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Armed Conflict on the Final Frontier: The Law of War in Space

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I. INTRODUCTION

> [T]he lawful bearing of arms–under a strict code of military justice and within a corpus of humanitarian law– has been accepted as a practical necessity.[1]
>
> John Keegan (1993)

Some may reasonably wonder, for purposes of analysis under the international law of war, whether there is any meaningful distinction between warfare prosecuted within airspace and warfare prosecuted within outer space. In both cases, the military assets above the earth's surface may support the combat occurring below, or may engage targets in the same combat environment. Given this, some may view armed conflict from and within outer space as simply a subset of air warfare. Others may see armed conflict in outer space as superior to air warfare–that is, air warfare as a subset of space warfare. Still others may view space conflict as a new category of combat that is sui generis. We can state the question more simply as follows: is the "aerospace" environment fundamentally one field of combat operations or two?

This article suggests that for purposes of analysis under the law of war, space combat will be sui generis–fundamentally different from combat in terrestrial airspace.[2] This approach raises at least three implications for the

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[1] JOHN KEEGAN, A HISTORY OF WARFARE 5 (1993).

[2] Professor Matte argues that "airspace" is a misnomer, and that the proper term is "air medium." He makes this distinction in arguing against "any kind of arbitrary demarcation between 'air space' and 'outer space.'" N.M. MATTE, AEROSPACE LAW: TELECOMMUNICATIONS SATELLITES 11 n.31 (1982). Professor Matte further observed that the two environments are "*at present* governed by two different legal regimes," *id*. (emphasis added), but that the more logical approach is to speak of an aerospace continuum. On this approach, "the rules and norms of aeronautical law, on the one hand, and of aerospace law, on the other hand, should be applied according to functional criteria, i.e., the type of activity being carried out." *Id*. This contrasts with the "traditional view" of crafting and applying law to the

analysis undertaken herein. First, space combat will not be analyzed as simply an extension of air combat; the two are fundamentally different types of combat suggesting different doctrinal tenets of power. While the military use of space has traditionally been viewed as a medium from which to support terrestrial warfare, including air warfare, space as a medium of warfare itself raises entirely different legal and operational issues.[3] Thus, freed from a strict air warfare paradigm, the effort to establish limits on space combat in its own right can draw principles of armed conflict from those applicable to land and sea warfare, as well as from those governing air warfare.

Second, one of the key differences of space warfare, at least for the near future, will be the spatial separation of human combatants from their weaponry. Whether kinetic energy or space-based laser weapons in low-earth orbit, or jamming satellites used to corrupt telecommunications signals in

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medium in which the activity is carried out, either air or space. Though insightfully recognizing the great difficulty of establishing a non-arbitrary boundary between air space and outer space, this view, if applied to armed conflict, would identify applicable norms limiting weaponry and methods of warfare based on a functional approach, rather than on where the combat occurs. The difficulty with this from a military point of view lies in the conceptual challenge of creating warfare policy, doctrine, and operating plans without a clear demarcation of the theater of operations. *See, e.g.*, W.B. Scott, *Pentagon Considers Space As New Area of Responsibility*, 146:12 AV. WK. & SPACE TECH., Mar. 24, 1997, at 54 [hereinafter Scott, *Space as New Area of Responsibility*].

[3] One author aptly terms the difference "significant." R.D. NEWBERRY, SPACE DOCTRINE FOR THE TWENTY-FIRST CENTURY 10 (1998) [hereinafter NEWBERRY]. The difference is helpfully illustrated by three representative schools of thought on the relationship between military activity and outer space: (1) space as a demilitarized sanctuary; (2) space as the high ground; and (3) space as a theater of operations. J.E. Justin, *Space: A Sanctuary, the High Ground, or a Military Theater*?, *in* INTERNATIONAL SECURITY DIMENSIONS OF SPACE (U. Ra'anan & R.L. Pfaltzgraff, Jr., eds., 1984) 102-09 [hereinafter Justin]. The first view recognizes a minimal role for the military use of space but not its weaponization. Two thoughtful, moderated accounts representing this view were recently provided by two USAF officers. One aims at "opening the debate" on the space sanctuary view. B.M. DeBlois, *Space Sanctuary: A Viable National Strategy* 12:4 AIRPOWER J. 41 (Winter 1998) [hereinafter DeBlois]. The other claims to present the "strongest possible argument for a space sanctuary today." D.W. ZIEGLER, SAFE HEAVENS: MILITARY STRATEGY AND SPACE SANCTUARY THOUGHT (1998) [hereinafter ZIEGLER]. The second of the three schools of thought, sees the role of military activity in space as principally supportive of terrestrial combat and could include the use of weapons from space. This view stresses the inseparability of the air and space media, and makes heavy use of the term "aerospace," a term coined in 1958 by USAF Chief of Staff General Thomas White. Justin at 107; *see also* D.N. SPIRES, BEYOND HORIZONS: A HALF CENTURY OF AIR FORCE SPACE LEADERSHIP 54 (rev'd ed., 1998) [hereinafter SPIRES]. The third view represents the most complete use of space for military purposes. This view sees space not merely as another medium in which to augment existing military roles, but as an emerging combat environment, or military mission, in its own right. The present author's analysis rests on the conclusion that international law does not prohibit the use of outer space as a complete military theater of operations per se. This assumes that any force used as part of military operations in space is compliant under the *jus ad bellum*. For a discussion of the *jus ad bellum*, *see infra* notes 132 through 140 and accompanying text.

geosynchronous orbit, the warrior is distant from his instruments of war by between 100 and 22,500 miles. When seeking to apply the current laws of war, it appears this phenomenon will require new ways of thinking about a legal regime that has as its purpose the amelioration of human suffering. Beyond simply targeting other combatants, terrestrial infrastructure, or weapons systems, space warfare as it is now most widely conceived contemplates the destruction of unmanned military assets in the air or space environment.[4] Given these factors, it seems that the minimization of human suffering, the chief goal of the laws of war, is already achieved to some extent for space as compared with the other combat environments. From this observation follows the conclusion that with respect to space warfare as it is currently conceived, the law of war will be more applicable to regulation of means and methods of war, than to the protection of human life.[5]

Third, the first implication notwithstanding, the legal analysis of issues unique to space combat, such as the legality of new means and methods of space warfare, cannot rely solely on analogy with legal relationships governing other combat environments. This is due in part to the relative infancy of space warfare and to the recency of its technology. To a certain extent, the international regulation of space combat will evolve only *subsequent* to State action making such combat an imminent possibility.[6] Because the law governs actual social relations and not theoretical abstractions, and because there have been no reported or anticipated cases of actual space combat, conclusions about legal restrictions on such combat must begin tentatively. This is not to abandon hope of outlining contours of the legal regulation of space combat

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[4] The unmanned assets used in outer space are obvious–satellites and missiles. Unmanned assets used within airspace include unmanned aerial vehicles (UAVs), currently used for surveillance, as well as missiles either headed for or from space or used entirely within airspace. *See generally* JEFFREY N. RENEHAN, UNMANNED AERIAL VEHICLES AND WEAPONS OF MASS DESTRUCTION: A LETHAL COMBINATION? 5-13 (1997) (provides helpful discussion of UAVs and remotely piloted vehicle technologies).

[5] This is to say that as long as space warfare is prosecuted through unmanned missions against assets wholly within the space environment, that portion of the law of war traditionally known as "Hague Law" will govern space warfare more readily than that portion known as "Geneva Law." For a discussion of "Hague Law," *see infra* notes 188 through 207 and accompanying text. For a discussion of "Geneva Law," *see infra* notes 208 through 219 and accompanying text.

[6] Professor Schmitt has pointed out that on rare occasions, international law has sought to outlaw the deleterious effects of certain anticipated technologies. In this regard he cites the ban on blinding laser weapons, adopted before such weapons had ever been used in military operations. "Much more frequently, however, law has proven *reactive*. Indeed, in the twentieth century, codification efforts have followed major wars in almost lock-step fashion." Michael N. Schmitt, *Bellum Americanum: The U.S. View of Twenty-First-Century War and Its Possible Implications for the Law of Armed Conflict*, *in* 71 INTERNATIONAL LAW STUDIES, THE LAW OF ARMED CONFLICT: INTO THE NEXT MILLENIUM 389 (Michael N. Schmitt & Leslie C. Green, eds., 1998), *reprinted in* 19 MICH. J. INT'L L. 1051 (1998) [hereinafter Schmitt, *Bellum Americanum*].

under existing international norms; certain points do clearly emerge from the analysis. It is simply to acknowledge realistically the limitations of such an inquiry at this time. States faced a similar dilemma in the days leading up to World War I with aerial combat. At that time, one could hardly establish firm legal principles in the absence of State practice.[7] As was the case in the 1910s with respect to air warfare, a great deal of original reflection on the implications of space combat is needed today.

This article will examine the intersection of two subsets of public international law as they bear on space warfare: the law of war and the law of outer space. The analysis will focus on the relevant legal issues from the perspective of the United States, currently the most active spacefaring nation on Earth. Because the American vision for space war is the most "developmentally mature,"[8] it is a virtual certainty that U.S. practice will dominate the development of international law limiting the means, methods, and extent of the use of force in space.

Part II presents a historical review of the development of military activity in space. It discusses reactions by the international community to new weapons such as V-2 rockets, cruise missiles, intercontinental ballistic missiles, and nuclear devices. It also examines the history of U.S. military satellite development. This part also presents aspects of existing and foreseeable technology for armed conflict within and from outer space.

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[7] As Geoffrey Best puts it, "there was no international law on aerial warfare before the turn of our century. The Hague Conferences [1899 and 1907] gingerly laid a few foundations. . . . but the terms used were soon discovered to be archaic, and vital questions had been begged." G. BEST, WAR AND LAW SINCE 1945 199 (1994). It will be difficult to avoid similar mistakes as States contemplate moving into uncharted legal territory once again. Any attempt to depict the future in plausible terms is fraught with many challenges. The following three challenges, taken from a fascinating Air Force study on future concepts, capabilities, and technologies in the year 2025, certainly apply to any attempt to envision a future law of war and the conditions necessitating it:

> First, one runs the risk of assuming that because we *can* do something, we *will*. In this case technology drives planning, not the reverse. Second, we straight-jacket the future with today's assumptions. That is, we focus on an array of problems and possibilities that are too narrow compared to the array we actually will encounter. A third problem is the reverse of the previous one. Here, we are too expansive and imagine far more than we or the world are in fact capable of accomplishing in the time frame under review.

J.W. Kelly, *Executive Summary, in* AIR FORCE 2025 6 (1996) [hereinafter AIR FORCE 2025].

[8] Schmitt, *Bellum Americanum*, *supra* note 6, at 390. Numerous commentators, including senior military officers, have widely termed Operation Desert Storm the first space war. *See, e.g.*, R. Saltus, *Air Force says it Might Have Won the War in 2 More Weeks*, BOSTON GLOBE, Apr. 5, 1991, at 10; C. Covoult, *DESERT STORM Reinforces Military Space Directions*, 134:14 AV. WK. & SPACE TECH., Apr. 8, 1991, at 42.

Parts III-V consider international law applicable to space warfare. Part III analyzes international law pertaining to armed conflict and distinguishes between the *jus in bello* and the *jus ad bellum*. Further, Part III outlines the key principles derived from treaties and customary international law and clarifies that "law of war," "law of armed conflict," and "humanitarian law" are phrases that have come to be largely synonymous with each other. Part IV examines the five multilateral space treaties comprising the *corpus juris spatialis*, and highlights key passages of relevance to space warfare. Part V considers related authorities such as the Limited Nuclear Test Ban Treaty, Anti-Ballistic Missile Treaty, Antarctic Treaty, and the United Nations Convention on the Law of the Sea, as well as three United Nations General Assembly (U.N.G.A.) Resolutions. Though not regulating outer space activity per se, the treaties are relevant either because of inherent parallels they have to the regulation of outer space, or because they contain specific provisions limiting space activities.

Part VI applies the legal regime governing international armed conflicts to space warfare. Here, the article examines the bases on which the law of war applies to outer space. In doing so, the article suggests that the process by which the law of war was applied to the last new combat medium, air, serves as a model for the likely development of the international regulation of space warfare. Part VI discusses problems of definition within the *corpus juris spatialis* that challenge any effort to apply the law of war to space combat. It further outlines U.S. national and military space policy and highlights the role that State law of war manuals might play in the future development of restrictions on space warfare. Part VI then briefly considers information warfare, a phenomenon heavily reliant on space assets and one of growing concern to the U.S. military.

Part VI also addresses special problems arising from, among other things, the prospect of applying the law of war to space warfare. This Part will analyze the significant problem posed by space assets dedicated to uses of both a civilian and military nature. It will also examine the status of assets owned both by belligerent and neutral States, as well as assets owned by opposing belligerents. It will further consider legal problems raised by the military status of astronaut combatants in light of the status conferred on all astronauts under current space law, as well as the question of whether astronauts found in foreign territory must be returned to opposing belligerents in time of war.[9]

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[9] Though several interesting studies consider the possibility of warfare with extra-terrestrial forms of intelligent life, such consideration is far beyond the scope of this article. Such analyses also exceed the scope of international law proper. Nonetheless, these works often make useful observations about future space weaponry and the difficulty of scientific prediction. For example, one sober, scientifically-respectable work, considering the technological preconditions for successfully defending against alien attack, distinguishes this project from that of mere science fiction, and points out the importance of allowing authors free rein in speculating about future technologies.

Part VI concludes by examining whether proposed rights of innocent passage through foreign airspace for the purpose of accessing outer space will factor in the future regulation of means and methods of space warfare.

II. THE MILITARY ASCENT TO SPACE

> We will engage terrestrial targets someday–ships, airplanes, land targets–from space. We will engage targets in space, from space. . . . [The] missions are already assigned, and we've written the concepts of operations.[10]
>
> General Joseph W. Ashy, USAF (1996)

In most respects, the history of mankind's ascent to space is a history of the militarization[11] of outer space. A review of this history, along with a basic

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> Suppose an observer of the Wright brothers' [sic] memorable first flight at Kitty Hawk had been given the assignment of foretelling what aviation would be like seventy or so years later. Had he envisaged the wide-bodied jet or the supersonic transport he would have been absolutely correct. He would also have been laughed to scorn by his contemporaries at the time. Had he merely enlarged the Wright brothers' [sic] frail biplane into some bigger, stronger thing with umpteen engines and several sets of wings, chances are he would have been considered a true visionary even though his projected creation might be more akin to a flying bird-cage.

J.W. MACVEY, SPACE WEAPONS SPACE WAR 80 (1979). *See also* D. LANGFORD, WAR IN 2080: THE FUTURE OF MILITARY TECHNOLOGY (1979) [hereinafter LANGFORD].

[10] W.B. Scott, *USSC Prepares for Future Combat Missions in Space*, 145:5 AV. WK. & SPACE TECH., Aug. 5, 1996, at 51. General Ashy served as the Commander, United States Space Command [hereinafter USSPACECOM], Air Force Space Command, and the North American Aerospace Defense Command from September 1994 to August 1996.

Providing another in a series of observations on the military "operationalization" of outer space, General Ashy later predicted that "the relatively high percentage of space force capabilities devoted to a supporting role will change to a 'supported' role. In other words, future military operations will be supported not only *from* space (as in the first stages of airplane use), but also within and to space." J.W. Ashy, *Space Operations and Organization: Some Thoughts About the Future*, 146:16 AV. WK. & SPACE TECH., Apr. 16, 1997, at 56.

[11] The term "militarization," as applied to outer space, should not be confused with "weaponization." Though there are no authoritative international definitions of either term, the former refers to "the use of outer space by a significant number of military spacecraft." I.A. Vlasic, *Space Law and the Military Applications of Space Technology, in* PERSPECTIVES ON INTERNATIONAL LAW 386 n.6 (N. Jasentuliyana, ed., 1995) [hereinafter Vlasic, *Space Law and Military Applications*]. Such activity may be non-aggressive and scientific in nature, or aggressive and hostile. It may or may not involve the use of weapons, though the contrasting term weaponization is meant to suggest that by itself, the term militarization as applied to space does not necessarily include the presence of weapons. The term weaponization "refers to the placing in outer space for any length of time any device designed to attack man-made targets in outer space and/or in the terrestrial environment." *Id.* Though not necessarily so, the

familiarization of current and potential implements of space warfare, provides the requisite context from which the analysis herein can proceed to legal considerations related to the weaponization of space. Among other things, an understanding of technical space developments provides insight into the way international legal norms have developed. As discussed more fully in Part III, while the means by which States may lawfully attack each other's assets and personnel within space remains partially proscribed, the law has condoned the non-aggressive military use of space for decades.

A. Origins and Evolution of Space Militarization

1. Missiles and Rockets

Space warfare, as any other use of outer space, requires access to the space environment. That access requires the use of missiles and rockets, later termed "boosters" in view of their utility as launch vehicles for spacecraft. As for most other segments of space technology, rockets[12] were first developed for use by military forces. Matte notes the likelihood that "as early as 3000 B.C. the Chinese had developed rockets for, among other things, use in warfare."[13] It would be almost 5000 years however before rockets became a major instrument of warfare.

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term implies the maintenance and use of such weapons by military forces. Thus, though conceptually distinct, weaponization should generally be conceived as a form of militarization.

[12] Rockets can be distinguished from missiles essentially in that the latter possess superior navigational technology, making them more accurate for striking targets. Otherwise, the following definition of rocket could apply to both: "A vehicle that can operate outside Earth's atmosphere, because it carries its own oxidizer, as well as fuel." JOHN M. COLLINS, MILITARY SPACE FORCES: THE NEXT 50 YEARS 159-60 (1989) [hereinafter COLLINS, MILITARY SPACE FORCES].

[13] N.M. MATTE, SPACE ACTIVITIES AND EMERGING INTERNATIONAL LAW 13 (1984) [hereinafter MATTE, SPACE ACTIVITIES]. Matte further observes that "[m]ilitary use has given the greatest impetus to modern rocket technology." *Id*. Durch and Wilkening trace the rocket's history as follows:

> The military rocket is a device whose pedigree is obscure. Though many credit the Chinese with their first use in the thirteenth century, there is some indication that the formulae for the propellants used in those rockets may have come to China from Europe. On the other hand, the Mongol expansion of the middle thirteenth century may have transported Chinese technology westward. That same expansion brought rocketry to India, where it was encountered by the British as early as 1750. Indian war rockets were used primarily to spook cavalry (in effect, as early jamming devices), and at that they were apparently effective.

W.J. Durch & D.A. Wilkening, *Steps Into Space, in* NATIONAL INTERESTS AND THE MILITARY USE OF SPACE 17 (W.J. Durch, ed., 1984) [hereinafter Durch & Wilkening].

It was German ingenuity that first applied rocket technology to large-scale military combat use.[14] At the Peenemunde experimental site on the Baltic coast, Germany constructed the famous V-2 ("Vergeltungswaffe Zwei") rocket.[15] Making its first flight in October of 1942,[16] the rocket stood over 13 1/2 meters high, weighed 15,300 kg, had a range of 322 km,[17] and was propelled by an engine producing more than 800,000 horsepower.[18] The rocket used a turbo fuel pump generating pressure at 300 pounds per square inch while pumping 50 gallons (189.5 liters) of fuel per second.[19] For guidance and control, the most difficult technical feat, the rocket relied on gyros that only partially compensated for wind and other destabilizing factors in flight. Nonetheless, the V-2 represented a fearsome weapon to which there was no known defense. It also ushered in one of the most significant revolutions in military weaponry.[20]

Following the war, under "Operation Paperclip" the leading German rocket scientists were captured for further work in the U.S. With their expertise, the U.S. began reconstructing the essence of V-2 technology for the development of more advanced rockets. This work, together with experience gained from the 1930s and 1940s studies and experiments at the California Institute of Technology under Dr. Theodore Von Kármán, contributed to Project MX-774–later to become the Atlas missile, a research and development

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[14] David Spires points out that following World War I, Germany was interested in bombardment rockets for its army that was "sorely constrained by the Versailles Treaty." SPIRES, *supra* note 3, at 5. Although the Treaty of Versailles effectively disarmed Germany by forbidding the development of heavy artillery and poison gas, it did not constrain all potential weapons such as the rocket. In 1919, few thought of it as practical weapon of war. Durch & Wilkening, *supra* note 13 at 17. Following the Nazi rise to power in the early 1930s the Treaty was repudiated outright. However, the research into military rocketry continued as the merits of the potential weaponry became clearer.

[15] In popular parlance, the "V" stood for "vengeance" and the "2" represented the second rocket-type fielded by the German army. The first model, the much smaller V-1, was produced by the German Luftwaffe as an aerodynamic pulse-jet "cruise" missile. Although the big rocket was known to technical specialists as the A-4, V-2 is the more common designation that is familiar to most observers of the German rocket program (the "Wehrmacht" program). The V-2's three predecessor models began in 1933 with the A-1 and ended in 1936 with the A-3. German scientist von Braun would later describe the A-1 as taking 1 1/2 years to build and 1/2 second to blow up. T.A. HEPPENHEIMER, COUNTDOWN: A HISTORY OF SPACE FLIGHT 15 (1997) [hereinafter HEPPENHEIMER].

[16] *Id*. at 4

[17] SPIRES, *supra* note 3, at 5.

[18] HEPPENHEIMER, *supra* note 15, at 22.

[19] *Id.* at 23. For this purpose, the German scientists used modified firefighter's pumps which also required simple construction, fast action, very high flow rate, and constant delivery pressure.

[20] Indeed, Wernher von Braun termed its capture by the U.S. "one of the greatest technical prizes in history." W. VON BRAUN & F. ORDWAY III, HISTORY OF ROCKETRY AND SPACE TRAVEL 117 (3rd ed., 1975) [hereinafter VON BRAUN & ORDWAY].

effort aimed at creating a 5,000 mile range intercontinental ballistic missile.[21] General Henry Arnold, chief of the U.S. Army Air Corps just prior to its establishment as the U.S. Air Force in 1947, predicted that such a weapon "is ideally suited to deliver atomic explosives, because effective defense against it would prove extremely difficult."[22] Little did General Arnold know that such defenses would continue to prove extremely difficult through 2000 and beyond.[23]

In the U.S., missile research and development competed directly for precious funding with long range bombers. "As with satellite proposals, initial postwar interest in long-range guided missiles soon succumbed to an Air Force policy that relied on strategic bombers carrying air-breathing missiles."[24] Nonetheless, missile advocates kept sufficient interest engaged to fund development of the Redstone, Jupiter, and Juno missile programs at the U.S. Army's Redstone Arsenal.[25] In addition to various sounding rocket[26] and cruise missile programs,[27] and the Thor Intermediate Range Ballistic Missile

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[21] I M.J. MUOLO, SPACE HANDBOOK: A WAR FIGHTER'S GUIDE TO SPACE 3 (1993) at 3 [hereinafter MUOLO]. Although the U.S. cancelled the project in 1947, it was reinstated in 1951 and has "changed little in over 40 years. . . . Significant advances in its capability and adaptability are reasons the Atlas has become the 'DC-3' of space launch vehicles." *Id.* at 126-27.

[22] Quoted in SPIRES, *supra* note 3, at 10.

[23] For a discussion of missile defense and the legal regime regulating it, see *infra* notes 447–463 and accompanying text.

[24] SPIRES, *supra* note 3, at 17. Until the early 1950s, the early missile advocates were forced into a form of circular reasoning:

> missiles seemed too challenging technologically, but no funds could be spent on solving the technological dilemmas; so the problems would go unresolved and the missile would remain 'impossible.' To questions about the logic of budgeting for missile programs, the answer always seemed to be the dogmatic response: 'the time is not right' for an expanded program.

Id. at 21.

[25] At least four factors account for the change in attitude by the U.S.: first, news that the Soviets had successfully detonated an atomic bomb in August 1949; second, communism's triumph in China; third, reports of Soviet advances in missile technology; and fourth, the outbreak of the Korean war in June 1950. *Id.* at 22, 23.

[26] Examples include the WAC Corporal, Aerobee, and Viking. Of these, the WAC Corporal became "the first man-made object to enter extra-terrestrial space" having been launched as a second stage from a V-2 to a height of 250 miles. *Id.* (quoting F. Malina's paper "Origins and First Decade of the Jet Propulsion Laboratory" at 60).

[27] Early cruise missiles included the Snark, the first intercontinental cruise missile, and the Navaho. The latter traveled to its target under "ramjet" power, achieving speeds in excess of Mach 3. Ramjet technology utilizes a process of "ram" compression at supersonic speeds in order to avoid the need for jet turbines. The U.S. has used ramjet technology since the 1940s for its Navaho missiles. SPIRES, *supra* note 3, at 21. In addition, the U.S. has used the technology since 1959 for its A-11 and A-12 (later SR-71) reconnaissance aircraft. W.E.

(IRBM), improvements to the original V-2 design soon led to the first operational U.S. Intercontinental Ballistic Missile (ICBM)–the Atlas.[28] Within a few years, the U.S. fielded the even larger and more sophisticated Titan missile,[29] evolved versions of which are still widely in use today both as ICBMs and commercial space boosters.[30]

Following World War II, the Soviet Union captured its share of German scientists as well. Using the V-2 as its point of departure, the U.S.S.R. did more than simply build copies of the weapon, it put the rocket back into

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Burrows, *The Oxcart Cometh, And Goeth at Mach 3.2*, 13:6 AIR & SPACE, Feb./Mar. 1999, at 68.

In the years following WWII, the threat of nuclear exchange made the small, slow cruise missiles ineffective as an intercontinental delivery system as compared to ballistic missiles.

> The ICBM's can travel thousands of miles along arcs that take them hundreds of miles out into space; their trajectories, once determined during the interval that the motors are in operation, are thence affected only by gravitational forces and by air resistance during their exit from and re-entry into the atmosphere.

VON BRAUN & ORDWAY, *supra* note 20, at 121. Cruise missiles could not compete with this capability for intercontinental application.

[28] The Atlas contained significant performance enhancements that allowed for it to leave earth's atmosphere and then send an independent warhead back to earth. These included housing its liquid fuel within the rocket's skin, and making the warhead separable from the rocket so the latter could avoid the design features requiring survivability upon reentry.

[29] The Titan was originally conceived as a backup program to the Atlas. The two programs were developed simultaneously in order to save time in countering the increasing perception of Soviet missile superiority. In 1953, Assistant Secretary of the Air Force for Research and Development, Trevor Gardner, became the champion of ICBM development in the U.S. having "made it his mission in public life to convince the government that the nation must pursue a crash program to develop an operational Air Force ICBM or face nuclear disaster." SPIRES, *supra* note 3, at 31. Gardner's technological evangelism proved so successful, that by the fall of 1955, President Eisenhower designated the Atlas ICBM the "highest national priority" weapons system. *Id.* at 35. Management for the crash missile program fell to Gardner protégé Brigadier General Bernard Schriever, a man who "used his intelligence, patience, and superb negotiating skills with military, government and private industry leaders to become an effective advocate for missile and space systems causes." *Id.* at 33.

[30] The complete family of Titan missiles includes several versions: I (1959); II (1962); Gemini (1965); IIIA (1964); IIIB (1966); IIIC (1965); IIID (1971); IIIE (1974); 34B (1975); 34D (1982); IISLV (1988); III (1989); IV (1989). P. CLARK, JANE'S SPACE DIRECTORY, 1997-1998 277 (13th ed., 1997) [hereinafter JANE'S]. In addition to the Atlas and Titan missiles, the Department of Defense uses a variety of other missile systems, principally as spacelifters rather than weapons systems, including the SCOUT, Pegasus, Delta, and Space Transportation System ("Space Shuttle"). MUOLO, *supra* note 21, at 121-34. Additional missiles developed since World War II for weapons use include the Polaris and Poseidon (both sea-launched), Pershing, and the Minuteman.

production within the Soviet zone of occupation in Germany.[31] Unlike the U.S., the Soviet Union did not have a huge fleet of long-range bombers, thus the prospect of ICBM development did not have the same bureaucratic obstacles from a competing weapons platform. What it did have were relatively primitive atomic weapons that were bulky and required tremendous lift to propel them across an intercontinental range. They proceeded to create just such heavy-lift launch vehicles.[32] The first Soviet ICBM, bearing the designation "SS-6," was launched in August 1957, a full fifteen months before the first Atlas launch. It was an SS-6 that carried the world's first artificial satellite, Sputnik I, into orbit on October 4, 1957.[33]

2. Nuclear Devices

Following the advent of rocketry, creating a weapon of ultimate destructive capability was just a matter of time for the leading scientific minds. The conventional explosives used by the V-2 rockets simply mimicked the effects attainable by means of air-dropped bombs. These contained the equivalent of one ton of TNT. By contrast, the earliest nuclear weapons contained the equivalent of 20,000 tons (20 kilotons).[34] Later versions would deliver the equivalent of 15,000,000 tons (15 megatons) of TNT and more.[35]

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[31] HEPPENHEIMER, *supra* note 15, at 60. Though the U.S. got to Germany first, the Soviets were first to Peenemunde. By the time the Soviets got there, most of the documents and personnel had been removed by the Germans. Nonetheless, there was enough left for the Soviets to use productively, including middle and lower-level staffers familiar with the V-2 rocket research and development. Though the codename "Operation Paperclip" for the U.S. roundup of German scientists, documents, and hardware was revealed after the war, as was the British "Operation Backtrack," the Soviet codename was never made public. M. STOIKO, SOVIET ROCKETRY: PAST, PRESENT, AND FUTURE 71 (Holt, Rinehart & Winston, 1970).

[32] The implications from this early Soviet resolve were enormous. As von Braun later observed, "[t]he decision [to proceed with the ICBM before the U.S.] not only gave [the Soviets] a significant edge in ballistic missile technology for years, but was also a great factor in their leadership in space exploration." VON BRAUN & ORDWAY, *supra* note 27, at 140.

[33] The first U.S. satellite, Explorer 1, was launched atop a Juno 1 on Jan. 31, 1958. *See id.* at 160.

[34] LANGFORD, *supra* note 9, at 45. The first large-production nuclear weapon utilized a chain-reaction process known as fission, by which the mass of a uranium or plutonium atom is converted to energy. Langford notes that as between uranium and plutonium, the latter is easier to use for fission weaponry. *Id.* at 47. The nuclear weapon dropped on Hiroshima on Aug. 6, 1945 ("Little Boy") was a uranium bomb that was remotely detonated at a height of 570 meters over the city. "Detonation height determined how large an area would be damaged. . . . A bomb detonated too high would expend its energy blasting thin air; a bomb detonated too low would expend its energy excavating a crater. It was better to be low than high." R. RHODES, THE MAKING OF THE ATOMIC BOMB 631 (1986) [hereinafter RHODES]. On Aug. 9, 1945, a plutonium bomb ("Fat Man") was dropped on Nagasaki with an estimated 22 kiloton yield.

[35] LANGFORD, *supra* note 34, at 49. It bears noting that nuclear weapons are those characterized by the unique interaction of particles within an element's nucleus. Whereas the

Putting the matter plainly, U.S. President Truman would write in his personal diary, "we 'think' we have found a way to cause a disintegration of the atom."[36]

These early devices weighed five tons and required a rocket of several hundred tons to carry one weapon to Moscow–too heavy to be practically effective.[37] However, with the advance of the ICBM came the advance of the nuclear device. It soon became small enough to launch inside the nose-cone of a rocket.[38] Thus, the lightening speed of the rocket was mated to the overwhelming power of the nuclear weapon. And given its desirability for military advantage, it also proliferated.

> Between 1945 and 1992, the United States went on to manufacture a total of 70,000 nuclear weapons, some 10,500 of which are still in service. The Soviet Union produced 55,000, of which 15,000 are currently active. Britain reportedly made 834 nuclear warheads, France 1,110 and China 600. According to various reports of unknown reliability, Israel may have made 200, India twenty, Pakistan between four and seven. South Africa admitted it had produced six devices before giving up its programme; North Korea may have one or two.[39]

It was not until 1957 that the first nuclear detonations occurred in space.[40] Not only did this development become a catalyst for passage of a

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fission chain-reaction begins with the acquisition of a stray neutron particle which then spreads from nucleus to nucleus, the fusion reaction requires the fusing of two nuclei. Because of the natural magnetic repulsion of hydrogen nuclei, the two must be forcibly fused to begin the fusion reaction. This is accomplished by heating the nuclei to such a degree that their resulting speed yields collisions of sufficient force to achieve the fusion. Thus the term "thermonuclear" weapons. The triggering element used to generate the tremendous heat needed for fusion is a fission reaction. Once the fusion begins, it creates its own chain-reaction. By surrounding the entire explosive core with U-238, scientists discovered that the neutrons lost in the fusion reaction could be used to fuel a second fission reaction. Thus, the nuclear weapons most widely stockpiled make use of a fission-fusion-fission process. *Id.* at 49. The first thermonuclear device, carrying an explosive force of 10 megatons of TNT was detonated at the Eniwetok atoll in 1952 (also spelled Enewetak). In 1954, a 15 megaton device was detonated at the Bikini atoll. *Id.*

[36] RHODES, *supra* note 34, at 690

[37] HEPPENHEIMER, *supra* note 15, at 47. By contrast, the V-2 weighed a mere 14 tons.

[38] One Minuteman III ICBM is armed with the equivalent of 84 first-generation nuclear weapons. Rhodes, *supra* note 36, at photograph 106 (caption).

[39] D. SHUKMAN, TOMORROW'S WAR: THE THREAT OF HIGH-TECHNOLOGY WEAPONS 25 (1996) [hereinafter SHUKMAN].

[40] A Tass news agency announcement of Aug. 27, 1957 which reported the successful test of the Soviet ICBM also included reference to "a series of explosions of nuclear and thermonuclear (hydrogen) weapons … set off at great altitudes." M.S. MCDOUGAL, ET AL., LAW AND PUBLIC ORDER IN SPACE 389 n.7 (1963) [hereinafter MCDOUGAL, ET AL.]. Between Aug. 27, 1957 and Sept. 7, 1958, the U.S. exploded three atomic bombs over the South Atlantic at a reported altitude of between 200 and 300 miles. During the summer of 1962 in the Pacific at similar altitudes, the U.S. exploded weapons "in the hydrogen bomb range." *Id.*

treaty limiting nuclear weapons testing (Limited Nuclear Test Ban Treaty),[41] but it brought a plea from the Soviet Union that such tests not endanger the safety of Soviet cosmonauts. The U.S. responded to the Soviet concern with the assurance "that no activities were contemplated which could have harmful effects upon the Soviet spacemen."[42] Following passage of the Limited Nuclear Test Ban Treaty in 1963, such detonations in space were no longer lawful and simple verification measures made them easily detected.[43]

3. Satellites

In many ways, the evolution of satellite technology follows the evolution of missile technology. Without the latter, the former had no way of reaching outer space. Thus, the early battles for funding of satellite technology in the DOD and in Congress often pitted satellite and missile research against conventional weaponry.[44] Once funding for ICBMs came through however, it was soon realized that rockets more powerful than an ICBM might succeed in launching satellites.[45]

Though early scientists speculated on the possibility of artificial satellites in earth orbit, Project Rand, under the Douglas aircraft company,[46] demonstrated the feasibility of such a feat in its report of May 2, 1946. Report number SM-11827, "Preliminary Design of an Experimental World-Circling Spaceship," not only provided 236 pages and eight appendices of detailed technical theory, but it spawned numerous subsequent reports on the feasibility of satellite design, launch, and reentry. In simple terms, the report declared that "[i]f a vehicle can be accelerated to a speed of about 17,000 m.p.h. and aimed properly, it will revolve on a great circle path above the Earth's

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In a Nov. 3, 1958 report to the U.S. President, three possible military uses of a high-altitude nuclear detonation were identified: "The high energy radiation including particles from the explosion produces effects on space; the whirling high energy electrons generate radio noise; and the delayed radiation from the fission products can affect radio transmission." P.B. STARES, THE MILITARIZATION OF SPACE: U.S. POLICY, 1945-1984 108 (1985) [hereinafter STARES, THE MILITARIZATION OF SPACE].

[41] *See infra* notes 436–446 and accompanying text.

[42] MCDOUGAL, ET AL., *supra* note 40, at 45. The Soviet note and U.S. reply are reprinted in N.Y. TIMES, Aug. 12, 1962, at 22.

[43] The U.S. "Vela Hotel" series of satellites were launched in 1963 and 1964 to scan above the horizon and detect nuclear tests in space. They were, in the view of one military space historian, "one of the most successful Air Force space projects." CURTIS PEEBLES, HIGH FRONTIER: THE U.S. AIR FORCE AND THE MILITARY SPACE PROGRAM 41 (1997) [hereinafter PEEBLES, HIGH FRONTIER].

[44] SPIRES, *supra* note 3, at 35. In time, "the relationship between satellites and missiles had become better understood as rockets with sufficient thrust soon would be able to launch the heavier satellites. …"

[45] HEPPENHEIMER, *supra* note 15, at 90.

[46] Project Rand later became the Rand Corporation, a federally funded research and development corporation serving as the primary technical consultant to the U.S. Air Force.

atmosphere as a new satellite. The centrifugal force will just balance the pull of gravity."[47] The report subsequently predicted that "[t]he achievement of a satellite craft by the United States would inflame the imagination of mankind, and would probably produce repercussions in the world comparable to the explosion of the atomic bomb."[48]

The earliest military satellite program focused on a reconnaissance mission. In time, the mission for reconnaissance satellites in the U.S. would be shared between the military and the intelligence establishment. Systems such as the venerable Corona series were launched in early 1959 amid great secrecy and were controlled by the U.S. Central Intelligence Agency.[49] Though the focus of public U.S. military space activity remained in the Department of Defense, it was determined that reconnaissance missions from space could not be publicized.

Indeed, the Corona program was so sensitive that it was given the code-name "Discoverer" to establish a cover. The launches were said to contain "a scientific project that conducted biomedical research and other experiments in space."[50] As Corona began collecting Soviet imagery during the Eisenhower administration, the DOD established the Office of Missile and Satellite Systems with oversight for all national reconnaissance activities, later to become the National Reconnaissance Office (NRO). President Eisenhower's successor, perpetuated these basic organizational changes, including safeguarding the very existence of the NRO as a State secret.[51] Indeed, under

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[47] RAND CORPORATION, PRELIMINARY DESIGN OF AN EXPERIMENTAL WORLD-CIRCLING SPACESHIP (1998) (from the abstact; Report Number SM-11827, May 2, 1946).

[48] *Id.* at 2.

[49] Launched as a stop-gap measure for strategic reconnaissance between the termination of U-2 high altitude reconnaissance aircraft and the WS-117L system, the Corona system remained operational from its first flight on Feb. 28, 1959 through June 1972. The Air Force was nominally deemed a joint venture partner of the Corona program, which required mid-air recovery of film imagery taken by the orbiting camera. For a thorough account of the recently-declassified Corona program, see CURTIS PEEBLES, THE CORONA PROJECT: AMERICA'S FIRST SPY SATELLITES (1997) [hereinafter PEEBLES, THE CORONA PROJECT]. The WS-117L program, standing for "Weapon System 117L," led to development of the first military satellite, the Advanced Reconnaissance System. The system used an electro-optical television-type imaging system for its reconnaissance capability. The Air Force established the requirement for such a system on Nov. 27, 1954, followed by a formal General Operational Requirement in March 1955 which called for a system providing an image resolution of no larger than 20 feet. SPIRES, *supra* note 3, at 36-37

[50] PEEBLES, HIGH FRONTIER, *supra* note 43, at 13.

[51] The National Reconnaissance Office was considered so secret

> that even in classified documents outside the special security controls established for satellite photos and data, the words 'National Reconnaissance Office' and 'National Reconnaissance Program' were not to be used. Instead, the phrase 'Matters under the purview of DOD TS 5105.23' would be given. (This was the directive which established the NRO.) It would be

the Kennedy administration "the U.S. government no longer acknowledged that satellites were used for reconnaissance–a policy that remained in effect until 1978."[52]

Despite its continuing protection of national security matters, the NRO has recently revealed some of its methods and assets, including a $1.5 billion state-of-the-art Lacrosse imaging satellite.[53] The fifteen ton, school bus-sized satellite was developed in 1986 to track the movement of Warsaw Pact weaponry. Producing images to resolutions of 1 meter, the system uses radar technology to obtain images through clouds, foliage, or darkness.[54] As of 1997, the NRO maintained two Lacrosse satellites on-orbit with two more planned. In addition to these, the NRO maintains the KH-11 ("Keyhole") satellite system which, using optical sensors, is reported to produce resolutions of six to twelve inches (15 to 30 cm).[55]

Reconnaissance was not the only military mission for early satellites. Almost simultaneously with WS-117L, and indeed as an outgrowth of it, the U.S. military was developing a missile warning system to monitor the launch of Soviet ICBMs. The first such program, MIDAS ("missile detection and alarm system"), was troubled with false alarms and overall system unreliability virtually from its operational beginning in 1960.[56] Despite some successful test detections, the system was replaced in the early 1970s by geosynchronous

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> thirty-two years before the initials 'NRO' were spoken in public by a U.S. government official.

PEEBLES, THE CORONA PROJECT, *supra* note 49, at 96.

[52] PEEBLES, HIGH FRONTIER, *supra* note 43, at 14.

[53] Upon release of videotape depicting the satellite, AVIATION WEEK & SPACE TECHNOLOGY declared that it used "the most advanced technology employed by any U.S. military or civilian unmanned spacecraft." C. Couvalt, *Secret Relay, Lacrosse NRO Spacecraft Revealed*, 148:12 AV. WK. & SPACE TECH., Mar. 23, 1997, at 27.

[54] *Id.* With its solar array and still-secret radar antenna, the satellite is actually much larger than a bus.

[55] *Id.* at 28. For obvious reasons, the capability of military technology exceeds that which is commercially available. This continues to challenge military research and development however with ever-increasing improvements to commercial remote sensing capability. In April 1999, the Space Imaging Corporation aspired to exceed Russia's Spin-2 capability of two meters. The Ikonos 1 satellite boasted digital black and white images to resolutions of one meter. M. Mecham, *Commercial Imaging to Enter 1-Meter Era*, 150:17 AV. WK. & SPACE TECH., Apr. 26, 1999, at 84. After launch on Apr. 27, 1999, the satellite was lost when an electrical malfunction prevented the satellite from separating from its booster. *Athena/Ikonos Loss Caused by Open Circuit*, 150:24 AV. WK. & SPACE TECH., June 14, 1999, at 82; C. Covault, *Reviews Advance As New Satellite Fails*, 150:21 AV. WK. & SPACE TECH., May 24, 1999, at 61. The subsequent launch of a successor satellite on Sept. 3, 1999 now makes one meter resolution from space available to any purchaser.

[56] MIDAS was originally designated "Subsystem G" in the WS-117L program before becoming its own separate system. PEEBLES, HIGH FRONTIER, *supra* note 43, at 33. Previously, there were U.S. systems used to track space objects, however none were focused on the distinctive heat signature left by an ICBM or IRBM.

satellites of the Defense Support Program (DSP) which proved to be "highly successful," offering the President notice of a missile attack within moments of launch.[57] Using an advanced infrared telescope mounted to the spacecraft's front end, the DSP telescope remained focused on earth ready to generate an electronic signal upon detection of a missile launch. Its use continues today.[58]

Beyond these, other significant satellite systems were developed to carry military communications,[59] to provide weather intelligence,[60] and to aid

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[57] *Id.* at 38. In 1991, DSP satellites alerted coalition forces to the launch of Iraqi Scud missiles–the first use of U.S. missile warning satellites in combat. *Id.* at 39.

[58] Currently in development is the Space Based Infrared System (SBIRS) which will incorporate the current DSP system. The SBIRS will include much more than an early warning capability. Its operational requirements call for four mission areas: missile warning, missile defense, technical intelligence, and battlespace characterization. Federation of American Scientists, *Space Based Infrared System*, Federation of American Scientists, http://www.fas.org/spp/military/program/warning/sbir.htm (last visited June 28, 2000) (on file with the *Air Force Law Review*). The program originally entailed development of four satellites in GEO and two more in highly elliptical orbits (SBIRS-High), and a constellation of 24 additional satellites in low-earth orbit (SBIRS-Low). The U.S. Air Force recently cancelled a demonstrator project for the SBIRS-Low program citing costs and delays in the SBIRS-High program, which is now scheduled for launch in 2004. Launch of the SBIRS-Low system is set for 2006. R. Wall, *USAF Cancels SBIRS-Low Satellite Demonstrations*, 150:6 AV. WK. & SPACE TECH., Feb. 8, 1999, at 66; R. Wall, *Pentagon Delays SBIRS Launch*, 150:3 AV. WK. & SPACE TECH., Jan. 18, 1999, at 26.

[59] Though the early emphasis for military satellites was on scientific exploration and reconnaissance, interest in a space-based telecommunications network for the military began at least as early as Arthur C. Clarke's 1945 proposal to position three satellites in equidistant geosynchronous orbit (22,500 miles) for near-global communications coverage. Because Clarke first proposed use of the GEO for communications satellites, it is also sometime referred to as the Clarke orbit. G.H. REYNOLDS & R.P. MERGES, OUTER SPACE: PROBLEMS OF LAW AND POLICY 15 (2nd ed., 1997) [hereinafter REYNOLDS & MERGES]. The first communications satellite, Project Score, was launched on Dec. 18, 1958 and carried a tape-recorded Christmas message from President Eisenhower. PEEBLES, HIGH FRONTIER, *supra* note 43, at 44. A subsequent effort, dubbed Project West Ford, relied upon the release of 400 million copper dipoles of 0.7 inch length at an altitude of 2000 miles. The "needles" were to form a 25 to 30 mile wide ring around the earth off of which communications signals could be reflected. After a successful test, the military terminated the program in the face of vigorous scientific and environmental protests. *Id.* at 45. *See also* DELBERT R. TERRILL, JR., THE AIR FORCE ROLE IN DEVELOPING INTERNATIONAL LAW 63-66 (1999). Other systems were used in the 1960s until the Interim Defense Communications Satellite Program (IDCSP), later renamed the Defense Satellite Communications System (DSCS) became operational in 1967. These were followed by second and third generation satellites (DSCS II and DSCS III) providing strategic communications from fixed military installations. These systems have been updated by the MILSTAR system, "a totally secure, jam free system; its terminals can be carried in a suitcase and set up in two and one-half minutes." Donald J. Kutyna, *Indispensable: Space Systems in the Persian Gulf War, in* THE U.S. AIR FORCE IN SPACE 1945 TO THE TWENTY-FIRST CENTURY 103, 117 (R. Cargill Hall & Jacob Neufeld, eds., 1995). For mobile (tactical) communications, the DOD has used systems such as the Lincoln Experimental Satellite (LES), the Tactical Communications Satellite (TACSAT I), and the Navy's Fleet Satellite Communications System (FLTSATCOM). PEEBLES, HIGH FRONTIER, *supra* note 43, at 47-50. For a discussion of the legal issues raised by military use of the former International Mobile

navigation. Though assets supporting all three missions are indispensable to combat operations, the U.S. space-based navigation system has now become perhaps the best-known of all military space assets outside military circles. Developed in the 1970s, and declared fully operational on July 17, 1995,[61] the Global Positioning System (GPS) relies on twenty-four operational satellites (with an additional three spares in orbit) in medium-earth orbits in six orbital planes.[62] The basic concept is simple though ingenious:

> [The constellation of satellites flies] in twelve-hour orbits at an altitude of 12,543 miles. Each of them carries an atomic clock for precise determination of time, while ground-based tracking permits each one to know its position with similar accuracy. A ground receiver then accepts signals from the spacecraft in view, learning their positions as well as the exact times when the signals were transmitted. The receiver has its own internal clock, which is not very accurate, but the data from space allows it to synchronize this clock with those of the satellites. The receiver then calculates the length of time each signal has been in transit, traveling at the speed of light. This translates into an accurate determination of distance to each satellite. Through triangulation, the receiver then determines its own location.[63]

The system showed its great value during the 1991 Persian Gulf War by providing for combatants answers to the age-old questions "where am I" and "where am I going," to an accuracy of less than thirty feet.[64] It was also

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Satellite Organization's INMARSAT system, see *infra* Part VI, § E.1. The growth of military dependence on commercial communications systems will only increase the legal and operational issues during times of armed conflict. By 1999, approximately 60% of U.S. military satellite communications traveled over commercial systems. W.B. Scott, *Space Chief Warns of Threats to U.S. Commercial Satellites*, 150:15 AV. WK. & SPACE TECH., Apr. 12, 1999, at 51 [hereinafter Scott, *Threats to U.S. Satellites*].

[60] NASA's Tiros I satellite, launched on Apr. 1, 1960, created a revolution in weather forecasting. However, it could not satisfy military needs for coverage, readout locations, or timeliness. Scott, *Threats to U.S. Satellites*, *supra* note 59 at 52. DOD developed a series of satellites in the 1960s placed in 450 mile polar orbits that became the Defense Meteorological Satellite Program (DMSP). During the Vietnam war, cloud cover imagery from DMSP satellites became the basis of target selection and mission planning. *Id.* at 53. The program's existence was not publicly revealed until 1973. The DMSP has undergone numerous upgrades since its inception, to include sensors detecting temperature, atmospheric moisture, soil moisture, sea state, and ice cover. The DMSP has supported all major U.S. military operations since the Vietnam War. *Id.* at 55.

[61] *Id.* at 59.

[62] *Id.* at 57. *See also* Air Force News Service, U.S. Discontinues Selective Availability of GPS to Public, May 2, 2000 (on file with author).

[63] HEPPENHEIMER, *supra* note 15, at 348-49.

[64] W.J. BOYNE, BEYOND THE WILD BLUE: A HISTORY OF THE U.S. AIR FORCE 274 (1998). Because the U.S. made use of the system available to commercial and civil users shortly after the destruction of Korean Airlines Flight 007 by the Soviet Union in 1983, it opened a possible security risk from a military point of view. One nightmare scenario for security analysts is the specter of a "poor man's cruise missile" in the hands of hostile States or terrorists – that is, an

used to guide munitions launched from air, sea, and land-based weapons to their targets providing three-dimensional position and velocity data. This constantly-improving targeting capability will likely be a significant law of war contribution made by GPS. As discussed more fully in the next chapter, the ability to target accurately implies the legal duty to do so. The better GPS accuracy becomes, the higher the burden it will place on its users to distinguish legitimate from illegitimate targets, and to minimize collateral damage. Thus, it will no doubt "change the face of future warfare."[65] Operating on only sixteen satellites in the 1991 war,[66] the system nonetheless proved itself highly useful and will be indispensable to space missions for future conflicts well into the twenty-first century.[67]

B. Present and Potential Technologies Available for Space Combat

To date, there has not been a single reported case of force used in outer space by one nation against another.[68] Nonetheless, given the increasing global reliance on space systems, and increasing militarization of space, its weaponization and evolution into a distinct theater of military operations seems likely. Though technologies applicable for space combat will include a

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old weapon suddenly made extremely accurate by use of GPS. SHUKMAN, *supra* note 39, at 166. As a result, the U.S. initially degraded the accuracy of the primary signal, establishing the difference between a "coarse acquisition code" and the encrypted "precise code," to protect the military advantage the system offers its military and that of its allies. Recent developments associated with the U.S. military's Joint Direct Attack Munition (JDAM) put the required military position accuracy of the system at 3 meters. With growing reliance on the system by foreign and domestic non-military users as well, the potential liability to the U.S. has increased proportionately. B.D. Nordwall, *World Pressure Grows for Regional GPS Augmentations*, 147:22 AV. WK. & SPACE TECH., Dec. 1, 1997, at 66. As of May 1, 2000, President Clinton directed that the DOD provide the undegraded signal for public use. In discontinuing "selective availability," the President stated that future threats could be dealt with by applying selective availability on a regional basis as needed. Air Force News Service, U.S. Discontinues Selective Availability of GPS to Public, May 2, 2000 (on file with author). For a thorough analysis of potential U.S. liability both under domestic and international law, see Jeffrey A. Rockwell, Liability of the United States Arising Out of the Civilian Use of the Global Positioning System (1996) (unpublished LL.M. thesis, McGill University) (on file with author, and the Nahum Gelber Law Library, McGill University).

[65] SHUKMAN, *supra* note 39, at 163 (from a classified Pentagon assessment of the performance of GPS in the Gulf War).

[66] *Id.* at 163.

[67] In Operation Allied Force, the NATO allies made heavy use of GPS for navigation and precision-guided targeting. C. Covault, *Recon, GPS Operations Critical to NATO Strikes*, 150:17 AV. WK. & SPACE TECH., Apr. 26, 1999, at 35. However, heavy military reliance on GPS is a double-edged sword because the system is still extremely vulnerable to jamming. Interference by electronic jamming, or even destruction of part of the system by anti-satellite weaponry, might cripple a military force having abandoned its skills in other forms of navigation. SHUKMAN, *supra* note 39, at 164-65.

[68] Vlasic, *Space Law and Military Applications*, *supra* note 11, at 397, 398.

wide variety of military instrumentalities, the development of space weapons is the most obvious choice. Such weapons can be grouped according to a variety of criteria.[69] They can be grouped by missions intended such as "anti-satellite" and "missile defense," or by method of pursuit such as "boost phase intercept" and "direct ascent."[70] Depending on its characteristics, a space weapon could fit within several different categories at once. One of the most logical means of identification focuses on the weapon's means of destruction as its distinguishing feature. Most probable future space weaponry can be described using this method of identification, including those representative samples discussed in the six categories below.

1. Electromagnetic and Radiation Weapons

Perhaps the quintessential electromagnetic and radiation weapon is the nuclear bomb. Recognizing this, the first anti-satellite (ASAT) weapon system made operational by the U.S. involved a nuclear detonation in space.[71] Though the history and basic functioning of nuclear weapons have been noted previously, it is appropriate to consider briefly their effect as a weapon when detonated in outer space. Given the near-vacuum conditions of space, the range of a nuclear blast in terms of spreading radiation and heat is greatly diminished. In the absence of atmosphere, radioactive fallout cannot occur.[72] Further, the shock waves, violent winds, and intense heat generated by a

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[69] For a discussion of the problem of defining "space weapon," see notes 558–565 and accompanying text.

[70] An example of the latter is the U.S. ASAT Air-Launched Miniature Vehicle (ALMV). First tested against a functioning satellite on Sept. 13, 1985, the ASAT "kill vehicle" was launched aboard a missile from an F-15 for ascent to the target satellite and destruction by impact. "The warhead, or Miniature Vehicle (MV), is an extremely complex and sophisticated device consisting of eight cryogenically cooled infrared telescopes, a laser gyro, and sixty-four small computer-controlled rockets used for final course adjustments before colliding with the target. All this is packed into a 12-by-13 inch casing. After being guided to and released near the target, the Miniature Vehicle homes in on the heat emitted by the satellite and rams into it with sufficient force to destroy it." PAUL B. STARES, SPACE AND NATIONAL SECURITY 99 (1987) [hereinafter STARES, SPACE AND NATIONAL SECURITY]. *See also* C. Covault, *Antisatellite Weapon Design Advances*, 112:24 AV. WK. & SPACE TECH., June 16, 1980, at 243. In terms of destructive classification, the ALMV is a kinetic energy weapon.

[71] Though the previous SAINT ("satellite interceptor") system had been developed, it was never fielded. The latter system, known simply as Program 437, utilized a nuclear warhead launched atop a Thor IRBM from Johnson Island in the South Pacific. With a yield of 1 megaton, the warhead had a kill radius of 5 miles. The U.S. declared the system fully operational on June 10, 1964, and it remained in service or available for speedy redeployment until it was terminated on Apr. 1, 1975. *See* PEEBLES, HIGH FRONTIER, *supra* note 43, at 62-65.

[72] COLLINS, MILITARY SPACE FORCES, *supra* note 12, at 28.

nuclear blast within the atmosphere do not occur in space.[73] As a result, the collateral damage from the effects of heat and blast is fairly easy to confine.[74] Though the local effects in space from such a detonation can be very destructive, the most significant military effect of nuclear blasts in space relates to the creation of an electromagnetic pulse (EMP) in near-earth space where the outer space vacuum contacts the atmosphere.[75]

An EMP is created when "a cascade of gamma rays from any nuclear explosion in space collides with the upper atmosphere."[76] As these gamma rays race nearly instantaneously downward toward the top of earth's atmosphere, resultant charge imbalances create an electrical current that peaks 100 times faster than lightning, and is largely unrelated to the size of the detonation for any yield over a few hundred kilotons.[77] Similar to a lightning strike, the EMP lasts only for a millionth of a second but holds potential for devastation of sensitive circuitry. Unshielded electronics within several hundred miles of the epicenter may be disabled as every unshielded element in its path acts as a conductor. The higher the burst, the larger the area affected in the air and land beneath. A burst at a height of 300 miles (483 km) would affect the entire continental U.S.[78] "Poorly protected satellites and solar power systems in orbit are particularly vulnerable, because risk radii extend hundreds (sometimes thousands) of miles farther in space than in absorbent air."[79]

In addition to the effects of an EMP, "beta particles and gamma rays respectively cause intensive and extensive alterations in the ionosphere."[80] These weaken both radio and radar waves. This can result in high frequency blackouts over broad areas, followed by periods of impaired radio and radar performance.[81] Thus, the disruptive capabilities of a nuclear blast in space hold distinct military advantages.[82] Nonetheless, in addition to legal hurdles, Peebles notes that when first considered for its strategic value, the stationing of

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[73] In a vacuum, winds do not blow and shock waves cannot develop where no medium such as air, water, or earth resists compression. As for heat, the fireballs normally associated with nuclear blasts in the air do not occur above 65 miles (approximately 100 km). *Id.* at 29.

[74] By contrast, collateral damage from initial nuclear radiation "regardless of type, is indiscriminate, … [and] would be difficult to predict and expensive to control." *Id.* at 31.

[75] Such an event was portrayed in the James Bond Hollywood production *Goldeneye*.

[76] COLLINS, MILITARY SPACE FORCES, *supra* note 12, at 29.

[77] *Id.* at 31.

[78] *Id.* at 30.

[79] *Id.*

[80] *Id.* The ionosphere exists from 30 to 500 miles (approximately 48 to 805 km) above the earth's surface. *Id.* at 9.

[81] During a detonation at 48 miles (77 km) altitude on Aug. 1, 1958 over Johnson Island, the U.S. observed the degradation of high frequency radio traffic throughout a region several thousand miles in diameter for a period of approximately six hours. *Id.* at 29.

[82] Indeed the Soviet Union used an array of 64 nuclear tipped anti-ballistic missiles around Moscow as a small-area missile defense system. Code named "Galosh," the system undoubtedly could be converted into an ASAT system. STARES, SPACE AND NATIONAL SECURITY, *supra* note 70, at 96.

a nuclear weapon in space "made no technical or military sense" for at least four reasons, at least some of which are applicable today:

> First, an orbiting weapon required elaborate spacecraft systems, such as retro-rockets to deorbit it, others to guide it, and still others to arm it. Second, all of these integrated systems would have to perform reliably while on orbit for many months if not years, or the bomb became useless. . . . Third, if used in retaliation, such weapons could not be delivered at a moments [sic] notice, but would have to wait at least an orbit or two until the Earth turned beneath it and the intended target [came] into view. Finally, and perhaps most tellingly, if such a weapon were used for a first strike and a partial malfunction occurred as the nuclear bomb moved along its orbit, it might just as easily fall on Buenos Aires as on Washington D.C., or, worse yet, on Moscow.[83]

For these and other reasons, and despite the unquestioned devastating effects for any nation relying on sophisticated electronic infrastructure, a nuclear-triggered EMP attack on the U.S. is deemed unlikely. The Chairman of President Clinton's recent Commission on Critical Infrastructure labeled it "the most remote part of the threat spectrum."[84]

Non-nuclear electromagnetic weapons have also been proposed. A study for the U.S. Air Force analyzing the future of air and space power recently reported that "[t]he technology of high RF [radio frequency] power and large antennas is about to greatly expand."[85] The report concludes that when combined, these innovations will allow for the projection of extremely high power densities, including electromagnetic radiation, over extremely long distances to land, air, and space-based targets.[86] As an example, the report suggests that such a weapon in the geosynchronous orbit could create a six mile footprint on a battlefield which would "blank out" all radar receivers and would damage all unprotected communication sets within that area. The tremendous power envisioned would also allow injection of signals into even heavily shielded communications networks, allowing for "information warfare to be waged at will."[87]

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[83] PEEBLES, HIGH FRONTIER, *supra* note 43, at 59.
[84] J.C. Anselmo, *U.S. Seen More Vulnerable to Electromagnetic Attack*, 147:4 AV. WK. & SPACE TECH., July 28, 1997, at 67.
[85] Ivan Bekey, *Force Projection from Space*, *in* (unnumbered Space Applications Volume) NEW WORLD VISTAS: AIR AND SPACE POWER FOR THE 21ST CENTURY, at 83, 84 (1995) [hereinafter Bekey].
[86] *Id.*
[87] *Id.* at 85. With respect to information warfare, the report gives a number of examples: network viruses, disinformation, memory erasures, and false signals. For a brief discussion of information warfare and its relation to space combat, *see infra* Part VI, § D.

2. Kinetic Energy and Hypervelocity Weapons

Kinetic energy weapons, of which hypervelocity weapons are a subtype, are historically the most common forms of space weaponry. As suggested above, given the tremendous speeds at which objects travel in orbit, on the order of 4.7 miles per second in low-earth orbit, just about anything properly aimed could become a weapon even without the use of an explosive warhead. This is true because such an object's speed, including those of very small masses, gives it tremendous kinetic energy for impact.[88] One U.S. kinetic energy weapon, originally tested as a missile interceptor, could equally serve as an ASAT. Known as the Homing Overlay Experiment (HOE), the weapon, once boosted into space, unfurls a 4.5 meter radial "net" that is wrapped tightly behind the nose sensor. The net increases the lethal radius of the homing and kill vehicle. Successful testing in 1983 and 1984 showed the weapon capable of homing in and destroying a dummy warhead in space using a long-wavelength infrared sensor.[89]

A program currently under development in the U.S. is simply called the "KE ASAT" (kinetic energy ASAT). The system envisions using a large Mylar "shroud" to impact the target object.[90] Though it will disable its target object by force of impact as will many other kinetic energy ASATs, this system is unique in that the shroud is intended to minimize the creation of a large quantity of resulting space debris normally associated with kinetic energy weapon impacts.[91]

The railgun is another type of kinetic energy weapon that accelerates a projectile toward selected targets at hypervelocity speeds. Because the railgun will use electromagnetic forces to accelerate its projectiles, it is an "electromagnetic" weapon of sorts. However, it is distinct from the electromagnetic weaponry discussed above in that the final method of destruction is a kinetic impact rather than an electromagnetic force itself. Testing in the U.S. has resulted in the electromagnetic acceleration of tantalum discs to speeds of eleven kilometers per second.[92] Though not yet developed as a weapon, such railguns could be stationed in outer space.

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[88] For example, a 4,000 pound automobile would have to travel almost 270 miles per hour to equal the kinetic energy of a one-pound projectile traveling at 4.7 miles per second. DAVID E. LUPTON, ON SPACE WARFARE: A SPACE POWER DOCTRINE 22 (1988).

[89] B. Jasani, *Space Weapons and International Security–An Overview*, *in* SPACE WEAPONS AND INTERNATIONAL SECURITY 22 (B. Jasani, ed., 1987) [hereinafter Jasani, *Space Weapons*].

[90] Federation of American Scientists, *Kinetic Energy Anti-Satellite*, Federation of American Scientists, http://www.fas.org/spp/military/program/asat/ke_asat.htm (last visited June 29, 2000) (on file with the *Air Force Law Review*).

[91] *Id.*

[92] *Id.*

An additional space-based kinetic energy weapon has been proposed but not yet developed. Though not an ASAT, the weapon has been conceived for use against terrestrial targets. It would capitalize on the tremendous speed of long rods made of depleted uranium orbiting in space. Remotely commanded to reenter the atmosphere at hypersonic speeds, the rods could be precision-guided to targets in the air or on the surface of the earth. Their special shape and materials would allow for survival on reentry into the atmosphere with little prospect for collateral damage on impact. The ability to call down such objects from space at hypervelocity speeds would allow them to penetrate hundreds of feet into the earth. Strategically, it would also offer the attacker the "ultimate stealth" and maximum surprise.[93]

A final example in the kinetic energy category is the Gun Launch to Space (GLTS) project. The project envisions a large artillery-type structure capable of launching projectiles hundreds of miles. The most notable example of rudimentary technology on which the GLTS might be based is the Iraqi "supergun," employing a barrel 172 feet long and capable of propelling 114 pound projectiles to distances of 465 miles.[94] Although principally conceived as a system for boosting operational payloads to orbit, the GLTS project has numerous potential applications, including service as an ASAT.[95]

3. Laser Weapons

"Laser" is an acronym for Light Amplification by Stimulated Emission of Radiation and is a device that produces a narrow beam of radiation by means of a physical emission. The light constituting the laser beam can be produced by a variety of chemical means. Key components of such a weapon include both the laser itself and the beam control subsystems which aim the beam. Once created, the beam used in the proposed weapon's laser is so concentrated that it can be projected for extremely long distances with very little loss of energy. Study on laser weapons, including those capable of disabling satellites, began in the early 1960s,[96] and received increased attention as part of the Strategic Defense Initiative. Despite tremendous technical problems, mostly still unresolved, lasers could radically change warfare if ever fielded.[97]

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[93] Bekey, *supra* note 86, at 83.

[94] M. Potter, *Gun Launch to Space: International Policy and Legal Considerations*, *in* PROCEEDINGS OF THE THIRTY-FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE 305 (1992).

[95] *Id.* at 306.

[96] STARES, THE MILITARIZATION OF SPACE, *supra* note 40, at 111.

[97] During the height of research on the Strategic Defense Initiative many scientists openly questioned that a missile defense project involving space-based lasers could ever work. The Union of Concerned Scientists declared that an effective defense of the U.S. against a Soviet missile defense was unattainable. A report from the Congressional Office of Technology

At present, the U.S. is developing space, air, and ground-based lasers for possible use as weapons against enemy missiles and satellites. One of the two principal U.S. ground-based lasers is the Mid-Infrared Advanced Chemical Laser (MIRACL).[98] As the name suggests, the laser beam is generated by chemical reactions, produced by deuterium fluoride, resulting in a focused beam that is fourteen cm square.[99] It is the largest laser developed in the U.S., undergoing numerous tests since 1985 when it destroyed a stationary ICBM on the ground. In the late 1980s, the Congress prohibited DOD from using the laser against space objects.[100] The prohibition expired in 1995, however, and Congress failed to renew the ban. On Oct. 17, 1997, the MIRACL "illuminated" a satellite in orbit constituting the first-ever U.S. use of a laser against a satellite.[101] Though it did not destroy the object, the move was widely seen as a potential first step toward development of a laser ASAT capability.[102] No further tests against space objects are scheduled.

Assessment claimed the likelihood that such a system could protect the U.S. from Soviet missile attack "so remote that it should not serve as the basis for public expectations or national policy." L.B. TAYLOR, JR., SPACE: BATTLEGROUND OF THE FUTURE? 24 (rev. ed., 1988) (quoting Edward Edelson, *Space Weapons: The Science Behind the Big Debate*, POPULAR SCIENCE (July 1994)) [hereinafter TAYLOR]. Partly because of the tremendous technical difficulties, the program began to refocus on earth-based lasers.

[98] The other ground-based program is a free-electron laser designed to reflect its high-energy beam off orbiting space mirrors for redirection back to ground targets.

[99] Federation of American Scientists, *Mid-Infrared Advanced Chemical Laser*, Federation of American Scientists, http://www.fas.org/spp/military/program/asat/miracl.htm (last visited June 29, 2000) (on file with the *Air Force Law Review*). The beam is created via chemical reaction.

> Just downstream from the combustor, deuterium and helium are injected into the exhaust. Deuterium combines with the excited fluorine to give excited deuterium fluoride molecules, while the helium stabilizes the reaction and controls the temperature. The laser's resonator mirrors are wrapped around the excited exhaust gas and optical energy is extracted. The cavity is actively cooled and can be run until the fuel supply is exhausted. The laser's output power can be varied over a wide range by altering the fuel flow rates and mixture.

Id.

[100] Sami Fournier, *U.S. Test-Fires 'MIRACL' at Satellite Reigniting ASAT Weapons Debate*, (Oct. 1997) Arms Control Association, http://www.armscontrol.org/ACT/oct97/miracloct.htm (on file with the *Air Force Law Review*) [hereinafter Fournier].

[101] M.A. Dornheim, *Laser Engages Satellite, With Questionable Results*, 147:17 AV. WK. & SPACE TECH., Oct. 27, 1997, at 27. The test was not intended to destroy the satellite but merely examine what various MIRACL power levels could do to the target satellite's sensors. An official reported that the anticipated data gathering from the satellite was unsuccessful.

[102] Following the test, the Russian Foreign Ministry issued a statement saying that the laser "may become a step toward creating an anti satellite potential." Fournier, *supra* note 100. Even before the test, several U.S. lawmakers sent President Clinton a letter stating "[w]e are

The airborne laser (ABL) program under development calls for a much smaller laser system housed within a modified 747 aircraft. The weapon was conceived as a defense against missile threats but if the program continues to prove as successful as its latest tests (tracking ballistic missiles, overcoming atmospheric distortion), U.S. Air Force officials are weighing expanding its role to reconnaissance, cruise missile defense, and suppression of enemy air defenses.[103] The laser, still under development, will use an oxygen-iodine combustion process to produce the intense light. The first airborne test firing of the laser against a missile is scheduled for 2002.[104] Although the ABL has not been envisioned for an ASAT role, its anticipated 250 mile range would make it capable of reaching missiles and satellites in low orbits.

Space-based laser systems (SBLs) that target other space objects have the dual advantage of being less vulnerable to attack and avoiding the distorting effects of earth's atmosphere. The laser currently envisioned for the SBL system uses a hydrogen fluoride chemical reaction to create its light beam. Unlike the MIRACL and ABL systems, it must be developed to operate in the low pressure environment of space. The prototype Alpha laser was successfully tested in 1991 under conditions simulating the space environment. Results from the test showed that megawatt power levels similar to the MIRACL but optimized for space can be built and operated.[105] However, as with all three laser weapons programs several technical challenge remain for SBLs, including keeping the satellites loaded with a sufficient quantity of chemicals necessary to fuel the laser.[106] Current estimates call for space-based laser testing to begin sometime between 2005 and 2008.[107]

4. Particle Beam Weapons

The first proposed use of particle beam weapons for satellite defense occurred in 1965.[108] Even more technically challenging than lasers, both particle beam and laser weapons constitute "directed energy" weapons–that is,

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deeply troubled that a test of a ground based laser system with such obvious ASAT warfare capabilities would proceed ahead of any debate or deliberate policy development." *Id*.

[103] D.A. Fulghum, *Airborne Laser Aimed At New Defense Roles*, 149:14 AV. WK. & SPACE TECH., Oct. 5, 1998, at 111; D.A. Fulghum, *Airborne Laser Tested, Weighed for New Missions*, 147:17 AV. WK. & SPACE TECH., Oct. 27, 1997, at 26. The ABL program manager, Colonel Michael Booen, stated that "[t]his [laser's success] is going to break the door down for directed energy weapons." *Id.*

[104] W. Matthews, *Laser Faces 'Challenges,' Report Says*, A.F. TIMES, Jan. 19, 1998, at 24.

[105] Federation of American Scientists, *Space Based Laser*, Federation of American Scientists, http://www.fas.org/spp/starwars/program/sbl.htm (last visited June 29, 2000) (on file with the *Air Force Law Review*).

[106] J.R. Asker, *Washington Outlook*, 150:21 AV. WK. & SPACE TECH., May 24, 1999, at 27.

[107] M.A. Dornheim, *Pentagon Mulls Space Laser Test*, 148:12 AV. WK. & SPACE TECH., Mar. 23, 1998, at 32.

[108] STARES, THE MILITARIZATION OF SPACE, *supra* note 40, at 111.

weapons which destroy their targets by delivering energy at or near the speed of light (approximately Mach 1,000,000). This would be a considerable advantage during time-urgent military engagements.[109] In theory, a particle beam weapon could mimic the effects achieved by an electron accelerator by transferring energy to its target at nearly the speed of light. In so doing, it would transfer thermal energy similar to the action of a lightning bolt.[110] Unlike the short attack of a nuclear (or other) blast-triggered EMP, a particle beam weapon could keep its destructive beam focused on the target for longer periods of time.

Particle beam weapons differ from lasers in several respects. The former do not heat the surface of their targets as lasers do. Thus, the particle beam weapon does not weaken the structure of its target, but eats through the skin and damages its internal mechanisms.[111] Because it does not rely on light energy, the particle beam weapon would not be affected by cloud cover or a reflective coating as would a laser. However, despite their theoretical advantages, such weapons are exceedingly difficult to produce because of the high-energy current and repetition rates required.[112]

5. Explosive Proximity Weapons

The category of space weapons characterized by an explosion in proximity to its target is perhaps the most self-evident form of space weaponry. This type of weapon simply steers close to its target and blows it up by detonation in the target's vicinity. The best example is the Soviet ASAT system, first tested in the late 1960s and fielded in the 1970s.[113] The explosive kill vehicle is rocket launched to coincide with the period during which the earth's rotation will put the weapon into the same orbital plane as the target satellite. Once the ASAT achieves orbit, ground controllers maneuver the object for one to two revolutions of the earth until it is close enough to the

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[109] Another theorized advantage of directed energy (DE) weapons will be the range of employment options offered. These could fill the gap between diplomacy and bombs by allowing for an escalating scale of destructive from minor disruption to the target to total destruction. *See* W.B. Scott, *'Beam' Weapons Edging Into Arsenal*, 151:1 AV. WK. & SPACE TECH. July 5, 1999, at 53.

[110] TAYLOR, *supra* note 97, at 33. Because of its great speed and capacity for repeat firing, Taylor suggests that particle beams "would do to the ballistic missile virtually what the machine gun did to the infantry charge." *Id.* at 34.

[111] *Id.* at 33.

[112] *Id.* at 35.

[113] Some conceive this ASAT as a kinetic energy weapon. "The Soviet ASAT system could be categorized as a rocket-propelled KEW [kinetic energy weapon]." Jasani, *Space Weapons*, *supra* note 89, at 19. However, as its title suggest, a kinetic energy weapon derives its value as a weapon not from an explosive capacity, if any, but its kinetic energy. The design of the Soviet System relies heavily on its explosive charge; the ASAT need not even physically impact its target vehicle.

target for its own guidance system to activate. "When in range an explosive charge aboard the interceptor is detonated, sending a cloud of shrapnel at high speed to destroy the target."[114] Repeated testing has shown the system to be marginally effective.[115] Recent reports of Russian work on an EMP ASAT may prove more effective.[116]

Though not yet developed, "space mines" are another type of proximity weapon that tracks down its target and detonates on impact or other trigger event. Commentators suggest that the detonators for such mines could be activated by command from earth, which could be triggered by, for example, reaction to heat or mechanical action.[117] Although similar to kinetic energy weapons, the space mine's method of destruction is not the force of impact but the detonation.

6. 'Soft Kill' Weapons

A final category includes those weapons designed to disable their space-based targets, usually satellites, rather than destroy them. Though never fielded, at least three types of systems in this category have been considered, all of which rely on rendezvous with the target satellite.[118] First, weapons that spray paint onto the optics, solar arrays, or radiators of the target would disrupt power supplies or mission execution. Second, a target satellite could be nudged or tipped out of its current orbit in order to exhaust its control fuel. Third, electronic jamming could disrupt a satellite's proper functioning or shut it down altogether. In each case, unless detected before the "attack," disabling missions such as these could be undertaken covertly and the true source never be detected or proven. Because the results of these "soft kills" often mimic routine failures, detection would prove difficult.[119]

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[114] STARES, SPACE AND NATIONAL SECURITY, *supra* note 70, at 87. The average wait before launch can occur in order to attack a specific satellite is six hours. *Id.* at 88.
[115] *Id.* at 86.
[116] Reportedly, the Russians resumed ASAT testing in April of 1999 with a design that will utilize an EMP. As reported, the Pentagon considers this a "serious development" given that satellites are the "Achilles' heel of the U.S. military's high-technology force used for sending orders to forces around the world as well as communicating with troops and organizing logistics." B. Gertz & R. Scarborough, *Russian ASAT*, WASH. TIMES, June 18, 1999, at 9.
[117] A.A. Kokoshin, et al., *Measures for Counteracting Space Strike Weapons*, *in* SPACE WEAPONS AND INTERNATIONAL SECURITY 92 (B. Jasani, ed., 1987).
[118] See Bekey, *supra* note 86, at 87.
[119] *Id.*

III. THE LAW OF WAR[120]

> [The law of armed conflict] is no longer a body of law designed to ensure a fair fight between two opponents; . . .Today, the law of armed conflict is designed primarily to minimize suffering and prevent unnecessary destruction. This being so, belligerents are held to the standards to which they are capable of rising.[121]
>
> Lieutenant Colonel Michael N. Schmitt, USAF (1998)

Scholars have advanced numerous reasons for maintaining an international law of armed conflict.[122] At first glance, the creation of rules for war–apparently the ultimate breakdown in order–seems ironic at best.[123] And

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[120] This article uses the phrases "law of war," "law of armed conflict," and "humanitarian law" as being essentially synonymous. Historically, "law of war" has been used, although "law of armed conflict" is more accurate given that such law applies in cases of conflict not amounting to war. "Law of war" will generally be used in order to highlight the connection between the relevant treaty regimes, rooted in the first five decades of the twentieth century, and current State practice. Some scholars articulate distinctions among the three phrases noting for example that humanitarian law is that subset of the law of war that concerns itself specifically with the reduction of human suffering. However, because the reduction of suffering is ultimately the goal of *all* restrictions on the means and methods of warfare, such distinctions seem overly technical. Others, such as the International Court of Justice (ICJ), prefer the term "international humanitarian law" which it describes as the synthesis of "Hague Law," governing means and methods of warfare, and "Geneva Law," governing the protection of the victims of war. *See* The Legality of the Threat or Use of Nuclear Weapons, 1996 I.C.J. 1, at 27 [hereinafter ICJ Advisory Opinion on Nuclear Weapons]. This definitional framework is ultimately helpful as it attempts to contain the full range of law governing the use of force in combat to a single category of international law. However, use of terms like "humanitarian" when applied to limits on war's means and methods risks merely equating the law of war with human rights law. On the dangers associated with doing so, *see infra* notes 176 and 220. On the connection between human rights law and the law of war, *see* Howard Levie, *Violations of Human Rights in Time of War As War Crimes*, *in* 70 INTERNATIONAL LAW STUDIES, LEVIE ON THE LAW OF WAR 373 (Michael N. Schmitt & Leslie C. Green, eds., 1998); Rene Provost, *Reciprocity in Human Rights and Humanitarian Law*, 1994 BRIT. Y.B. INT'L L. 383 (1995).

[121] Schmitt, *Bellum Americanum*, *supra* note 6, at 412.

[122] Reasons commonly include: diminishing suffering, diminishing the moral depravation of the soldiers, lessening the dangers that threaten the survival of our civilization, lessening the dangers that threaten the survival of mankind, favorably impacting the peacetime creation of doctrines and weapons, and furthering the cause of disarmament to the extent specific weapons are prohibited. B.V.A. Röling, *The Significance of the Laws of War*, *in* CURRENT PROBLEMS IN INTERNATIONAL LAW: ESSAYS ON U.N. LAW AND ON THE LAW OF ARMED CONFLICT 133 (A. Cassese, ed., 1975). To these six might be added a seventh and eighth – increased chances for the restoration of peace following armed hostilities, and, somewhat paradoxically, increased military efficiency by requiring the focused application of force.

[123] For some, "ironic" is the gentle way of putting it. Some authors express outright cynicism that the project of regulating warfare can ever succeed. Others provide examples leading to a

yet although war is a breakdown with respect to peaceful dispute resolution, it becomes the *ultimate* breakdown only if allowed by its participants. War need not lead to anarchy or violent chaos, even though it necessarily entails injury, killing, and death.[124] Numerous historical examples of military discipline displayed in combat show that the participants in war can recognize order or, at the very least, a chain of command.

It is tautological to assert that effective warfare requires application of efficient, ordered methods. Indeed when that form of order represented by the law of war breaks down, the military effects can be disastrous. Colonel Charles Dunlap quotes Richard Overy on the effects of Germany's disregard for the laws of war in its conflict against the Soviets on the Eastern front.

> [Such] criminalization of warfare produced a growing indiscipline and demoralization among German forces themselves. The German army shot fifteen thousand of their own number, the equivalence [sic] of a whole division. . . . Desertion or refusal to obey orders increased as the war went on, and the law of the jungle seeped into the military structure itself.[125]

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measured skepticism over various aspects of the law of war. This skepticism can take the form either that military forces and their civilian leaders cannot be trusted to follow the law when war begins, or that the law simply does not regulate consistently. An example of the former relates to action at the First Hague Peace Conference to phrase principles of warfare restrictively subject to exceptions, rather than permissively subject to restrictions. As Hays Parks notes, "[t]his is a manifestation of the fundamental distrust international lawyers have for things military, and a reluctance to permit battlefield commanders any latitude in situations that require a judgment call." W. Hays Parks, *Air War and the Law of War* 32:1 A.F. L. REV. 1, 14 n.54 (1990) [hereinafter Parks]. Regarding the latter form of skepticism, Doswald-Beck claims that the law's prohibition of certain forms of bullets without an unambiguous prohibition of nuclear weapons "creates skepticism regarding the seriousness of any of the law of war." L. Doswald-Beck, *Implementation of International Humanitarian Law in Future Wars*, *in* 71 INTERNATIONAL LAW STUDIES THE LAW OF ARMED CONFLICT: INTO THE NEXT MILLENNIUM, 39 at 43 (Michael N. Schmitt & Leslie C. Green, eds., 1998).

[124] Those viewing war as necessarily barbaric, for reasons of strategy or otherwise, react coolly to the whole notion of rules, or moderation in war. Thus, British Vice Admiral Sir John Fisher declared at the 1899 Hague Peace Conference that humanizing war was tantamount to humanizing hell. His suspicion at the law of war flowed from his view of the very nature of war:

> [w]hat you call my truculence is all for peace. If you rub it in, both at home and abroad, that you are ready for instant war with every unit of your strength in the first line, and intend to be first in, and hit your enemy in the belly, and kick him when he is down, and boil your prisoners in oil (if you take any!), and torture his women and children, then people will keep clear of you.

Parks, *supra* note 123, at 13 n.50.

[125] Charles Dunlap, *A Virtuous Warrior in a Savage World*, 8 A.F. ACAD. J. LEGAL STUD. 71, 89 (1997-1998) (quoting Richard Overy, WHY THE ALLIES WON 302-05 (1995)).

Many factors contributed to the Nazi defeat, but the German way of war on the Eastern front failed at least in part because it became "disorderly." Thus, advocacy for an efficient, effective military force can itself become an argument for the laws of war, which will have the effect of reinforcing military discipline.[126]

Whatever the reasons, warfare has attended the human race since the beginning of recorded history. In reflecting on the phenomenon, theorists and scholars have described the nature of warfare in a variety of ways. Some see it as the logical and brutal extension of politics;[127] others view warfare as principally about deception and avoidance of the enemy's physical strengths.[128] However one conceives warfare, all agree that armed combat is an event in which the battlefield reality is much worse that its mere description

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[126] Such an argument assumes a certain form of warfare that values and benefits from order. Theoretically, guerilla or terrorist tactics could eschew the type of "order" discussed here. But even these methods of warfare assume a certain level of coordination, planning, and thus order.

[127] Carl von Clausewitz famously wrote that,

> war is not merely an act of policy but a true political instrument, a continuation of political intercourse, carried on with other means. What remains peculiar to war is simply the peculiar nature of its means. . . . The political object is the goal, war is the means of reaching it, and means can never be considered in isolation from their purpose.

CARL VON CLAUSEWITZ, ON WAR, 87 (M. Howard, & P. Paret, trans. & eds., 1976) [hereinafter CLAUSEWITZ]. Elsewhere, Clausewitz describes how ugly those "other means" really are:

> If one side uses force without compunction, undeterred by the bloodshed it involves, while the other side refrains, the first will gain the upper hand. That side will force the other to follow suit; each will drive its opponent toward extremes, and the only limiting factors are the counterpoises inherent in war. . . . It would be futile–even wrong–to try and shut one's eyes to what war really is from sheer distress at its brutality.

Id. at 75-76.

[128] Thus ancient Chinese strategist Sun Tzu "did not conceive the object of military action to be the annihilation of the enemy's army, the destruction of his cities, and the wastage of his countryside. 'Weapons are ominous tools to be used only when there is no alternative.'" Samuel B. Griffith, *Introduction* to SUN TZU, THE ART OF WAR, 1, 40 (S.B. Griffith, trans., 1963). The dichotomy between the approaches of Clausewitz and of Sun Tzu led B.H. Liddell Hart to write

> Civilization might have been spared much of the damage suffered in the world wars of this century if the influence of Clausewitz's monumental tome *On War*, which moulded European military thought in the era preceding the First World War, had been blended with and balanced by a knowledge of Sun Tzu's exposition on 'The Art of War.'

B.H. Liddell Hart, *Forward* to SUN TZU, THE ART OF WAR v (S.B. Griffith, trans., 1963).

might suggest.[129] Because of this, the principled warrior is the last to desire war; when given the discretion, he reserves it as a last resort. Nonetheless, warfare has been a permanent fixture of the human race. As one source puts it, "[a]ccording to estimates based on the period from 3600 B.C. until 1960, mankind has known only 292 years of universal peace, and in the remaining 5268 years has faced 14,513 armed conflicts taking 1240 million human lives."[130] These statistics highlight the fact that for the sake of preserving

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[129] One need only view two recent Hollywood productions, *Saving Private Ryan* and *The Thin Red Line*, to experience the horrors of war beyond the written word. In both cases, the films vividly portray the existential horrors of warfare (violent death, mutilation, betrayal, savagery, terror) through realistic reenactment. Yet even the film medium, powerful as it is, cannot reproduce the feelings experienced in war either by the combatant or the noncombatant. Beyond this, *Saving Private Ryan*, in particular, included reenactment of several violations of the law of war. In one case toward the end of the film, a young American soldier is shown killing a German soldier who had his hands in the air and had surrendered his weapon and intent to resist, thus entitling himself to protection as a prisoner of war. Though the 1949 Geneva Convention (III) Relative to the Treatment of Prisoners of War had not yet come into existence at the time of this depiction, the 1907 regulations annexed to the Hague Convention (IV) on land warfare had. These regulations, which governed military conduct during WWII, unambiguously required humane treatment for prisoners of war. The young American is portrayed as being the underdog having impotently witnessed another German lawfully, though agonizingly, killing an American compatriot just moments before. Perhaps the most troubling aspect of this scene is the unfortunate effect it likely has on most American audiences. Rather than producing feelings of distaste at having witnessed a war crime, the screenplay appears designed to elicit a sense of euphoria that the younger, weaker American finally got the enemy. To the extent that the popular media manipulates public opinion in ways such as this, respect for the law of war is not engendered, but diminished. This is not to disparage this particular movie. The Secretary of Defense rightly honored director Steven Spielberg on Aug. 11, 1999 at a ceremony during which the Secretary awarded him the DOD Distinguished Civilian Public Service Award for successfully honoring the memory of a past generation that made the ultimate sacrifice in a just cause. The example is simply intended to highlight dangers that may exist for the law of war in the popular mind coming out of even magnificent works such as *Saving Private Ryan*.

[130] E.J. Osmanczyk, *War*, *in* THE ENCYCLOPEDIA OF THE UNITED NATIONS AND INTERNATIONAL RELATIONS, 1018 (2nd ed., 1990). Horrible as it is, Malanczuk notes that war has not always been perceived as it is today.

> It is hard to realize that during the eighteenth and nineteenth centuries most people (except for a few pacifists) regarded war in much the same way as they regarded a hard winter – uncomfortable, certainly, but part of the settled order of things, and providing excellent opportunities for exhilarating sport; even the wounded soldier did not regard war as wrong, any more than the skier with a broken leg regards skiing as wrong.

PETER MALANCZUK, AKEHURST'S MODERN INTRODUCTION TO INTERNATIONAL LAW 308 (7th ed., 1997) [hereinafter MALANCZUK, INTRODUCTION TO INTERNATIONAL LAW].

human life and international public order, one must accept, however cynically,[131] both the importance and relevance of the laws of war.

A. Jus in Bello vs. Jus ad Bellum

When speaking of the various international norms limiting the prosecution of war, scholars have historically distinguished between the *jus in bello*, or, the laws regulating the conduct of States once armed conflict between them has begun,[132] and the *jus ad bellum* consisting of the law governing resort to armed conflict. The former law applies to conflicts that the belligerents themselves may not regard as "wars."[133] The latter law is of

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[131] Despite some vigorous dissent, the law of war has influenced the conduct of armed forces in many ways. As examples to the contrary, consider Cicero's oft-quoted maxim *inter arma silent leges* (lit. "in war the law is silent"), and professor Fenwick's pessimistic candor, "it is futile to attempt to revive [the laws of war]. . . . Let's face the facts. War has got beyond the control of law. . . . The sooner every man, woman and child old enough to think realizes that he will be a party to the next war, the better." C.G. Fenwick, 43 PROC. AM. SOC'Y INT'L L. 110 (1949) (transcript of oral response to W. Downey, Jr., *Revision of the Rules of Warfare*). Roberts and Guelff cite several international norms that have been observed principally because of the law of war including, humane treatment of prisoners, a state's entitlement to neutral status, illegitimacy of certain targets, and that persons not active in the conflict should be spared from the consequences of the fighting to the extent possible. Adam Roberts & Richard Guelff, *Introduction* to DOCUMENTS ON THE LAWS OF WAR, 1, 14 (Adam Roberts & Richard Guelff, eds., 1989) [hereinafter Roberts & Guelff].

[132] Because the law of war is a matter of public international law, and regulates the conduct of States relative to each other, it does not ordinarily regulate purely internal, civil wars. Nonetheless, certain regional agreements relate to internal conflicts. Further, Roberts and Guelff note that,

> customary international law provided that the laws of war might become applicable to a non-international conflict through the doctrine of 'recognition of belligerency' . . . [by which] the government of a state in which an insurrection existed could recognize the belligerency of the insurgent faction, and the laws of war would thereby become applicable.

Roberts & Guelff, *supra* note 131, at 12. The authors further note that the doctrine of recognition of belligerency has fallen into decline, and that the surer basis for application of certain fundamental humanitarian provisions in non-international conflicts is Common Article 3 of the four 1949 Geneva Conventions. *Id.* at 13. Finally, while the 1977 Geneva Protocol II is intended to expand the provisions of Common Article 3, it too applies only during the existence of an "armed conflict."

[133] "[T]oday humanitarian law is applicable in any international armed conflict, even if the parties to that conflict have not declared war and do not recognize that they are in a formal state of war." Christopher Greenwood, *Historical Development and Legal Basis*, *in* THE HANDBOOK OF HUMANITARIAN LAW IN ARMED CONFLICT 1, 10 (Dieter Fleck, ed., 1995). As Greenwood uses the term, "international humanitarian law" is synonymous with the older phrase "law of war" (with the exception of the law of neutrality), the former including all rules designed to regulate the treatment of the individual–civilian or military, wounded or active–as well as rules governing the means and methods of warfare. *Id.* at 9.

relatively recent origin and is expressed most authoritatively in Article 2(4), and Chapter VII of the United Nations Charter.[134] Based on this distinction, Michael Walzer points out that the truly lawful war must satisfy requirements under both legal regimes: "War is always judged twice, first with reference to the reasons states have for fighting, secondly with reference to the means they adopt."[135] This two-part analysis leads another publicist to distinguish between a war's "*just cause* and [its] *just means*."[136]

Some authors conceive a conceptual framework in which the law of war concerns itself principally with the *jus in bello*. Thus, Kalshoven writes "[t]he laws of war, or *jus in bello*, are those rules and principles of international law which . . . govern the conduct of war."[137] This is both the majority view and the better view. By contrast, others prefer to speak of the law of war as comprising *both* aspects. "The term 'laws of war' can have different meanings and refers to both the rules governing resort to armed conflict (*ius ad bellum*) and the rules governing the actual conduct of armed conflict (*ius in bello*)."[138] Because the term *jus ad bellum* more properly coincides with phrases such as "the right of self-defense" and "resort to the use of force," it should therefore be distinguished from "laws *of* war." Equating the *jus in bello* with the phrase "laws of war" is not only a matter of historical convention,[139] but of logical application of law to war. Simply put, the *jus ad bellum* is to be regarded as separate from the law of war because of the

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[134] *See infra*, Part III, § C.4.

[135] MICHAEL WALZER, JUST AND UNJUST WARS: A MORAL ARGUMENT WITH HISTORICAL ILLUSTRATIONS 21 (2d. ed., 1977).

[136] THOMAS FRANCK, FAIRNESS IN INTERNATIONAL LAW AND INSTITUTIONS 246 (1995). Though Franck frames the distinction in moral categories (i.e. "just"), the context makes clear he is asserting that the early development of international *legal* norms mirrored those of the "just war" tradition–an ethical as well as a legal theory of warfare. Franck claims that this tradition held sway in Western societies as both a legal and ethical theory until the 1648 Peace of Westphalia ushered in an international order based on "a balance of power among sovereign nations [rather than] the ideal of a unified empire under God and right reason. This Westphalian system remained in place until the outbreak of war in 1914. Positivism largely banished notions of just war from the realm of law to the outer marches of moral philosophy." *Id.* at 252.

[137] Fritz Kalshoven, *Laws of War, in* 4 ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW 316 (Bernhardt, ed., 1982).

[138] MALANCZUK, INTRODUCTION TO INTERNATIONAL LAW, *supra* note 130, at 306.

[139] Arguably, prior to 1928 and execution of the Treaty of Paris (Kellogg-Briand Pact) which purported to outlaw warfare as a legitimate means of dispute resolution, there was no such thing as a *jus ad bellum*. While there were ethical principles relating to conditions for a "just war" and for self-defense, nothing approached the level of international *law*. Even the Treaty of Versailles, which took initial steps toward conditioning the use of force (e.g. Article 16 which made acts of war against any member of the League of Nations acts of war against all members), did not explicitly ban war itself. Treaty of Versailles, art. 16, (1919 Supp.) 13 AM. J. INT'L L. 2.

"cardinal principle that *jus in bello* applies in cases of armed conflict whether the conflict is lawful or unlawful in its inception under *jus ad bellum*."[140]

B. Customary Principles within the Law of War

Given the misery left by warfare through the centuries, warring nations have developed customary practices seeking to ameliorate its devastating effects. As the customs of war have evolved into the customs *and laws* of war, the dominant objective underlying the law as it relates to military force has remained constant and can be summed up in one word: restraint.[141] This was perhaps best summarized for the fist time in an international instrument by Article 22 of the Second Convention adopted by the 1899 Hague Peace Conference: "The right of belligerents to adopt means of injuring the enemy is not unlimited."[142] As discussed below, the dominant concepts distilled from the vast body of customary international law amount to very few; military

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[140] Roberts & Guelff, *supra* note 131, at 1.

[141] This is subject to the clarification that while the law of war as a body of legal principles does work to *limit* the means and methods of warfare, those principles recognize that in the world of fact (versus legal principle) acts of combat exist and may even appear to be *allowed* by reference to the relevant legal principle. Some may view this reference to legal principles as *authorization*, as for example in this reference to the principle of military necessity: "I did X, an otherwise prohibited act, because it was militarily necessary." For a discussion of military necessity, *see infra*, Part III, § B.1. But to view the law of war as *authorizing* or *enabling* behavior, misses a fundamental principle of international law. Professor Schmitt, author of the foregoing military necessity example, puts it best: "To exist as a principle of law, military necessity must have independent legal valence. That can, by definition, only occur when it is characterized as a limitation, for, as a general rule, all that is not prohibited in international law is permitted." Michael N. Schmitt, *Book Review: Law on the Battlefield* 8 A.F. ACAD. J. L. STUD. 255, 257 (1997-1998) (reviewing A.P.V. ROGERS, LAW ON THE BATTLEFIELD (1996)) [hereinafter Schmitt, *Book Review*]. This analysis applies to all principles and tenets of the law of war–thus all are restrictions on behavior. As for the general proposition in international law that all that is not forbidden is permitted, the International Court of Justice recently quoted from two previous cases, as it recounted the position of several States leading up to its advisory opinion on the threat or use of Nuclear Weapons. *See* ICJ Advisory Opinion on Nuclear Weapons, *supra* note 120 (referencing the *Steamship Lotus* and *Nicaragua* cases). In the *Steamship Lotus* case, the Permanent Court of International Justice (P.C.I.J.) stated that "restrictions upon the independence of States cannot . . . be presumed" and that international law leaves to States "a wide measure of discretion which is only limited in certain cases by prohibitive rules." P.C.I.J. (ser. A) No. 10, at 18-19. Then more recently, the International Court of Justice stated that "in international law there are no rules, other than such rules as may be accepted by the State concerned, by treaty or otherwise, whereby the level of armaments of a sovereign state can be limited." Military and Paramilitary Activities (Nicar. v. U.S.) 1986 I.C.J. 4, 135. Though the latter language specifically addressed armaments, it rests on the rationale from the *Steamship Lotus* case–unless prohibited, an action is allowed.

[142] Convention (II) with Respect to the Laws and Customs of War on Land, July 29, 1899, (1907 Supp.) 1 AM. J. INT'L L. 129.

necessity, discrimination, proportionality, and humanity.[143] These principles, recognized in subsequent treaty law, limit the means and methods available to belligerents for conducting armed conflicts, and thus each demands restraint of the belligerent State.[144] Because there are no treaties establishing specific *jus in bello* principles for space combat, these customary principles provide the most authoritative source, subject to the specific principles of space law discussed in Chapters Four and Five, on which the analysis of a *jus in bello* for space must proceed.

1. Military Necessity

Military necessity expresses the idea that for an attack to be lawful belligerents must be able to show the connection between the attack, and the suppression of the enemy's military capability. De Mulinen points out that military necessity pertains to those measures: "(a) not forbidden by the law of war; and (b) required to secure the overpowering of the enemy."[145] Implied in the restriction this principle imposes is the requirement that attackers have identified the prospective target in advance of attack as one that is militarily legitimate. Put otherwise, the attacker must be convinced that attacking the target will contribute to the victory of his military undertaking. As the quote at the head of this chapter suggests, the more capable a belligerent is in properly identifying these militarily necessary targets, the more responsibility it has in doing so.

Taken to its logical extreme, the principle of necessity could be used to justify the very sorts of activity the laws of war prohibit.[146] Any argument

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[143] These four principles are generally viewed as summarizing the customary law of war, though this enumeration is not accepted universally. Thus, Hays Parks describes the concept of proportionality as subordinate to, and an expression of, discrimination. He argues that discrimination is attended today with some confusion "because of the attempted injection of the concept of *proportionality* into the law of war." Parks, *supra* note 123, at 5 n.18. By contrast, Professor Schmitt subordinates distinction to proportionality, and recognizes chivalry as a forth distinct customary principle. *See* Michael N. Schmitt, *Green War: An Assessment of the Environmental Law of International Armed Conflict* 22:1 YALE J. INT'L L. 1, 52 (1997) [hereinafter Schmitt, *Green War*]. Whatever the formulation however, each approach includes the relevant prescriptive norms as developed in customary law, while giving special emphasis to some but not others.

[144] As the subsequent analysis shows, the law demands such restraint whether the operation in question is offensive or defensive in nature.

[145] FREDERIC DE MULINEN, HANDBOOK ON THE LAW OF WAR FOR ARMED FORCES 82-83 (Int'l Committee of the Red Cross 1987) [hereinafter DE MULINEN]. Perhaps subpart (b) of this formulation is the more important as subpart (a), simply invoking that which is not forbidden by the law of war, could apply to *any* principle of the law of war and says nothing unique about the restrictions imposed by military necessity.

[146] Such was the case in nineteenth century Germany as expressed through the doctrine of Kriegsraison. This concept, an interpretation of the traditional notion of military necessity, asserted that military necessity "could justify any measures – even in violation of the laws of

taking the principle to this extreme commits two legal errors. First, it fundamentally misinterprets the principle by failing to recognize the sovereign freedom States have in the absence of legal prohibition.[147] Legally speaking, a State does not need concepts like military necessity to justify its behavior in war provided such behavior is otherwise compliant with applicable *jus in bello* restrictions. As Schmitt emphasizes, "[m]ilitary necessity operates within this paradigm to prohibit acts that are not militarily necessary; it is a principle of limitation, not authorization. In its legal sense, military necessity justifies nothing."[148] Second, as with all of the customary principles underlying the law of war, but especially military necessity, the concept must be balanced against the others. The U.S. Air Force stresses this point in its manual on the law of war:

> The law of armed conflict has been shaped with a recognition of the concept of "military necessity." Hence "necessity" cannot be claimed as a defense to violations of absolute prohibitions included in the law of armed conflict, for example, killing of prisoners of war. More importantly, various military doctrines, such as accuracy of targeting, concentration of effort, maximization of military advantage, conservation of resources, avoidance of excessive collateral damage, and economy of force are not only fully consistent with compliance with the law of armed conflict but reinforce its observance.[149]

2. Discrimination

Discrimination,[150] as the term suggests, stresses diligence in "the selection of methods, of weaponry and of targets . . . it includes the idea of the immunity of non-combatants and those *hors de combat*, that is, the sick, wounded, and shipwrecked, but it is not only about that: it can also refer to geographical and other limitations."[151] This description incorporates several

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war – when the necessities of the situation purportedly justified it." Air Force Pamphlet 110-31, The Conduct of Armed Conflict and Air Operations ¶ 1-3(a)(1) (Nov. 19, 1976) (reissue pending as AFPAM 51-710) [hereinafter AFP 110-31]. Abuse of the principle continued into the twentieth century as Carnahan notes: "The modern denigration of military necessity goes back at least to the Nuremberg trials after World War II, where some defendants argued that military necessity justified their atrocities against civilian populations." He continues that "military necessity is widely regarded today as an insidious doctrine invoked to justify almost any outrage. As a result, the principle has not been allowed to play the creative role that it is capable of playing." Bruce M. Carnahan, *Lincoln, Lieber and the Laws of War: The Origins and Limits of the Principle of Military Necessity* 92 AM. J. INT'L L. 213, 230 (1998) [hereinafter Carnahan, *Lincoln, Lieber and the Laws of War*].

[147] For a discussion addressing this error, *see supra* note 141.

[148] Schmitt, *Green War*, *supra* note 143, at 54.

[149] AFP 110-31, *supra* note 146, at ¶ 1-6(b).

[150] Also termed "distinction."

[151] Roberts & Guelff, *supra* note 131, at 5.

concepts, one of the most significant being the distinction between combatants and non-combatants. In general, the law of war prohibits attack of any person deemed a "non-combatant." This means that the lawfulness of the use of force against individuals under the *jus in bello* presupposes attack of those qualifying as combatants. Recognized at least since the nineteenth century,[152] the law of war establishes the category "combatants" in order to specify those who may be attacked, but also to create a measure of protection for those so categorized.[153] The 1907 Regulations annexed to the Hague Convention (IV) Respecting the Laws and Customs of War on Land stated the general criteria for recognizing combatants: (a) commanded by a person responsible for his subordinates; (b) have a fixed distinctive emblem recognizable at a distance; (c) carry arms openly; and (d) conduct operations in accord with the laws and customs of war.[154]

The care required by the principle of discrimination to distinguish between combatants and non-combatants rests on an even more fundamental principle: military objective.[155] This principle requires that a belligerent's armed attacks be limited to targets that are military in nature and the destruction of which advances the attacker's tactical, operational, or strategic position. Such targets would certainly include combatants in action, as well as inanimate objects deemed necessary for the opponent's prosecution of the conflict. Thus, Article 48 of the 1977 Protocol I to the 1949 Geneva Conventions provides the clearest statement of the customary principle, and assumes in its "basic rule" concerning the general protection of civilians populations that belligerents will recognize military objectives. "In order to ensure respect for and protection of the civilian population and civilian objects, the Parties to the conflict shall at all times distinguish between the civilian

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[152] Professor Green, quoting from a treatise dating to 1802, states that "[i]t is only with the writers of the nineteenth century that either a clear definition or the rights of soldiers or the first usage of the term 'combatants' is found." LESLIE C. GREEN, THE CONTEMPORARY LAW OF ARMED CONFLICT 101 (1993) [hereinafter GREEN].

[153] Thus, the law protects those combatants who are captured, wounded, sick, or shipwrecked. The combatant category also does not include every member of the military force, for example chaplains and medical personnel.

[154] Annex to the Convention, Regulations Respecting the Laws and Customs of War on Land, Oct. 18, 1907, art. 1, (1908 Supp.) 2 AM. J. INT'L L. 90 (entered into force Jan. 26, 1910) [hereinafter Hague Convention (IV) Annex]. Those military members who should ordinarily fit this category but do not for failure to comply with one of its terms, such as soldiers not wearing a uniform or concealing their weapons, become "unlawful combatants" and risk loss of protections afforded to lawful combatants.

[155] Admiral Robertson notes the fundamental character of the principle of discrimination, and thus of military objective, by reference to the International Court of Justice Advisory Opinion on Nuclear Weapons. There the court opined that military objective is one of the two "cardinal principles" of the law of armed conflict (the other being the prohibition on the use of weapons causing unnecessary suffering to combatants). H.B. Robertson, *The Principle of the Military Objective in the Law of Armed Conflict*, 8 A.F. ACAD. J. LEGAL STUD. 35 (1997-1998) (citing ICJ Advisory Opinion on Nuclear Weapons, *supra* note 120, at 28) [hereinafter Robertson].

population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives."[156] Subsequently, Protocol I defines "military objective" (relating to objects versus noncombatants) as being "limited to those objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage."[157]

The obligation created by the principle of distinction attends both the attacker and the defender.[158] Further, because the principle requires attackers to exercise due care in the selection, engagement, and destruction of targets, it imposes a duty commensurate with the belligerent's ability to discriminate. Given the lack of precision afforded by gravity-driven projectiles dropped from hot air balloons, the outright prohibitions on such methods of war in 1899 and 1907 make sense in light of the principle of discrimination.[159] However, the increasing capability of modern weaponry not only provides increased tactical options, but potentially increased obligation as well. To the extent that a laser-guided bomb can be used to effectuate an attack that properly distinguishes legitimate from illegitimate targets, but a conventional gravity bomb cannot, the attacker may be obligated to either forego the attack or use the less common, more costly precision munition.[160] Of course, relevant to this targeting and weaponeering analysis would be the attacker's overall campaign plan. The possibility certainly exists that use of precision munitions

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[156] Protocol Additional to the Geneva Conventions of Aug. 12, 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), Dec. 12, 1977, art. 48, 1125 U.N.T.S. 3. (entered into force Dec. 7, 1978) [hereinafter Protocol I].

[157] *Id.*, art. 52(2). Though not adopted universally as a treaty rule, Admiral Robertson notes that Protocol I's provisions on military objective from Articles 48 and 52 are widely incorporated into military manuals and are "recognized as a norm of customary international law." Robertson, *supra* note 155, at 44.

[158] For further discussion of this point, *see infra* note 196.

[159] *See* Declaration (XIV) Prohibiting the Discharge of Projectiles and Explosives from Balloons, Oct. 18, 1907, 36 Stat. 2439; Declaration (IV, 1) To Prohibit for the Term of Five Years the Launching of Projectiles and Explosives from Balloons, and Other Methods of a Similar Nature, July 29, 1899, 32 Stat. 1839.

[160] Schmitt's observation bears repeating.

> [The law of armed conflict] is no longer a body of law designed to ensure a fair fight between two opponents . . . . Today, the law of armed conflict is designed primarily to minimize suffering and prevent unnecessary destruction. This being so, belligerents are held to the standards to which they are capable of rising.

Schmitt, *Bellum Americanum*, *supra* note 6, at 412. Schmitt's implication is that technological advancement comes at some cost with respect to the law of war; the more effectively weapons can avoid unnecessary destruction, the less ability belligerents legally have in allowing for the possibility of such destruction.

early in a campaign might produce less overall value under the proportionality analysis than had the use been reserved for a later target in the campaign.

3. Proportionality

The customary rule of proportionality, more difficult to articulate than necessity or discrimination, requires that the use of military force be proportional to the legitimate military objective in view. This represents more than simply the principle of war advocating only such force as is necessary to attain the objective; it actually requires a balancing of anticipated military advantage against anticipated damage caused.[161] It essentially prohibits the use of military force that creates collateral damage to civilians or property, not otherwise legitimate targets, that is disproportionate to the military value of the objective.[162] As Roberts and Guelff point out, this doctrine can refer to two different situations: first, the proportionality of a belligerent response to a grievance (in this sense proportionality provides a link between the *jus ad bellum* and *jus in bello*); and second, "proportionality in relation to the adversary's military actions or to the anticipated military value of one's own actions, including proportionality in reprisals."[163]

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[161] In this way, proportionality differs from the principle "economy of force." Schmitt, *Green War*, *supra* note 143, at 55 n.267.

[162] This principle not only governs the use of force during the ongoing operations of armed conflict, but during an act of self-defense under Article 51 of the Charter of the United Nations as well. *See infra* note 262. Thus, it is a "rule well established in customary international law" that in exercising its right to self-defense, a State may only use "measures which are proportional to the armed attack and necessary to respond to it." Military and Paramilitary Activities (Nicar. v. U.S.), 1986 I.C.J. 4, 94. The U.S. took the position that the lawfulness of an act of self-defense depends in part on the necessity and the proportionality of the measures taken. *Id.* at 103.

[163] Roberts & Guelff, *supra* note 131, at 5. The concept of reprisals has proven controversial in international law. In 1977, Protocol I to the Geneva Conventions sought to eliminate a form of reprisal taken against civilians or the civilian population. Professor Green explains that reprisals are "otherwise illegal measures taken in response to prior illegal measures of the adverse party and which are intended to cause the adverse party to cease its illegal activities and comply with the law. They are not measures taken simply by way of retaliation." GREEN, *supra* note 152, at 331, 332. Abraham Sofaer points out that the U.S. decision not to ratify the Geneva Protocol I came, in part, because it narrowed the right of reprisal. He further states that this factor was of concern to the U.S. Joint Chiefs of Staff, and that it "would hamper the ability of the United States to respond to an enemy's intentional disregard of the limitations established in the Geneva Conventions of 1949 or Protocol I." Abraham Sofaer, *Agora: The U.S. Decision Not to Ratify Protocol I to the Geneva Conventions on the Protection of War Victims*, 82 AM. J. INT'L L. 784, 785 (1988). Interestingly, Parks attributes the failure of the diplomatic conference to produce fundamental agreement among the delegations to the "cultural and philosophical differences that were substantially greater than they had been [at the Hague in 1907 and Geneva in 1949]." He further points out that many delegations were led by international lawyers lacking subject-matter expertise; "no delegation had a military officer of the stature of a Mahan, Fisher, or Rodgers." Parks, *supra* note 123, at 76.

In the former sense of proportionality posed by Roberts and Guelff, the massive coalition military operation in the 1991 Persian Gulf War would have been disproportionate to an unlawful border incursion and then an immediate retreat by the Iraqis. Though unlawful, such incursion could be remedied with far less force. In the latter sense of proportionality, in response to the opponent's military actions, the destruction of a hydroelectric dam in order to eliminate a sniper perched on top would constitute an attack disproportionate to the legitimate objective of eliminating the threat posed by the sniper. Though the dam may be its own legitimate objective under certain circumstances, it is not made legitimate simply as a means of achieving the destruction of a far less significant target.

Because of the difficulty of applying the principle of proportionality to specific contexts in modern warfare, scholars and practitioners have devised tests to assist those engaging in target selection and military operations planning. One useful formulation for aerial combat has been advanced by Colonel Gómez of the Spanish Air Force: "an aerial attack expected to cause civilian casualties would be acceptable should it have the same degree of approval as a similar action taking place over a part of the country's own territory under enemy occupation, in which case the civilian casualties would be compatriots."[164] This formulation essentially asks the military planner to put himself in the position of the enemy. Such an approach could be modified to apply the principle of proportionality to space warfare. Gómez aptly attributes the difficulty in applying the principle of proportionality to the subjectivity involved in the application, and thus terms the principle the "Achilles heel of the law of war."[165]

4. Humanity

Finally, the concept of humanity incorporates several concepts, including that which is still called "chivalry."[166] In practice, this principle may

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[164] F.J.S. Gómez, *The Law of Air Warfare* 323 INT. REV. RED CROSS 347, 354 (1998) [hereinafter Gómez].

[165] *Id.*

[166] In some formulations, chivalry receives attention as a separate customary principle. As it has developed in the law of war, chivalry distinguishes between acts of deception that undermine the goodwill of the enemy, and those that do not. Thus, acts of perfidy are always prohibited. As enumerated in Article 37 of Protocol I to the Geneva Conventions, these prohibited acts include feigning an intent to negotiate under a flag of truce or of a surrender, feigning an incapacitation by wounds or sickness, feigning civilian or non-combatant status (such as marking of combat aircraft with the international symbols affording protection as medical aircraft), and feigning protected status by the use of signs, emblems, or uniforms of the United Nations or of neutral States. By contrast, the law does not prohibit "ruses," such as the use of camouflage, decoys, mock operations, and misinformation, which deceive the opponent yet do not betray his confidence in measures requiring his goodwill and which are intended to ameliorate the effects of war. Protocol I, *supra* note 156, art. 37.

not pose the urgency it once did in limiting armed conflict because of the way the other principles have matured taking it into account. This is particularly true of necessity and proportionality, as Colonel Schmitt observes: "to the extent suffering is useless it is militarily unnecessary and, because it offers no direct and concrete military advantage, disproportionate."[167]

Nonetheless, the principle of humanity accounts for several efforts at outlawing means and methods of warfare deemed to cause unnecessary suffering. International law does not restrict belligerents from wounding or killing opposing forces so that they will not fight back. It follows from this that once a combatant is rendered *hors de combat* ("out of combat"), he is no longer a legitimate target for further attack. Thus, while it is legitimate to wound a combatant so as to render him *hors de combat*, means and methods of warfare having the effect of exacerbating wounds that would render a combatant *hors de combat*, are deemed "unnecessary." The principle has been applied over the centuries to weapons from antiquity, and those developed more recently that have been addressed through treaty instruments. These include poisoned weapons,[168] barbed weapons, small-caliber incendiary or explosive bullets,[169] expanding bullets,[170] glass and other nondetectable fragments,[171] and most recently, blinding lasers.[172] In theory, prohibition of

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[167] Schmitt, *Bellum Americanum*, *supra* note 6, at 409.

[168] As Carnahan notes, "[t]he ban on poisoned weapons is one of the oldest continuing prohibitions in the law of war." Burrus M. Carnahan, *Unnecessary Suffering, The Red Cross and Tactical Laser Weapons* 18 LOY. L.A. INT'L & COMP. L.J. 705, 714 (1996) [hereinafter Carnahan, *Unnecessary Suffering*]. It predates any attempts at codification by centuries.

[169] Declaration Renouncing the Use, in Time of War, of Explosive Projectiles Under 400 Grams Weight, Dec. 11, 1868, (1907 Supplement) 1 AM. J. INT'L L. 95.

[170] These munitions have soft or hollow points so as to flatten on impact. Also called "dum-dum" bullets after the munitions factory near Calcutta India where first developed, they are outlawed for over 30 States Parties to a Hague Declaration of 1899. Hague Declaration (IV, 3) Concerning Expanding Bullets, July 29, 1899, (1907 supp.) 1 AM. J. INT'L L. 155. The declaration explicitly applied to bullets "which expand or flatten easily in the human body, such as bullets with a hard envelope which does not entirely cover the core or is pierced with incisions." *Id.* Though not a party to the Declaration, the United States has acknowledged that it will abide by the terms of the agreement. Carnahan, *Unnecessary Suffering*, *supra* note 168, at 720.

[171] Protocol [to the Convention on Conventional Weapons] on Non-Detectable Fragments (Protocol I), Apr. 10, 1981, 1342 U.N.T.S. 7 (entered into force Dec. 2, 1983). This Protocol to the 1980 Convention on Conventional Weapons prohibits the use of "any weapon the primary effect of which is to injure by fragments which in the human body escape detection by X-rays." *Id*.

[172] Protocol [to the Convention on Conventional Weapons] on Blinding Laser Weapons (Protocol IV), Oct. 13, 1995, 35 I.L.M. 1218 (1996) (entered into force July 30, 1998) [hereinafter Protocol on Blinding Lasers]. The International Committee of the Red Cross (ICRC) takes the prohibition of Protocol IV a step further in its 1995 pamphlet *Blinding Weapons*, and declares all "blinding as a method of warfare" to be a violation of international humanitarian law. Carnahan, distinguishing the ICRC's denunciation of poison gas in 1925, notes that this "striking policy departure" marks the first time in history that the ICRC has

all of these weapons limits space war to the extent that any of them might be delivered against human beings from or within outer space.

As the principle of military necessity must be balanced by humanitarian concerns, some legal commentators note that humanitarian concerns must be balanced against legitimate military needs as well. The *jus in bello* principles presuppose that their application occurs in the midst of armed conflict–that is "*in bello*"–and that in some cases States will accurately assert a legal right to militarily subdue the other.[173] This forces the law to assume a pragmatic posture with respect to the goal that warfare remain humane. Thus, Professor Green rightly observes,

> [s]ince the law of armed conflict rests upon a judicious balance between military operational needs and humanitarianism, and since the purpose of

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"publicly denounced a specific method of warfare as a violation of international law." Carnahan, *Unnecessary Suffering*, *supra* note 168, at 705. Carnahan concludes that by declaring the

> undefined concept of 'blinding as a method of warfare' unlawful and making exaggerated claims for the destructiveness of lasers, the ICRC has helped to lay the basis for false war crime charges against any soldier captured with a portable laser. The ICRC may have compromised its own ability to prevent abuse of prisoners of war subjected to such charges.

Id. at 731. Although itself bordering on exaggeration, at least one important reminder can be taken from this conclusion–a very possible consequence of crusading against a means of warfare in the interest of soldiers may make the very soldiers in view more vulnerable. A final observation regarding this protocol lasers relates to its prospective nature vis-à-vis the weapons at issue. This is one of the only attempts in the law of war to prohibit the use of a weapons system before it has been deployed in combat, or even fielded for training purposes prior to combat.

[173] For example, under Article 51 of the United Nations Charter, States have the "inherent right" to use armed force in self-defense. *See* discussion *infra* notes 262 and 267. This raises two fundamental issues. First, because the right is inherent, and has been recognized by customary international law long prior to the appearance of the United Nations Charter, the right existed *before* the law prohibited warfare as an instrument of national policy. This right has been widely recognized at least since the Caroline incident of 1837. *See* D.J. HARRIS, CASES AND MATERIALS ON INTERNATIONAL LAW 894 (5th ed., 1998) [hereinafter HARRIS]. Second, because the United Nations Charter speaks of this prerogative toward self defense as a "right," it appears to be an explicit *authorization* to act in certain circumstances. Taken as an authorization, and coupled with the *jus in bello*, the reasonable implication of this understanding of Article 51 is that States not only have the right to self defense, but have the right to use armed force in self defense, and have the right to attack militarily necessary targets in proportionate, "humane" ways as long as such attacks are otherwise predicated on compliance with the *jus ad bellum*. Though this understanding borders on repudiation of the principle articulated in the *Steamship Lotus* case, that is, States may act as they please unless prohibited by law, by suggesting that with respect to self defense the law plays an *authorizing* rather than merely prohibitive role, it is better seen as merely a limited exception to the *Lotus* rule rather than a direct challenge to it. For a discussion of the *Steamship Lotus* case, *see supra* note 141.

> the Geneva Law is the preservation of humanitarianism accompanied by respect for civilians and the long-term interests of the parties to the conflict by reducing the possibility of sentiments of *revanchisme*, application of humanitarian principles does not override the needs of practical realism. Idealism and a belief in humanitarianism must not result in an automatic rejection of military needs or careless accusations of war crimes or crimes against humanity. However, the assessment of military needs must always be made in good faith.[174]

This is not to say that military necessity ever provides an authorization to act (as the following example might incorrectly suggest: "the employment of military force was authorized because doing so was militarily necessary"), but simply to say that each of the customary law of war principles represent an important *limitation* on means and methods of warfare while simultaneously recognizing that warfare nonetheless persists in human experience. This fact affects the content that the law invests into the term "humanity." This fact further pragmatically presupposes that unless the law somehow accommodates itself to such realities as the continued existence of war, States will ignore it. One can recognize the existence of such accommodation by observing the simple fact that unfettered humanitarianism does not characterize the law of war. If it did, then not only would such "law" never have achieved the force of law in the first place,[175] but the *jus in bello* would prohibit all means and methods of war for the simple reason that any one of them are apt to produce suffering to some extent. Pure humanitarianism would prohibit all suffering of any kind, as the law of war plainly does not.[176] The principles therefore

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[174] GREEN, *supra* note 152, at 333.

[175] Given the development of international law in this century, it is highly doubtful States would ever completely restrict themselves from resort to the use of force under any circumstances – the ultimate extension of pure humanity.

[176] It is for this reason that there is some danger of confusion in referring to the law of armed conflict as humanitarian law. To the extent that the latter title evokes images of human rights law, the term humanitarian, and the legal content it suggests, could be transposed improperly from the one subset of public international law to the other. This would fail to accord the term its rightful and more limited place as it functions within the law of armed conflict. Put simply, humanitarian as used in human rights law does not necessarily mean "humanitarian" as used in the law of armed conflict. This does not mean the two bodies of law are strictly distinct. *See, e.g.*, Levie and Provost cites at *supra* note 120. It also does not at all mean that humanity in the law of war is a narrow principle of customary international law. As Schmitt observes, as applied to protection of the environment in armed conflict, humanity assumes an extra-anthropocentric quality. In this way it can be seen as a broader concept than "humanitarian" as used in human rights law, and includes prohibition of "activities that are not so much inhumane as *inhuman*. They are acts we intuitively recognize as inherently wrongful regardless of the context in which they occur. In a sense, they are violative of the 'dictates of public conscience.'" Schmitt, *Green War*, *supra* note 143, at 61.

require constant balancing and readjustment. Each acts as a limit on permissible military activity so that no one principle obliterates the other.[177]

C. TREATY LAW

Without doubt, the easiest means of determining international law is by reference to the explicit will of States as expressed in treaties. Though of minimal value for ascertaining specific principles applicable to space warfare, the relevant treaties do provide the general foundation from which a space law of war will emerge. And, the four general principles of the law of war outlined above, reinforced within this treaty law, will apply to armed conflict in any combat environment.[178]

A discussion of relevant treaty law restraining armed conflict would not be complete without reference to several historical antecedents. The diplomatic conferences producing the Hague and Geneva Conventions, and their progeny, followed several modest attempts to codify the *jus in bello*. One such attempt, reflected in the Lieber Code of 1863, so called for its author, Columbia University professor Francis Lieber, governed the prosecution of war for the Union Army during the American Civil War. Promulgated by President Lincoln as General Order Number 100, the Lieber Code's 157 articles set forth standards for the prosecution of the war and treatment of Confederate troops.[179]

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[177] Schmitt articulates a sequential analysis in determining whether a military course of conduct comports with the law.

> 1. Means: Do the methods or means selected to execute the attack violate the principles of distinction, humanity, or any specific prohibition of the law of armed conflict? 2. Target: Is the target a military objective? If so, is attack on this type of target specifically forbidden? If not, is the destruction of the target militarily necessary? 3. Result: Does the concrete and direct military advantage anticipated outweigh the collateral damage and incidental injury likely to result?

Schmitt, *Book Review*, *supra* note 141, at 276 n.24. This approach helpfully clarifies that each principle acts as a filter to weed out impermissible military acts while at the same time recognizing that these principles are not authorizations to act, but limitations on acts which might otherwise be lawful.

[178] It should be remembered that the two basic treaty regimes represented by the Hague Conventions and the Geneva Conventions, do not purport to be the exhaustive sources for law of war restrictions. Though they are, to a large extent, codifications of customary law, customary international law remains as a viable source not only for circumstances unaddressed in the treaty law, but to govern the conduct of non-parties to the treaties.

[179] *Instructions for the Government of Armies of the United States in the Field*, General Order No. 100, Apr. 23, 1863, THE LAWS OF ARMED CONFLICTS: A COLLECTION OF CONVENTIONS, RESOLUTIONS AND OTHER DOCUMENTS 3 (Dietrich Schindler & Jiri Toman, eds., 1988) [hereinafter Schindler & Toman].