclear Proliferation, and National Missile Defense*, 27 INT'L SECURITY 86, 88–90 (2003).

A more effective space-based missile defense system would reduce the benefits to regional challengers, such as Iran or North Korea, of nuclear weapons. It might help persuade these nations to reduce their efforts to develop these weapons in the first place. The reduced value of a small nuclear program could make these regimes more amenable to negotiations rather than force. Using a space-based system to counter regional nuclear powers would have the effect of supporting regional stability. If we understand North Korea and Iran to be revisionist powers who seek to alter the status quo in their regions, removing nuclear weapons as their guarantee against attack or invasion should reduce their ability to engage in hostilities. A missile shield would give U.S. diplomacy, supported by the threat of force, more credibility because American leaders would no longer have to worry about nuclear threats in response.

A missile defense system might also ease the "security dilemma" posed by the development of nuclear weapons programs by regional powers. The security dilemma arises when a nation takes measures for its defense that could also be interpreted by other nations as offensive in nature.[418] For example, a nation might deploy a large military for defensive reasons, but the size of the army and navy worries its neighbors, who then respond by launching their own armament programs.[419] Nuclear weapons create a severe version of the security dilemma because it is difficult to distinguish between their defensive and offensive capabilities, and because their offensive use conveys a great advantage and they have little defensive use. As a result, nations will have an incentive to use them before they lose them to a preemptive strike. In response to the rise of a regional nuclear power, threatened neighbors might develop their own nuclear deterrents or launch preventive conventional attacks to destroy arsenals on the ground.

A space-based missile defense system, however, could counter a regional power's nuclear rise without triggering a competitive spiral. A missile defense has little offensive capability, which makes the defensive intention of the responding nation clear and less threatening. It creates uncertainty about the success of any nuclear attack and it also increases the number of missiles that an opponent would require to successfully engage in coercion.[420] It could thus help assure allies that the United States would come to their aid, even in the face of a nuclear threat by a revisionist power, which would help maintain stability in critical regions in Central Europe and East Asia. Deploying such a system also reduces neighbors' incentives to expand their retaliatory capabilities or to consider first-strike plans. A limited missile defense would limit the value of a nuclear arsenal, and hence reduce the incentives for an expansionary policy.

A limited missile defense system could even shore up the strategic balance between the great powers. Deterrence requires that a nation have a credible second-strike capability. Strategists believe that a rational nation would not launch

418. *See generally* Robert Jervis, *Cooperation Under the Security Dilemma*, 30 WORLD POL. 167, 170 (1978).

419. *See id.*

420. BRAD ROBERTS, THE CASE FOR U.S. NUCLEAR WEAPONS IN THE 21ST CENTURY 88 (Stanford U. Press 2016).

a nuclear attack if it is subject to nuclear retaliation because the costs of the attack would far outweigh any benefits.[421] A reliable national missile defense could prevent the success of a first strike, or at least create enough uncertainty in the aggressor's mind that a first strike may completely eliminate its opponent's retaliatory capacity.

A limited ABM system would not pose a threat to stability between the great powers. Nuclear deterrence depends on the ability of a defending nation to inflict retaliatory costs that outweigh the gains from an attack. A state must have an assured-destruction capability: a nuclear response that will destroy an attacker's civilian and military infrastructure. For mutually assured destruction to succeed, the defender must have a guaranteed ability to retaliate, because an attacker will not launch a first-strike if it knows that its opponent can still respond with enough nuclear weapons to devastate its cities and population.[422] Without any physical means to defend themselves from nuclear attack, great powers must rely on deterrence to protect their security.

During the Cold War, the U.S. and the U.S.S.R. secured their second-strike capabilities in a number of ways. They constructed huge arsenals, numbering well above 10,000 warheads each, to increase the difficulty of finding and destroying all of their nuclear deterrent.[423] They decentralized their deterrent by dispersing nuclear weapons on air, ground, and sea platforms—the famous "triad."[424] They deployed ground missiles in "hardened" underground silos and kept nuclear-armed bombers on an alert status where they could take off before an attack could land.[425] They made their retaliatory forces more difficult to locate by developing submarine launched ballistic missiles, which allowed them to hide their nuclear deterrent in the vastness of the oceans.[426]

Critics of missile defense might worry that a space-based missile defense might destabilize this system of mutually assured destruction. If Russia and China were to conclude that the U.S. could redirect an ABM and ASAT system against them, they might start to modernize and expand their nuclear forces. Even a limited system might use sensors and weapons based in orbit to acquire earlier and more accurate tracking data on Russian and Chinese nuclear forces. This might give the U.S. the ability to strike at a missile in its boost phase, when it is slow, vulnerable, and cannot yet engage decoys and countermeasures. In critics eyes, therefore, a more comprehensive space-based missile defense would undermine the strategic balance of power by undermining Russian and Chinese

421. FRED KAPLAN, THE WIZARDS OF ARMAGEDDON 31 (Simon & Schuster 1983).

422. The classic works on nuclear deterrence theory include BERNARD BRODIE, STRATEGY IN THE MISSILE AGE (Princeton U. Press 1959); KAHN, *supra* note 411; THOMAS C. SCHELLING, THE STRATEGY OF CONFLICT (Harvard U. Press 1960); THOMAS C. SCHELLING, ARMS AND INFLUENCE (Yale U. Press 1966); Albert Wohlstetter, *The Delicate Balance of Terror*, 37 FOREIGN AFF. 211 (1959). For important elaborations, see ROBERT JERVIS, THE ILLOGIC OF AMERICAN NUCLEAR STRATEGY (Cornell U. Press 1984); ROBERT POWELL, NUCLEAR DETERRENCE THEORY: THE SEARCH FOR CREDIBILITY (Cambridge U. Press 1990).

423. *See generally* LAWRENCE FREEDMAN, THE EVOLUTION OF NUCLEAR STRATEGY (2d ed. 1989).

424. *Id.* at 342.

425. *See id.* at 129–130.

426. *See id.* at 352.

confidence—not in the survivability of their nuclear assets from a first strike attempt, but in their second-strike capability to inflict sufficient harm on the United States.[427] These concerns would seem to recommend a legal ban on all space-based missile defense, much like the 1972 Anti-Ballistic Missile Treaty, to assure the great powers of the credibility of their deterrents.[428]

These concerns, however, are misplaced. Space technology has not yet advanced to the point where the United States could deploy a system capable of tracking and intercepting even dozens of missiles at once. The current mid-course missile defense system relies on two dozen ground-based interceptors of questionable reliability.[429] Meanwhile, even under the New START nuclear arms reduction treaty, Russia has about 1,550 warheads.[430] China, which is not a party to any of the U.S.-Russia arms treaties, has at least 250, easily enough to overwhelm the existing U.S. ground-based missile defense system.[431] Even with intensive research and development, the U.S. could not develop a space-based system for a decade that would prove effective against the limited arsenals of smaller powers, such as North Korea.[432] To be sure, several of the components of an effective ABM system might easily scale from a smaller system to a more comprehensive defense against the ICBMs of the great powers. Either system would demand sophisticated systems for early warning, tracking radars, targeting sensors, and battle management computers. If the only difference between the limited and comprehensive system becomes the number of interceptors, an effective ABM system might spark competition from other nuclear powers, particularly those with smaller arsenals like China.

Nevertheless, neither Russia nor China would rationally be threatened. Both nations could still launch sufficient missiles while a U.S. first strike was in the air to destroy American cities.[433] To gain a true advantage, the United States would have to develop a new technology—space-based interceptors—and boost them into space in sufficient numbers to guarantee the destruction of hundreds of ICBMs. Such a comprehensive, effective anti-missile umbrella rests beyond the grasp of current technology.[434] The great powers would also have relatively cheap and effective means available to defeat a space-based missile defense system. They could simply construct larger arsenals, at relatively low expense, such as ground-based ICBMs and SLBMs with high numbers of MIRV warheads, to

427. *See* Powell, *supra* note 90.

428. *See* FREEDMAN, *supra* note 423, at 363–364.

429. *See* WOOLF, *supra* note 44.

430. AMY F. WOOLF, CONG. RESEARCH SERV., R41219, THE NEW START TREATY: CENTRAL LIMITS AND KEY PROVISIONS 4 (2019).

431. *See id.* at 45.

432. *See* KARAKO & WILLIAMS, *supra* note 412.

433. There are no official statistics on the size of China's nuclear arsenal. In 2016, the U.S. Department of Defense estimated that China possessed 75–100 ICBMs, some of which had MIRV capability, but had no estimates of the number of warheads. OFFICE OF THE SEC'Y OF DEF., 17FA69, ANNUAL REPORT TO CONGRESS: MILITARY AND SECURITY DEVELOPMENTS INVOLVING THE PEOPLE'S REPUBLIC OF CHINA 2016, 25 (2016).

434. *See* BOB PRESTON ET AL., SPACE WEAPONS EARTH WARS 25–26 (2002).

overwhelm any U.S. missile defense system. Or they could develop weapons to attack the ABM system itself.[435]

Rather than trigger a new nuclear arms race, a space-based ABM system could bolster strategic stability. The success of a nuclear deterrence strategy depends on maintaining a retaliatory capability powerful enough for the costs of any first-strike attack to exceed its benefits. The strategic balance will become less stable as a nation's second-strike capability begins to weaken, because the nation will become more vulnerable to a first strike. A limited space-based missile defense will enhance the survivability of nuclear deterrents by degrading the effectiveness of an attack. A space-based system could not completely intercept an initial nuclear attack by Russia or China, but it could shield enough nuclear weapons for a retaliatory strike. The survival of a deterrent will dissuade an opponent from the attempt in the first place. A limited space-based missile defense should allow a nation to maintain an effective second-strike capability with a smaller arsenal than before.

This capability might become even more important in the post-Cold War period. Advances in technology are challenging the survivability of nuclear deterrents. The same revolution that has made the unmanned aerial drone so effective in carrying out pinpoint strikes—precision-guided munitions, remote sensors, and real-time control—has improved the ability of conventional and nuclear missiles to destroy hardened ground silos and even ballistic missile submarines.[436] There is evidence that potential adversaries, such as North Korea, Russia, and China, have studied theories of victory in a conflict with the United States waged under the threat of a nuclear exchange.[437] A missile defense could discourage Russia and China from risking brinkmanship in a conflict, such as in Ukraine and the Baltics, or in the South China Sea and Taiwan. Russia or China might attack an ally, such as the Baltic states or Japan, on the theory that the threat of a limited nuclear exchange could induce restraint on the part of the United States.

Under the analysis here, the United States and the other great powers should refuse to join an international ban on space-based ABM systems. A similar analysis indicates that they should also reject an international legal ban on ASAT weapons. China has already joined Russia and the U.S. in demonstrating ASAT capabilities.[438] Washington cannot put the genie back in the bottle, even if Moscow and Beijing wished, because missile defense systems enjoy a latent ASAT capability.[439] The same sensors, computers, and interceptors that can shoot down ballistic missiles can also destroy orbiting satellites. Verifying any international ban on ASAT weapons would prove difficult, if not impossible.

435. *See generally* Powell, *supra* note 90.

436. *See, e.g.*, Keir A. Lieber & Daryl G. Press, *The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence*, 41 INT'L SECURITY 9, 18–32 (2017).

437. BRAD ROBERTS, THE CASE FOR U.S. NUCLEAR WEAPONS IN THE 21ST CENTURY 6 (2016).

438. *See* JOHNSON-FREESE, *supra* note 81, at 216–17.

439. *See id*. at 7.

Even if it were possible to verify an anti-ASAT agreement, it would not be in the national interest of the United States or other great powers to join. ASAT weapons provide nations with a precise means of using force in a dispute that has little chance of civilian death. When used against military satellites, ASATs can deprive enemies of the ability to wage information-enhanced combat. When used against civilian satellites, they inflict precise economic pressure on an opponent, similar to sanctions or an embargo. Disrupting space communications could inflict a measured form of coercion that can induce nations to settle their disputes before they reach higher levels of destruction. The U.S. should continue development of ground or air-launched ASAT technology, as those are already feasible, and expand the reach of ground-based weapons that can interfere with communications and control of satellites. A space-based system could further disable rival satellites to provide more options in a crisis.

As with missile defense, however, the United States and other great powers have an interest in deploying only a limited ASAT capability. Attacks against satellites that provide early warning of nuclear launches could undermine the effectiveness of a nuclear second-strike capability. Deterrence relies on the defending nation's ability to detect an attack, guarantee that enough weapons survive, and carry out a retaliatory strike. Disabling an opponent's satellite detection system could destabilize a balance of power by creating uncertainty in the mind of the defending nation whether an attack is occurring and whether enough of its arsenal will survive. A nation might respond by launching a retaliatory strike immediately upon losing a satellite, a prospect that increases as it relies on a smaller deterrent force.

Under the New START treaty, for example, the United States and Russia agreed to reduce their nuclear arsenals to 1,550 strategic nuclear warheads and about 700 deployed ICBMs, SLBMs, and nuclear bombers by which to deliver them.[440] Both nations rely primarily on satellites to provide early warning of launches; the U.S. Space-Based Infrared System uses four satellites in geo-synchronous orbit, two more in elliptical orbits, and up to twenty-four in low earth orbit.[441] If an opponent destroyed part of this system, it could partially blind the U.S. to ICBM launches. Under the pressure of a crisis, commanders might conclude that ASAT use against early warning satellites might be a prelude for a nuclear strike. Concerns about a strike could encourage leaders to use the assets most vulnerable to a first-strike—ICBMs with multiple warheads based in ground silos—which are also the most destructive.

The risks of triggering a nuclear exchange far outweigh the coercive value in subjecting these satellites to attack. In this specific area, nations have a high interest in mutual cooperation to limit ASAT against nuclear detection satellites. Nuclear powers need a reliable early warning system to prevent misunderstandings and mistaken decisions to launch their weapons. Nations can rely on self-

440. Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms, Russ.-U.S., art. II, Apr. 8, 2010, T.I.A.S. No. 11-205; *see also* Woolf, *supra* note 430.

441. *See* Jeffrey T. Richelson, *Space-Based Early Warning: From MIDAS to DSP to SBIRS*, NAT'L SECURITY ARCHIVE (Jan. 8, 2013), http://nsarchive.gwu.edu/NSAEBB/NSAEBB235/20130108.html.

help to solve part of the problem by hardening the defenses of this class of satellites, to make them more difficult to destroy or jam, and by fielding redundant systems that can absorb an attack. But they can also address the problem by agreeing to place strategic warning satellites off-limits. A formal treaty would prove difficult to verify, as ASAT weapons capable of striking targets in low earth or geosynchronous orbits would have the ability to attack early warning systems. Instead, nuclear powers would have to rely on deterrence to enforce any such agreement. The U.S. should only deploy sufficient ASAT weapons for the targeting of military satellites that provide support for terrestrial military operations, but not enough to overwhelm the early warning systems of its main competitors.

Russia and China may find it difficult to trust American promises to respect their strategic surveillance satellites. Once the U.S. deploys an ASAT system, extending its capabilities to include early warning satellites may just be a matter of adding more interceptors. As with a comprehensive ABM system, the U.S. military will have already achieved the central challenge of integrating sensors, trackers, and battle management systems. On the other hand, the superpowers confronted a similar problem in agreeing to limit, and then reduce, their strategic stockpiles.[442] Both the United States and Russia could observe the number of launchers on each side, though some—especially bombers and medium range missiles—could carry either nuclear or conventional warheads. They also permitted on-site verification to monitor warheads and their disposal.[443] Similarly, an agreement to limit but not prohibit ASATs could rely on national technical means to verify launch sites and radar installations, while relying on on-site visits to confirm interceptor numbers. Ultimately, as with the SALT and START agreements, the U.S., Russia, and China would have to rely upon deterrence to enforce an ASAT agreement.[444] The only way to ensure that nations do not use ASAT weapons against strategic surveillance satellites is if they maintain their capacity to retaliate. Deterrence, therefore, requires that the United States develop the ASAT capabilities that it would want to have for coercion purposes anyway.

These principles suggest a second important area for cooperation to limit certain types of space-based arms. The United States should seek to limit the deployment of space weapons that could represent a first-strike threat. Even with the end of the Cold War, the major powers have maintained their nuclear arsenals—though in reduced form—to deter attack.[445] Under the strategy of mutually assured destruction, the great powers maintain a sufficient force to respond to any nuclear attack with a devastating counter-attack.[446] The more protected nuclear weapons are from attack, the more confidence nations can have in their deterrent effect and the less likely an opponent will attempt a first strike. Under

442. *See* Woolf, *supra* note 430.
443. *Id.* at 8.
444. *See id.* at 12; MOLTZ, *supra* note 103, at 174.
445. *See generally* Powell, *supra* note 90.
446. *See generally* FREEDMAN, *supra* note 423.

this strategy, ground-based nuclear missiles are the least reliable deterrent because their positions are fixed and hence vulnerable to a nuclear attack, while submarine-launched ballistic missiles are the most reliable because of the difficulty in locating and attacking them.

Under this logic, weapons that have great offensive force but remain vulnerable to attack pose the greatest threat to nuclear stability. Ground-based missiles with high number of MIRV (multiple independent reentry vehicle) warheads are most dangerous because their great benefit is offensive use, when they can strike multiple targets at once. They have the most value in a first-strike against an opponent's nuclear capability. But they remain as equally vulnerable as any other ground-launched ICBM. Because an opponent could eliminate a larger share of a nuclear force with successful hits on MIRV ICBMs, they make attractive targets while also creating a "use it or lose it" attitude toward launching them. As a result, the Soviet Union, now Russia, and the United States made progress in retiring ground-launched high MIRV ICBMs in favor of missiles with a few, or even single, warheads.[447] The United States, for example, now deploys only a solo nuclear warhead on its 400 ground-launched Minuteman III ICBMs, and it put aside plans to develop the MX Peacekeeper ICBM, which would have carried up to ten warheads each.[448]

The United States should limit the development of space weaponry designed to strike ground targets for similar reasons. Exotic systems, such as hypersonic rail guns, directed energy beams, or gravity rods, could destabilize the strategic balance of power. While still far off into the future, these weapons may appear attractive at first glance because of their swift speed, explosive force, precise targeting, and minor fallout. According to some estimates, gravity alone would allow a space-based, non-explosive warhead to hit a ground target, twelve to fifteen minutes after launch, with the kinetic force of a small nuclear weapon.[449] Stationing a weapons platform in high orbit makes launches difficult to detect, with a speed and angle of descent almost impossible to defeat with anti-missile or anti-aircraft defenses.[450] The speed and destructiveness of these weapons, however, give governments little time to determine whether an attack seeks to destroy their nuclear deterrent. The short warning time may create a strong incentive to use military assets that are vulnerable to a first-strike—again, ground-based ICBMs armed with multiple reentry warheads. In a crisis situation, such weapons may create the conditions for a mistake of judgment by national leaders that could have disastrous consequences.

An international agreement limiting these exotic space-to-ground strike weapons might appeal to the interests of the major nuclear powers. Nuclear-armed nations share an interest in cooperating to limit weapons that have a first-strike capability that could undermine the reliability of their strategic deterrents.

447. *See* Woolf, *supra* note 430, at 28–29.

448. AMY F. WOOLF, CONG. RESEARCH SERV., RL33640, U.S. STRATEGIC NUCLEAR FORCES: BACKGROUND, DEVELOPMENTS, AND ISSUES 8 (2017).

449. PRESTON ET AL., *supra* note 434, at 40–45.

450. *See id.* at 46

They also gain by cooperating to reduce the chances of error and mistake that might trigger a nuclear exchange. The nations with the technical ability to develop and field such advanced space weapons are also those with nuclear deterrents. They could avoid the costs of a competition to field ever more advanced space strike weapons and any possible defenses, such as creating larger and more dispersed nuclear forces or space-based anti-satellite weapons.

A ban on offensive orbital strike platforms would also benefit nations without access to advanced space technology. Competitors would have less reason to fear the prospect of a surprise first strike, and they could forgo the costs of building their own offensive and defensive systems. In exchange, the United States and the other great powers could remove a potential threat to strategic stability. An international agreement would not demand as great a concession from the United States as it would from other nations. The U.S. armed forces have multiple alternatives for global strike missions, such as ICBMs, cruise missiles, stealth bombers, and conventional air, ground, and sea-based artillery. Washington does not need space-to-ground attack systems in order to coerce opponents, and it could forestall competition from rivals who might hope to leapfrog U.S. dominance in conventional and nuclear arms with exotic space weapons. A treaty would also prove relatively easy to verify: a nation would need a significant launch capacity to lift all of the weapons into space and the orbital platform needed for basing.[451]

There is a last important criticism of these approaches to space weapons, which applies primarily to the United States. Because the United States has made the greatest investments in space for both military and civilian purposes, it may be uniquely vulnerable to military warfare in the heavens. About half of all satellites are American.[452] Many of them support U.S. military and intelligence operations ranging from verification of strategic weapons to tactical information in battle. The U.S. has become more dependent on high-speed communications, precision munitions, and space-based information, than any other nation.[453] Meanwhile, anti-satellite weapons rest in the grasp of any nation that can launch a ballistic missile into orbit. Nations that suffer from a disadvantage in conventional, terrestrial armed forces could quickly narrow the gap by launching an attack on U.S. space systems. Without the information and communications provided by satellites, U.S. military effectiveness will be significantly degraded—all without harming anyone or destroying anything on the ground.

But arms control over the entire class of space-based weapons is extremely unlikely. As argued earlier, nations will agree upon limits or prohibitions on weapons and their use when there is a rough symmetry in their capabilities.[454] An agreement must not grant a decisive advantage to any nation that does not exist under the status quo; otherwise, the treaty will create strong incentives to

451. *Cf.* PRESTON ET AL., *supra* note 434, at 48.

452. *SATCAT Boxscore*, CELESTRAK (Oct. 2, 2019), http://www.celestrak.com/satcat/boxscore.asp.

453. JEREMY RABKIN AND JOHN YOO, STRIKING POWER: HOW CYBER, ROBOTS, AND SPACE WEAPONS CHANGE THE RULES FOR WAR 227 (2017).

454. *See supra* Part III.

cheat. In the case of space-based weapons, neither the United States nor its rivals can have confidence that an agreement will survive. First, the United States currently enjoys an overwhelming advantage in military activities in space; it would be unlikely to give up its superiority in space-enhanced operations. Second, other nations may see that space weapons, particularly ASAT, provide a quick and relatively inexpensive means to threaten the U.S.'s advantage in conventional military systems. Nor would these nations, such as China or Iran, have any incentive to sign a ban on ASAT since they have few space resources themselves under threat of attack.

Instead of an international agreement, the better course for the United States lies in defensive strategies. Its best response to the growing ASAT capabilities of its rivals is to harden its satellites and build redundancies into its systems. It can also threaten conventional terrestrial attacks on opponents who interfere with its satellites and celestial lines of communication. As other nations build their own space-based networks, they will increasingly fall subject to the reciprocal threat of U.S. ASAT weapons. Deterrence, rather than international law, will provide the protection for the U.S.'s superior civilian and military space assets.

As this Section has shown, the current legal regime is not able to accommodate the primary benefits of space weapons. Rigid interpretations of proportionality, distinction, and other international law principles hinder a state from having access to more knowledge about their adversary and remove as a tool a valuable means of coercion, thereby increasing the probabilities of provoking a more destructive war. While space technology continues to advance and the legal regime becomes less current, the U.S. should rely on deterrence as a means not only to protect itself and its interests, but in serving broader international humanitarian goals.

Critics of space warfare raise environmental harms and unforeseen collateral damage as pitfalls. Early anti-satellite and anti-ballistic missile weapons relied on nuclear explosions that could destroy the electronics of nearby satellites and irradiate parts of space for long periods. Testing in the early 1960s showed that nuclear weapons explosions even on earth generated EMP radiation that severely damaged satellites in low-earth orbit; presumably then, an explosion in space could indiscriminately disable most satellites in its orbital path.[455] Kinetic anti-satellite weapons produce a different environmental threat. A successful impact can produce large debris fields that turn thousands of fragments into high-velocity weapons, which can hit other satellites with the force of a ten-ton truck traveling at 118 m.p.h.[456] While some of the debris would soon burn up in the atmosphere, much of it could stay in the same orbit for months, if not years. Military attacks on space assets could degrade the space environment for long periods of time.

Such considerations, however, should not lead to a permanent ban on space weapons. Instead, they militate in favor of developing a wide array of space

455. MOLTZ, *supra* note 103, at 51–52.

456. *Id.* at 53; JOHNSON-FREESE, SPACE AS A STRATEGIC ASSET, *supra* note 81, at 110–11.

weapons that do not depend solely on kinetic kills for effectiveness. One sort of weapon often discussed in the space literature is "soft kill" technology. Rather than destroying targets with direct hits, soft kill weapons disables an opponent's celestial lines of communication by jamming satellite controls.[457] The United States, for example, could use ground-based lasers to blind satellites or electromagnetic interference to prevent communication with ground controllers. It could even hack into an opponent's ground-to-space uplinks to take over a satellite's controls and render it inoperable or move it to the wrong orbit.[458] Operating directly in space, the United States could deploy micro-satellites in the same orbit as a target and then disable it by using jamming or interference, or even by attaching them to the hull of the target and changing its trajectory. Over the last ten years, the U.S. Air Force has run at least three programs to develop micro-satellites for surveillance and possible ASAT missions.[459]

These soft kill weapons could bring further advantages beyond using force in a "cleaner" way than kinetic weapons. They could be used, for example, as a temporary access denial weapon. Soft kill weapons need only prevent an opponent from using its celestial lines of communications during the course of a dispute. Because they do not destroy their targets, soft kill weapons can restore the availability of space as a resource once a conflict ends. In this respect, such use of force in space would have similar characteristics to the pacific blockades of the nineteenth century, which temporarily interrupted the targets' normal intercourse with the rest of the world. Once a crisis ended, the naval power could lift its blockade and commerce could resume peacefully. A conflict would end without significant damage to lives or property—the only harm would be the lost economic activity during the period of blockade. Such opportunities allow nations to pressure each other in less harmful ways than just conventional, armed hostilities.[460] Thus, these soft kill options should help produce more clear, effective negotiations between nations that can bring disputes to an end faster, and with less cost, than before.

VI. CONCLUSION

While President Reagan's dream of building an anti-missile shield to protect the entire United States is still far off, space is quickly joining land, sea, and air as an arena for conflict. The great powers began to use space for military activity with the launching of the first satellites in the 1950s.[461] Satellites today provide the information, intelligence, and communications that form the backbone for today's up-tempo, integrated, high-tech military operations. In the next

457. Kevin Pollpeter, *China's Modernization Efforts and Activities in Outer Space, Cyberspace, and the Arctic*, *in* ASSESSING CHINA'S POWER 116 (Jae Ho Chung ed., 2015).

458. KLEIN, *supra* note 408, at 93–94.

459. JOHNSON-FREESE, *supra* note 81, at 138–39.

460. A prominent example of this is that Allied economic warfare against Germany in World Wars I and II through the levying of a blockade of both military and civilian shipping. *See* CHARLES CHENEY HYDE, INTERNATIONAL LAW: CHIEFLY AS INTERPRETED AND APPLIED BY THE UNITED STATES 1727–32 (2d. ed. 1945).

461. *See, e.g.*, Richelson, *supra* note 441.

decades, we might see the realization of Reagan's hopes with the deployment of capable anti-missile defenses in space. Nations naturally are developing anti-satellite weapons to defeat the wide American advantage in space as a support for terrestrial operations and a battlefield in its own right.

Although the great powers have limited military activities in space, most importantly the ban on WMD, they have left important areas free of regulation. International agreements do not prohibit the passage of missiles through space, the stationing of conventional weapons in orbit, or the gathering of intelligence and the transmission of communications from space. States should continue to use force in these ways for self-defense, to defeat terrorist groups and regional aggression, and to resolve their disputes.

Combat in space may spark the same fears as other technologies of lowering the barrier to armed conflict. But it also offers the same benefits of greater precision, less destruction, and lower risk of general war. In the area where space weapons might prove genuinely destabilizing, such as a platform for strategic first-strike weapons against earth targets, the United States and its allies should take the first steps for an arms limitation agreement. But other than this sole area, the great powers should take advantage of the technological progress in space to pursue their security goals.