Note

Space: The ~~Final~~ Next Frontier

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Aye, the celestials have swooped down themselves,
Grim bent on miracles or incarnations.
Earth and her offspring patiently endured,
(Having no choice) and as the years rolled by
In trial and toil prepared their counterstroke –
And now 'tis man who dares assault the sky.
Fear not, Immortals, we forgive your faults,
And as we come to claim our promised place
Aim only to repay the good you gave
And warm with human love the chill of space.

—Professor Thomas G. Bergin, "For a Space Prober," the first poem launched into outer space, 1961.[1]

[O]ur destiny beyond the Earth is not only a matter of national identity, but a matter of national security. So important for our military. So important. And people don't talk about it. When it comes to defending America, it is not enough to merely have an American presence in space, we must have American dominance in space. So important.

—President Donald J. Trump[2]

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1. Phil Leonard, *Message to the Gods: The Space Poetry that Transcends Human Rivalries*, CONVERSATION (Nov. 15, 2017), http://theconversation.com/message-to-the-gods-the-space-poetry-that-transcends-human-rivalries-86572 [https://perma.cc/C2PR-HNYU].

2. NBC News, *President Donald Trump: We Will Have the Space Force, "Separate but Equal,"* YOUTUBE (June 18, 2018), https://www.youtube.com/watch?v=5lEaLcumd08 [https://perma.cc/7YQE-GKD3].

INTRODUCTION

Space wars have long been a thing of science fiction. To date, there has never been an armed attack in outer space. Yet as the world enters its sixth decade in the "Space Age,"[3] advancements in science and technology bring with it the acute possibility of armed conflict erupting in outer space.[4] The final frontier is frequently being discussed in terms of "battlefield[s],"[5] "warfighting,"[6] and the next theater of warfare.[7] This increase in bellicose rhetoric marks a shift towards the stark reality that space has joined its three warfare counterparts—air, land, and sea—as a viable war domain.[8] In fact, the United States Senate re-

3. *Sputnik 1*, NASA, https://www.nasa.gov/multimedia/imagegallery/image_feature_924.html [https://perma.cc/2GSF-UDLN] (last updated Aug. 7, 2017) (stating that on October 4, 1957, Sputnik 1 was successfully launched into orbit in outer space).

4. *See, e.g.*, Michel Bourbonnière & Ricky J. Lee, Jus ad Bellum *and* Jus in Bello *Considerations on the Targeting of Satellites: The Targeting of Post-Modern Military Space Assets*, *in* ISRAEL YEARBOOK ON HUMAN RIGHTS 167, 167 (Yoram Dinstein ed., 2014) (quoting W.B. Scott, *USSC Prepares for Future Combat Missions in Space*, AVIATION WEEK & SPACE TECH. 51, 51 (1996) (quoting General Joseph W. Ashy, Commander in Chief of U.S. Space Command, as saying, "Some people don't want to hear this, and it sure isn't in vogue, but – absolutely – we're going to fight in space. We're going to fight from space and we're going to fight into space when [orbital assets] become so precious that it's in our national interest to do so. That's why the U.S. has development programs in directed energy and hit-to-kill mechanisms.")).

5. Adam Irish, *The Legality of a U.S. Space Force*, OPINIO JURIS (Sept. 13, 2018), http://opiniojuris.org/2018/09/13/the-legality-of-a-u-s-space-force/ [https://perma.cc/LR8R-NE33].

6. *Id.*

7. U.S. DEP'T OF DEF., FINAL REPORT ON ORGANIZATIONAL AND MANAGEMENT STRUCTURE FOR THE NATIONAL SECURITY SPACE COMPONENTS OF THE DEPARTMENT OF DEFENSE (2018), https://media.defense.gov/2018/Aug/09/2001952764/-1/-1/1/ORGANIZATIONAL-MANAGEMENT-STRUCTURE-DOD-NATIONAL-SECURITY-SPACE-COMPONENTS.PDF [https://perma.cc/RJF8-DQ2E] (outlining America's impending need for a United States Space Command to "improve and evolve space warfighting").

8. *See* Helene Cooper, *Pence Advances Plan to Create a Space Force*, N.Y. TIMES (Aug. 9, 2018), https://www.nytimes.com/2018/08/09/us/politics/trump-pence-space-force.html [https://perma.cc/3MLQ-P4LR]; *see also* President Donald Trump, *supra* note 2; *White House Fact Sheet, President Donald J. Trump Is Launching America's Space Force*, WHITE HOUSE (Oct. 23, 2018), https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-launching-americas-space-force/ [https://perma.cc/FBW2-QG2A]. India is mirroring the United States' aggressive rhetoric after they successfully targeted their own satellite. Doris Elin Urrutia, *India's Anti-Satellite Missile Test Is a*

cently passed the National Defense Authorization Act which established a United States Space Force as a distinct armed force within the Department of the Air Force.[9] The Space Force is tasked with "protect[ing] the interests of the United States in space [and] deterr[ing] aggression in, from, and to space . . . ."[10] Thus, with the birth of the United States Space Force, the likelihood of armed conflict rupturing in space is all but certain.

Accordingly, other States[11] have increased their space capabilities as the world launches into a new armed race in outer space.[12] The armed race largely revolves around State-development of dual-use satellites and the means or methods of warfare[13] used to incapacitate these satellites. The United States, China, India, and Russia have invested heavily in anti-satellite technology (ASAT) and associated capabilities in response to the growing military applications of satellites.[14] These dual-use satellites are used in both military and civilian contexts, and it is

Big Deal. Here's Why, SPACE.COM (Mar. 30, 2019), https://www.space.com/india-anti-satellite-test-significance.html (quoting Satish Dua, former Chief of Integrated Defense Staff of the Indian Army, as saying: "India has to be fully equipped for war—whether it is subsurface, surface, air or space warfare . . . . Space pervades all warfare as it enables intelligence and surveillance, information warfare, [and] cyber domain[s].").

9. National Defense Authorization Act, Pub. L. No. 116-92, § 9091, 133 Stat. 1198 (2020).

10. *Id.* § 9091(d)(1)–(2).

11. For the purposes of this Note, "States" refers to sovereign nations as commonly understood under international law.

12. *See generally* SECURE WORLD FOUND., GLOBAL COUNTERSPACE CAPABILITIES: AN OPEN SOURCE ASSESSMENT (Brian Weeden & Victoria Samson eds., 2018), https://swfound.org/media/206118/swf_global_counterspace_april2018.pdf [https://perma.cc/UWD9-7SYU] (finding that States, such as China, Russia, and the United States, have increased development of a broad range of kinetic and non-kinetic counterspace capabilities); David A. Koplow, *The Fault Is Not in Our Stars: Avoiding an Arms Race in Outer Space*, 59 HARV. INT'L L.J. 331, 332 (2018) (discussing the current arms race in space and what measures should be taken to prevent it).

13. *See generally* Bill Boothby, *Space Weapons and the Law*, 93 INT'L L. STUD. 179, 181 (2017) (distinguishing means of warfare as weapons such as projectiles, space vehicles, and lasers used kinetically to attack a space vehicle from methods of warfare which are activities designed to adversely impact an enemy's military operations or capacity such as nudging another space vehicle out of orbit, shading, or other interference with an enemy's space assets).

14. Laura Grego, *A History of Anti-Satellite Programs*, UNION CONCERNED SCIENTISTS (Jan. 2012), http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nwgs/a-history-of-ASAT-programs_lo-res.pdf [https://perma.cc/V6Y7-WFAD] (providing an overview of ASAT programs by spacefaring na-

often difficult to distinguish between the two.[15] In recent years, States have demonstrated their increasing ability to conduct kinetic[16] attacks against satellites in orbit[17] or engage in hostile in-orbit disruptions.[18]

The stakes are high. The United States relies on space more than any other nation for the full range of its military and civilian activities.[19] Were adversaries to launch an attack on United States space assets, the repercussions would be catastrophic. For instance,

> televisions would go blank, mobile networks silent, and the Internet would slow and then stop. Dependent on time stamps from GPS satellites, everything from stock markets to bank transactions to traffic lights and railroad switches would freeze. Airline pilots would lose contact with the ground, unsure of their position and without weather data to steer around storms. World leaders couldn't communicate across continents. In the US military, pilots would lose contact with armed

tions); *see also* BRIAN WEEDEN, THROUGH A GLASS, DARKLY, CHINESE, AMERICAN, AND RUSSIAN ANTI-SATELLITE TESTING IN SPACE (2014), http://swfound.org/media/167224/through_a_glass_darkly_march2014.pdf [https://perma.cc/WP8N-R9GH] (outlining the ASAT capabilities of China, Russia, and the United States).

15. Jane C. Hu, *The Battle for Space*, SLATE (Dec. 23, 2014), https://slate.com/technology/2014/12/space-weapon-law-u-s-china-and-russia-developing-dangerous-dual-use-spacecraft.html [https://perma.cc/5UKC-422Y].

16. *See* Boothby, *supra* note 13, at 206.

17. Just this past March, India demonstrated their ASAT capabilities by targeting a satellite in the Low-Earth Orbit. Urrutia, *supra* note 8; *see also* Brian Weeden, *2007 Chinese Anti-Satellite Test Fact Sheet*, SECURE WORLD FOUND. (Nov. 23, 2010), https://swfound.org/media/9550/chinese_asat_fact_sheet_updated_2012.pdf [https://perma.cc/MST9-FKXC].

18. *See* Jim Sciutto, *US Military Prepares for the Next Frontier: Space War*, CNN (Nov. 29, 2016), https://www.cnn.com/2016/11/28/politics/space-war-us-military-preparations/index.html [https://perma.cc/98JM-PED9] ("Russia has deployed what could be multiple kamikaze satellites such as 'Kosmos 2499'—designed to sidle up to American satellites and then, if ordered, disable or destroy them. China has launched the 'Shiyan'—equipped with a grappling arm that could snatch US satellites right out of orbit.").

19. *See id*. *See generally* U.K. MINISTRY OF DEF., DEV., CONCEPTS & DOCTRINE CTR., SPACE: DEPENDENCIES, VULNERABILITIES AND THREATS (2012), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/33689/20120313mne7_space_vulnerabilites.pdf [https://perma.cc/4ABT-A2MS] (discussing the wider range of military and civilian facilities provided from outer space); Joseph N. Pelton, *Satellite Communications*, *in* SPACE DEVELOPMENT 15 fig. 2.6 (2012) (listing several examples of the broad range of expanding global satellite applications).

> drones over the Middle East. Smart bombs would become dumb. Missiles would sit immobile in their silos. The US could lose early warning of nuclear attacks for parts of the Earth.[20]

It is crucial to identify the way international humanitarian law, *jus in bello*,[21] will apply to armed conflict in outer space. The present surge in space weapons development coupled with the unique physical environment of outer space underpin the urgency with which States must form a consensus regarding the application of *jus in bello* to military space operations. Any emergent consensus must take due consideration of how to adapt the Use of Force doctrine appropriately to the context of outer void space. *Jus in bello*'s Use of Force doctrine regulates combatant activities in conflict and outlines four considerations when using force: distinction,[22] proportionality,[23] humanity,[24] and military necessity.[25] Of note, the complex nature of dual-use satellites and exceptional physical characteristics of outer space will necessitate a different proportionality consideration than a terrestrially-based attack.[26] While distinction, humanity, and military necessity continue to be relevant factors in determining whether an actor complies with *jus in bello* in outer space, these factors are outside of the scope of this Note because any analysis under the proportionality principle presupposes that the attack used a

20. Sciutto, *supra* note 18.

21. *Jus in bello* refers to the law of armed conflict. It is the law that governs the use of force between States. *See infra* Part I.C.

22. G.A. Res. 2444 (XXIII), at 50 (Dec. 19, 1968) ("That distinction must be made at all times between persons taking part in the hostilities and members of the civilian population to the effect that the civilians be spared as much as possible.").

23. U.S DEP'T OF DEF., LAW OF WAR MANUAL § 2.4 (2015), https://dod.defense.gov/Portals/1/Documents/pubs/DoD%20Law%20of%20War%20Manual%20-%20June%202015%20Updated%20Dec%202016.pdf?ver=2016-12-13-172036-190 [https://perma.cc/NR6J-R55X]; *see also* Letter from Daniel Webster to Henry S. Fox, Apr. 24, 1841, THE DIPLOMATIC AND OFFICIAL PAPERS OF DANIEL WEBSTER, WHILE SECRETARY OF STATE 110 (1848) (explaining that even actions taken in self-defense should not be "unreasonable or excessive" since such actions "justified by the necessity of self-defense, must be limited by that necessity, and kept clearly within it.").

24. U.S. DEP'T OF DEF., *supra* note 23, § 2.3 (defining humanity as "the principle that forbids the infliction of suffering, injury, or destruction unnecessary to accomplish a legitimate military purpose").

25. NATO, AAP-6, NATO GLOSSARY OF TERMS AND DEFINITIONS, 82 (2019) (defining military necessity as "[t]he principle whereby a belligerent has the right to apply any measures that are required to bring about the successful conclusion of a military operation and that are not forbidden by the Law of War").

26. *See infra* Parts II.A, III.C.

lawful weapon and the target is a legitimate military target.[27] Instead, this Note will narrow in on the complexities around determining proportionality in outer space.

This Note explores the implications of the use of force in outer space under the current space and *jus in bello* regimes. Looking at the use of kinetic and direct energy ASATs[28] under a proportionality calculus, this Note will propose a new consideration framework which outlines what an actor would have to consider before acting in order to comply with the proportionality principle. Part I will lay down the necessary conceptual basis for developing this new proportionality framework in three dimensions. First, it discusses the existing space *corpus juris*.[29] Second, it explores the emerging ASAT threat and several ASAT technologies which will then be evaluated under the new proportionality framework in Part III. Third, it explores the legal scholarship on armed conflict; in particular, the literature on proportionality and its considerations. Part II will highlight the gaps between space law and *jus in bello*. Specifically, it discusses the regimes' deficiencies due to imperfect analogies to other earth-warfare domains, the lack of clear legal definitions for concepts in space law, and the uniqueness of the outer space environment. Part III argues *jus in bello* does apply, and it is imperative that it applies to outer space. It then outlines a framework which incorporates four considerations an actor should take before employing ASATs, including determining the operational nature of the satellite, where the target is situated, the anticipated harm to the environment and civilians, and the military advantage expected to be gained. This Note demonstrates the four considerations' workability through its application to two ASAT technologies. Ultimately, this Note's essential purpose is to supply a workable framework for State actors to use when determining whether targeting legitimate military objects with ASATs complies with the proportionality principle under *jus in bello*.

27. Bourbonnière & Lee, *supra* note 4, at 200.

28. For the purposes of space, in this Note, only hit-to-kill kinetic weapons and jamming will be discussed in depth and analyzed under the framework in Part III.

29. *Corpus juris* refers to the existing body of law. *Corpus Juris*, BLACK'S LAW DICTIONARY (11th ed. 2019).

I. THE MIRE OF SPACE LAW AND *JUS IN BELLO*

This Part discusses, in three steps, the scope of the current space law regime, the emerging ASAT threat, and the legal scholarship on the proportionality principle in the *jus in bello* regime. Section A discusses the development of the space law regime and how it presently functions. Section B reveals the emergent threats posed by ASAT technology, and in particular, two ASAT technologies—hit-to-kill and jamming ASATs. Section C provides an overview of *jus in bello* and the proportionality principle in detail.

A. THE SPACE LAW REGIME

The space *corpus juris*[30] developed during the infant years of the space race and since 1979, there have not been any treaties added to the space law regime.[31] There are five main treaties which comprise the space *corpus juris*.[32] Of the five main treaties, the Outer Space Treaty (OST) is the most comprehensive treaty, and it heads the space law regime as a hopeful, quasi-constitution for space.[33] The OST has the most bearing on the question of whether *jus in bello* applies to outer space. The preamble to the OST provides that the exploration and use of space shall be for "peaceful purposes."[34] Markedly, the term "peaceful"

30. *Corpus juris* is Latin for "body of law." *Id.*

31. *See infra* note 32 and accompanying text.

32. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410 [hereinafter OST] (bestowing upon astronauts the unique status of "envoys of mankind"); Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched in Outer Space, Apr. 22, 1968, 19 U.S.T. 7570 (creating an affirmative duty for Contracting Parties to search for, rescue, and unconditionally return astronauts to the launching authority); Convention on the International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389 (stating Contracting Parties are liable for damage to people or property caused by their space activities whether such damage occurs on Earth, in outer space, or on the moon or other celestial body); Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695 (establishing a space object registry whereby "launching States" are required to furnish certain information regarding each space object launched into space); Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 (providing that the moon and its natural resources belong to the "common heritage of mankind").

33. J.I. Gabrynowicz, *The "Province" and "Heritage" of Mankind Reconsidered: A New Beginning*, 2 SECOND CONF. ON LUNAR BASES & SPACE ACTIVITIES 691, 692 (1992).

34. *See* OST, *supra* note 32.

is not defined by the treaty.[35] During the drafting of the OST, there was an East-West divide over whether "peaceful" means "non-military" or "non-aggressive."[36] Non-military would bar all military activity in space, whereas non-aggressive would allow for peacetime military activities.[37] Today, through consistent and uniform State practice, it is widely understood "peaceful" means "non-aggressive."[38]

The OST's Article III and Article IV speak directly to the issue of the legality of military activities in space. Article III requires all activities in the exploration and use of outer space to be in accordance with international law.[39] This provision protects all the rights bundled in the UN Charter, including, "the inherent right of individual or collective self-defence" under Article 51.[40] Article IV prohibits nuclear weapons and weapons of mass destruction from being "stationed" in space.[41] The partial weapons ban does not proscribe the stationing of non-nuclear weapons in space, such as anti-ballistic missiles, killer satellites, or anti-satellite weapons.[42] Nor does this partial ban affect a nuclear weapon making a temporary transit through outer space toward its intended target, since it is not "stationed" in space.[43]

35. *Id.*

36. Paul B. Larsen & Francis Lyall, *The Military Use of Outer Space*, *in* SPACE LAW: A TREATISE 469 (2d ed. 2018). See *infra* Part II.B.1 for an in-depth discussion of "peaceful purposes."

37. *See* Larsen & Lyall, *supra* note 36.

38. Fabio Tronchetti, *The Applicability of Rules of International Humanitarian Law to Military Conflicts in Outer Space: Legal Certainty or Time for a Change?*, *in* PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 357, 362 (2012).

39. OST, *supra* note 32, art. III ("States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, *in accordance with international law, including the Charter of the United Nations*, in the interest of maintaining international peace and security and promoting international co-operation and understanding." (emphasis added)).

40. U.N. Charter art. 51.

41. *See* OST, *supra* note 32, art. 4 ("States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.").

42. Fabio Tronchetti, *Legal Aspects of the Military Uses of Outer Space*, *in* HANDBOOK OF SPACE LAW 331, 337 (Frans von der Dunk & Fabio Tronchetti eds., 2015).

43. *See* David Koplow, *ASAT-ISFACTION: Customary International Law and Regulation of Anti-Satellite Weapons*, 30 MICH. J. INT'L. L. 1187, 1198 (2009).

Read together, Article III and IV anticipate military activity in space, but they do not provide strong fetters against State military action. To its own detriment, the OST did not include any specific provisions relating to its application in wartime, and the Articles are an uninspiring effort to restrain States.[44] This lackluster approach has resulted in the current quagmire of scholarship discussing the OST's applicability to wartime and the hounding doubt which follows.[45] The uncertainty stemming from the OST's silence on the applicability of the *jus in bello* to military operations in space is at the heart of this Note. Specifically, this Note considers how proportionality will shake out in space confrontations.

B. THE EMERGENT THREATS POSED BY ASAT TECHNOLOGIES

The emergent threats posed by ASAT technology are directly related to the military and civilian value of satellites and their orbitals. This value is compounded by the ubiquitous dependence States place upon satellites for everyday civilian and military functions. Section B.1 provides an overview of the value of satellites and their orbitals proceeded by Section B.2, which elaborates on ASAT technologies and describes their characteristics.

1. Satellites and Orbitals

Satellites are indispensable to force enhancement during armed conflict. They support military operations through essential tasks such as providing secure and high-volume unsecured communications, targeting and navigational services, weather prediction, and battle assessment.[46] Unsurprisingly, satellites make excellent military targets due to their high military

44. *See* OST, *supra* note 32.

45. Arjeen Vermeer, *The Laws of War in Outer Space: Some Legal Implications for the* Jus ad Bellum *and* Jus in Bello *of the Militarisation and Weaponisation of Outer Space*, *in* THE NEW ORDER OF WAR 69, 74 (Bob Brecher ed., 2010) ("But it cannot be simply assumed that [the *jus in bello*] corpus applies *in toto* to armed conflict in outer void space, just because of the unique environment that the latter presents."); *cf.* Steven Freeland, *The Laws of War in Outer Space*, *in* HANDBOOK OF SPACE SECURITY, 81, 102 (Kai-Uwe Schrogl et al. eds., 2015) ("Overall, given the unique nature of outer space, the fundamental principles of the laws of war—developed to regulate *terrestrial* warfare and armed conflict—are probably neither sufficiently specific nor entirely appropriate for military action in outer space.").

46. Grego, *supra* note 14.

value.[47] As States increasingly invest in satellite technology, the more they become dependent upon them, and the greater likelihood those satellites may be compromised by hostile forces seeking to disrupt satellite functions in a time of conflict.[48] Additionally, besides the tactical advantage of disrupting an adversary's military capabilities, satellites make good targets because they are difficult to defend.[49] They are the "soft underbelly" of a State's national security.[50] For one, they are relatively few in number,[51] thereby destroying even a handful could have a catastrophic effect on an adversary. Second, satellites are "soft," they lack heavy shielding or the ability to defend themselves.[52] A satellite's primary source of protection comes from the difficulties associated with launching an attack through the unique space environment to a specific location.[53] Third, satellites follow known orbits with little ability to divert their trajectories.[54] Fourth, they are not usually equipped with sensors which alert them to an attack, or even if they are alert-equipped, the sensors are unable to tell them who is attacking.[55] Fifth, satellites are

47. *Japan, Australia Ask China to Explain Space Missile*, TRUTH SEEKER (Jan. 21, 2007), http://www.thetruthseeker.co.uk/?ps=5965 [https://perma.cc/R6A9-3R98].

48. *See, e.g.*, U.S. CONGRESS OFF. OF TECH. ASSESSMENT, ANTI-SATELLITE WEAPONS, COUNTER-MEASURES, AND ARMS CONTROL 33 (1985) ("The value, or utility, of military satellites is very real, but it is extremely difficult to quantify. The timeliness of information or the speed of communications may make the difference between winning a battle and losing one . . . .").

49. *See, e.g.*, SPACE SECURITY 147 (2008).

50. *See Japan, Australia Ask China to Explain Space Missile*, *supra* note 47 (quoting Rep. Edward Markey (D-Mass.) as saying, "American satellites are the soft underbelly of our national security").

51. *UCS Satellite Database*, UNION CONCERNED SCIENTISTS [hereinafter *UCS Satellite Database*], https://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database?_ga=2.245242117.1030392505.1542561754-1434941526.1542561754#.W_GgH_ZFzb0 [https://perma.cc/3WGG-G5AG] (last updated Dec. 16, 2019) (stating there are 2218 operational satellites in orbit).

52. SPACE SECURITY, *supra* note 49, at 147.

53. *Id.*

54. *Id.* (discussing some defender advantages that arise with different orbital paths. For example, satellites in lower altitude orbits are difficult to detect with space-based infrared sensors due to their proximity to Earth's atmosphere. Low-altitude orbits are also less predictable due to the fluctuation in atmospheric effects. Alternatively, higher altitude orbits raise power demands for terrestrial radars and provided targeted satellites with longer warning times).

55. *See* Koplow, *supra* note 43, at 1200.

expensive.[56] States and private actors often do not maintain a fleet of spares.[57] Lastly, satellites function differently depending on which orbit they occupy.[58]

There are three types of orbits[59] relevant to this Note's proportionality principle framework: Low-Earth Orbit (LEO), Medium-Earth Orbit (MEO), and Geosynchronous Earth Orbit (GEO).[60] The difference in orbitals is significant for three reasons. First the amount of debris in each orbit is varied.[61] This means an attack with resultant debris will have a different effect on each orbit, altering the proportionality calculation.[62] Second, some orbitals have a higher "real estate" value than others.[63] Lastly, the type of information each satellite transmits varies between the orbitals, which may influence the target's legitimacy and military value.[64]

56. Gary Brown & William Harris, *How Much Do Satellites Cost?*, HOWSTUFFWORKS, https://science.howstuffworks.com/satellite10.htm [https://perma.cc/TU4H-SGCW] (stating a satellite may cost as much as $290 million to build and an additional $10–400 million to launch).

57. *See* SPACE SECURITY, *supra* note 49, at 148 ("In general, there is currently little redundancy of commercial, military, or civilian space systems, particularly of the space-based components, because of the large per-kilogram cost of launch.").

58. *See* Gary Brown & William Harris, *How Satellites Work*, HOWSTUFFWORKS (May 19, 2000), https://science.howstuffworks.com/satellite7.htm [https://perma.cc/A76Q-2CJD].

59. See JOINT STAFF-MN//ACT, MULTINATIONAL EXPERIMENT 7 ACCESS TO GLOBAL COMMONS: PROTECTING ACCESS TO SPACE, 1-3 fig.1.1 (July 8, 2013), for different orbital altitudes.

60. These three areas of space contain roughly ninety-five percent of operational satellites. David Wright, *The Current Space Debris Situation*, UNION OF CONCERNED SCIENTISTS 2 (2010), https://swfound.org/media/99971/wright-space-debris_situation.pdf [https://perma.cc/PNP2-W3A6]. *See* Pelton, *supra* note 19, at 11 tbl.2.1, for a list of the advantages and disadvantages associated with each orbital.

61. *See* Fatima Ahmed Mohamed & Noor Azian Mohamad Ali, *Space Debris Low Earth Orbit (LEO)*, 4 INT'L J. SCI. & RES. 1591 (2013).

62. *See infra* Part I.C.2.

63. *See, e.g.*, THE SPACE ECONOMY AT A GLANCE 52 (2014) (stating GEO satellites are the most profitable orbits).

64. *See infra* notes 67, 73, 78 and accompanying text.

LEO do not have a formal definition, but it is generally considered to have an apogee[65] of roughly 1000 kilometers.[66] LEOs are favorable for observation, environmental monitoring, and small communications satellites.[67] These orbits are advantageous due to their proximity to earth, which allows them to use less powerful sensors and transmitters and deliver ultra-high bandwidth with less delay than GEO satellites.[68] For these reasons, the U.S. military is increasing its investment in LEO capabilities to support its real-time command-and-control needs.[69] However, the debris situation in LEO may be reaching a tipping point.[70] The rising instability in the current LEO environment is both a growing concern and consideration in the proportionality calculus for any military action taken against a satellite in LEO.

MEO similarly lacks a formal definition, but it is considered to include orbits between LEO and GEO.[71] Satellites in this area

65. The point in an orbit that is furthest from the Earth. *Apogee*, DICTIONARY.COM, https://www.dictionary.com/browse/apogee [https://perma.cc/D67L-PKH2].

66. *See* JOINT STAFF-MN//ACT, *supra* note 59, ¶ 108. They have an orbit period between 1.5 and 3 hours as well as an orbital speed of about 7 kilometers per second. Wright, *supra* note 60, at 2.

67. *See* JOINT STAFF-MN//ACT, *supra* note 59, ¶ 108.

68. *Id.*; Anne Wainscott-Sargent, *LEO/MEO Satellites Poised to Make a Mark in Military Sector*, VIA SATELLITE (Feb. 12, 2018), http://interactive.satellitetoday.com/leo-meo-satellites-poised-to-make-a-mark-in-military-sector/ [https://perma.cc/2PQR-9YBX].

69. Wainscott-Sargent, *supra* note 68 (quoting Tim Deaver, Corporate Vice President of Development and Strategy for SES Government Solutions, saying: "Government interest is growing day by day as they start to appreciate the capabilities and see the benefits they can get from low latency and high throughput").

70. See *infra* Part II.C.2, for a discussion on the Kessler syndrome. *See also* INTER-AGENCY SPACE DEBRIS COORDINATION COMM., STABILITY OF THE FUTURE LEO ENVIRONMENT (Feb. 22, 2013), http://www.unoosa.org/pdf/pres/stsc2013/tech-12E.pdf [https://perma.cc/D5BK-QFUW]; Michael J. Listner, *UN Report: Space Debris in Low Earth Orbit May Be Reaching the Tipping Point*, SPACE SAFETY MAG. (Feb. 14, 2013), http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/report-space-debris-low-earth-orbit-reaching-tipping-point/ [https://perma.cc/J8MD-5XBQ]. *But see* Koplow, *supra* note 43, at 1203 (arguing while debris is a concern at all altitudes, debris "generated at relatively low altitudes will usually degrade quite quickly, falling out of orbit and ordinarily burning up when re-entering the earth's atmosphere." Whereas debris at higher altitudes will remain in orbit for years, decades, or even centuries).

71. *See* JOINT STAFF-MN//ACT, *supra* note 59, ¶ 109.

reach altitudes of 20,000 kilometers.[72] The functions of satellites in this zone consist predominantly of global positioning systems.[73] The U.S. military is similarly increasing investment in satellites in MEO.[74] While MEO is not nearly as congested as LEO, due to fewer satellites and the larger volume of space, the space debris environment of MEO has not been systematically investigated and is largely unknown.[75]

GEO satellites have altitudes of approximately 36,000 kilometers.[76] GEO satellites fly around Earth at the same speed as Earth's rotation which allows the satellite to appear stationary overhead and provide constant coverage.[77] Some kinds of communications, weather, surveillance, and warning systems satellites use GEO.[78] While assessing the space debris collision hazard is more challenging for GEO than LEO, the desirability of GEO's orbital real estate is leading it to become congested with operational and defunct satellites, increasing the likelihood of collisions.[79]

All three orbitals are valuable in different ways: be it the tactical information they provide, the location the occupy, or the general services they afford.[80] Due to the desirability of satellites to everyday State functions, it comes as no surprise that almost

72. Wright, *supra* note 60, at 2. They have an orbit of twelve-hour periods and orbital speeds of four kilometers per second. *Id.*

73. *See* JOINT STAFF-MN//ACT, *supra* note 59, ¶ 109.

74. Ryan Schradin, *MEO: Bringing Robust and Secure Communications to the Military*, GOV'T SATELLITE REPORT (Apr. 20, 2018), https://ses-gs.com/govsat/defense-intelligence/meo-bringing-robust-secure-communications-military/ [https://perma.cc/32MX-DY9P] (noting the reliance of today's military on IT solutions and capabilities—at home and in theater—which necessitates a satellite that can offer higher throughputs, more bandwidth, and lower latency).

75. JOSEPH N. PELTON, SPACE DEBRIS AND OTHER THREATS FROM OUTER SPACE 19–20 (Joseph N. Pelton, Jr. & William H. Ailor eds., 2013); Jiri Silha et al., *An Optical Survey for Space Debris on Highly Eccentric and Inclined MEO Orbits*, 59 ADVANCES SPACE RES. 181, 182 (2017).

76. Stephen Clark, *U.S. Military Orders Two More Surveillance Satellites to Roam Geosynchronous Orbit*, SPACEFLIGHT NOW (Apr. 10, 2017), https://spaceflightnow.com/2017/04/10/u-s-military-orders-two-more-surveillance-satellites-to-roam-geosynchronous-orbit/ [https://perma.cc/2RX3-858C].

77. *Id.*

78. *Id.*

79. Marric Stephens, *Space Debris Threat to Geosynchronous Satellites Has Been Drastically Underestimated*, PHYSICSWORLD (Dec. 12, 2017), https://physicsworld.com/a/space-debris-threat-to-geosynchronous-satellites-has-been-drastically-underestimated/ [https://perma.cc/B88S-HK4E].

80. *See supra* notes 15–16 and accompanying text.

as soon after States developed satellites, they began developing ASAT technology.[81]

2. Anti-Satellite Technology

ASATs are weapons that are used to incapacitate or destroy satellites as military objectives.[82] There are two basic types of ASATs: kinetic and directed energy ASATs.[83] Historically, kinetic ASATs are "the most common forms of space weaponry."[84] Kinetic ASATs will destroy or incapacitate a satellite by collision using a single missile, releasing a cloud of pellets into the path of the satellite, or by sidling up close enough to blow up both itself and the targeted satellite.[85] Hit-to-kill ASATs function without explosives: instead, the energy released by the collision of two spacecrafts rushing towards each other at closing speeds of almost 36,000 feet per second suffice to destroy satellites.[86] Yet, given the tremendous speeds at which objects orbit, almost anything properly aimed could become a weapon—even masses as small as paint flecks.[87] The main concern for hit-to-kill ASATs

81. The first studies of military space satellites were initiated in 1946 by the U.S. Navy. FED'N OF AM. SCIENTISTS, THE HISTORY OF US ANTISATELLITE WEAPONS SYSTEMS 4, https://fas.org/man/eprint/leitenberg/asat.pdf [https://perma.cc/WM7K-PQDK]. Notions of anti-satellite defense developed as early as April 1954, well in advance of launching the first satellites. *Id.* at 5.

82. U.S. AIR FORCE, COUNTERSPACE OPERATIONS: AIR FORCE DOCTRINE DOCUMENT 2-2.1 at 4, 33 (2004), https://fas.org/irp/doddir/usaf/afdd2_2-1.pdf [https://perma.cc/ZY3Y-VJKP].

83. *See* Koplow, *supra* note 43, at 1200.

84. Robert A. Ramey, *The Law of War in Space*, GLOBAL NETWORK AGAINST WEAPONS & NUCLEAR POWER SPACE (Mar. 13, 2001), http://www.space4peace.org/slaw/lawofwar.htm#sixa [https://perma.cc/MD3Z-Y4PS].

85. *See* Boothby, *supra* note 13, at 206; *see also* Larsen & Lyall, *supra* note 36, at 469–70.

86. Paul Glenshaw, *The First Space Age*, AIR & SPACE MAG. (April 2018), https://www.airspacemag.com/military-aviation/first-space-ace-180968349/ [https://perma.cc/8DQN-8UEG] (providing an overview of the history of the United States' ASAT capabilities).

87. *Id.* Objects in low-Earth orbits travel at speeds on the order of 4.7 miles per second. DAVID E. LUPTON, ON SPACE WARFARE: A SPACE POWER DOCTRINE 13 (1988). For an example of the tremendous speeds at which objects orbit and how any object may become a weapon, consider that a 4,000-pound car would have to travel at roughly 270 miles an hour to equal the kinetic energy of a one-pound object traveling at 4.7 miles per second. *Id.* See Part II.C.2, for more discussion on space debris.

in the proportionality analysis will be the amount of space debris created by the offensive.[88]

On the other hand, jamming ASATs (a subset of directed ASAT technology)[89] disable rather than destroy their targets.[90] Satellite jamming interferes with radio communications between the satellite and users on the ground.[91] Jamming carries with it the possibility of being covert, as the effects are similar to the routine failures found in satellites, and as such, it would be difficult to detect.[92] This is especially true since the majority of interference with satellite communications is unintentional and due to factors like poorly trained operators.[93] However, there are noted instances of State actors and Non-State actors intentionally jamming foreign satellite broadcasts and commercial communications within their territories.[94] Despite these isolated instances of traced jamming to State actors, most jamming would be untraceable.[95] With jamming, resultant space debris is not a concern since it will not produce particles other than the defunct satellite. The main concern, as it relates to the proportionality principle, is the disruption to civilian usage and whether that disruption is excessive in relation to the military advantage expected to be gained. The next Section fleshes out how that civilian-military balance is carried out in *jus in bello*.

88. A U.S. shootdown created 285 pieces of debris which took almost nineteen years to fully reenter the atmosphere. *See* Glenshaw, *supra* note 86. International outrage was sparked by the 2007 China ASAT missile which created 3,000 pieces of debris. Weeden, *supra* note 17.

89. *See* Koplow, *supra* note 12, at 339 (explaining that directed energy ASAT technology uses either lasers, columns of sub-atomic particles, radio frequency transmissions, or microwave generators to disable a satellite. Directed energy ASATs can burn holes in a satellite's skin, blind its sensors, or possibly even employ cyber warfare to alter a satellite's onboard operations and commandeer it for the attacker's own purposes).

90. Blair Stephenson Kuplic, Note & Comment, *The Weaponization of Outer Space: Preventing an Extraterrestrial Arms Race*, 39 N.C. J. INT'L L. & COM. REG. 1123, 1139 (2014).

91. Grego, *supra* note 14, at 9 (explaining the "jamming" can interfere either with the "uplink" (the ground-to-satellite transfer of data to be broadcast) or the "downlink" (satellite-to-ground data transfer)).

92. Kuplic, *supra* note 90, at 1139.

93. Grego, *supra* note 14, at 9.

94. *Id.* at 9 nn.29–30 (explaining that Iran used a jamming device to block American transmissions, and the Falun Gong jammed a Hong Kong-based satellite and broadcast its own message).

95. *See supra* note 92 and accompanying text.

C. *JUS IN BELLO* AND THE PROPORTIONALITY PRINCIPLE

Jus in bello, or the law applicable to the conduct in armed conflict, is a robust area of the law comprised of hundreds of conventional and customary rules.[96] Over time, several noteworthy principles have emerged which regulate armed conflict: military necessity, humanity, distinction, and proportionality.[97] The *jus in bello* regime attempts to strike a balance between military necessity and humanity; as such, all four of these principles work in conjunction as "interdependent and reinforcing parts of a coherent system."[98] Military necessity allows certain actions necessary to secure the complete submission of the enemy as quickly and efficiently as possible.[99] Counterbalancing military necessity is humanity, which outlaws the infliction of suffering or destruction that is unnecessary to achieve that legitimate military objective.[100] Distinction has a long pedigree and is a central tenet of warfare; it requires parties to a conflict at all times to distinguish between combatants and civilians and direct attacks solely at the former.[101] Proportionality demands that even when an attack may be justified by military necessity, that attack does not cause unreasonable or excessive civilian injury in relation to the expected military advantage to be gained.[102] These principles are codified in the 1907 Hague Conventions[103] and the 1949 Geneva Conventions[104] together with their two Additional Protocols of

96. *See generally IHL Database: Customary International Law*, INT'L COMM. RED CROSS, https://ihl-databases.icrc.org/customary-ihl/eng/docs/v1_rul [https://perma.cc/EG9Z-G63F] (listing customary international laws).

97. *See* U.S. DEP'T OF DEF., *supra* note 23, at 51–52; Vermeer, *supra* note 45, at 74.

98. U.S. DEP'T OF DEF., *supra* note 23, at 51–52.

99. *Id.*; *see also* LAURIE R. BLANK & GREGORY P. NOONE, INTERNATIONAL LAW AND ARMED CONFLICT: FUNDAMENTAL PRINCIPLES AND CONTEMPORARY CHALLENGES IN THE LAW OF WAR 40 (2d ed. 2019).

100. U.S. DEP'T OF DEF., *supra* note 23, at 51–52; *see also* BLANK & NOONE, *supra* note 99, at 45.

101. BLANK & NOONE, *supra* note 99, at 48.

102. *Id.* at 58; *see also* U.S. DEP'T OF DEF., *supra* note 23, at 51–52.

103. *See* Regulations Respecting the Laws and Customs of War on Land, annexed to Convention No. IV Respecting the Laws and Customs of War on Land, Oct. 18, 1907, 36 Stat. 2227, T.S. No. 539 (establishing specific rules which prohibit using poison, killing persons who have surrendered, improper use of flags and uniforms, the destruction or seizure of enemy property which is not necessary, and the treacherous killing or wounding of enemy soldiers) [hereinafter 1907 Hague Regulations].

104. *See* Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field, Aug. 12, 1949, 75 U.N.T.S. 31

1977.[105] However, the current scholarship raises serious doubts as to the applicability of *jus in bello* norms in outer space.[106] It is important to note that these doctrines and their precursors are rooted in the concept of territoriality. The absence of a terrestrial platform in the outer space context raises problematic "fit" issues. Yet, given the likelihood that hostilities will arise in outer space, it is necessary to determine how and to what extent *jus in bello* may be adapted to fit the unique outer space environment. Specifically, this Note fleshes out several of the nuances in the application of the proportionality principle to outer space, which comprehensively addresses some of these "fit" issues.

The proportionality analysis begins with object distinction. Civilian objects cannot be the deliberate object of an attack, but attacks against military objectives are allowed.[107] Civilian objects are defined in the negative: they are all objects that are not military objectives.[108] On the other hand, military objectives are defined as those objects which "by their nature, location, purpose or use make an effective contribution to military action and whose partial or total destruction, capture or neutralisation [sic], in the circumstances ruling at the time, offers a definite military advantage."[109] If there exists any doubt as to whether an object normally dedicated to civilian purposes is being used militarily, the presumption is that it retains its civilian character and it

[hereinafter GC I]; Geneva Convention for the Amelioration of the Condition of the Wounded, Sick and Shipwrecked Members of the Armed Forces at Sea, Aug. 12, 1949, 75 U.N.T.S. 85 [hereinafter GC II]; Geneva Convention Relative to the Treatment of Prisoners of War, Aug. 12, 1949, 75 U.N.T.S. 135 [hereinafter GC III]; Geneva Convention Relative to the Protection of Civilian Persons in Time of War, Aug. 12, 1949, 75 U.N.T.S. 287 [hereinafter GC IV]. The Geneva Conventions are primarily concerned with maintaining human security and dignity during conflict.

105. Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts, June 8, 1977, 1125 U.N.T.S. 3 [hereinafter AP I]; Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of Non-International Armed Conflicts, June 8, 1977, 1125 U.N.T.S. 609.

106. *See supra* note 45 and accompanying text.

107. CUSTOMARY INTERNATIONAL HUMANITARIAN LAW VOLUME I: RULES 25 (Jean-Marie Henckaerts & Louise Doswald-Beck eds., 2005), http://www.loc.gov/rr/frd/Military_Law/pdf/Cust-Intl-Hum-Law_Vol-I.pdf [https://perma.cc/5GK5-MS8J].

108. *Id.* at 32

109. *Id.* at 29.

cannot be deliberately targeted.[110] Attacks against military objectives are allowed and incidental damage to civilians or civilian objects is not strictly prohibited. For instance, the death of civilians during an armed conflict does not in itself constitute a war crime.[111] *Jus in bello* allows for military commanders to carry out proportionate attacks against military targets, even if such an attack will cause civilian death or injury.[112] The proportionality principle merely demands that "[c]ombatants must refrain from attacks in which the expected loss of civilian life, injury to civilians, and damage to civilian objects incidental to the attack would be excessive in relation to the concrete and direct military advantage expected to be gained."[113] When conducting attacks, military officers need only consider the proportionality principle if civilians or civilian properties are at risk of harm.[114] In other words, there is no requisite proportionality calculus should combatants choose to target enemy combatants. If a civilian object has lost its presumptive protection by making an effective contribution to a military action and it becomes a legitimate military objective, any damage caused to that object as a result of the attack may not be considered in the proportionality determination.[115] Moreover, the proportionality principle addresses loss of life, injury, and damage to property; mere inconveniences or

110. *Id.* at 52 (listing several treaties and domestic instruments which share the presumption against civilian objects being military objectives language).

111. Letter from Luis Moreno-Ocampo, Chief Prosecutor, Int'l Criminal Court to parties concerned about war crimes in Iraq (Feb. 9, 2006), https://web.archive.org/web/20090327061739/http://www2.icc-cpi.int/NR/rdonlyres/F596D08D-D810-43A2-99BB-B899B9C5BCD2/277422/OTP_letter_to_senders_re_Iraq_9_February_2006.pdf [https://perma.cc/5GK5-MS8J].

112. *Id.*

113. U.S. DEP'T OF DEF., *supra* note 23, at 241. Even though this principle is articulated in the AP I which only applies to "any land, air or sea warfare," it is accepted that this provision is a part of Customary International Law and therefore, applies to outer space. AP I, *supra* note 105, art. 49(1), 51(5)(b); *see also IHL Database: Customary International Law, Rule 14. Proportionality in Attack*, INT'L COMM. RED CROSS, https://ihl-databases.icrc.org/customary-ihl/eng/docs/v1_rul_rule14 [https://perma.cc/W92H-YXLC].

114. *See* U.S. DEP'T OF DEF., *supra* note 23, at 242.

115. Bourbonnière & Lee, *supra* note 4, at 201. Article 52(2) of AP I provides the definition of a legitimate military object: "[M]ilitary objectives are 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." AP I, *supra* note 105, art. 52(2).

temporary losses are not a consideration in the calculation.[116] Any reasonably foreseeable effects must be included in the calculus as collateral damage and remote harm are not included.[117]

1. Applying the Proportionality Principle and Balancing Military Advantage with Civilian Losses

Proportionality is a notoriously slippery concept. It constantly straddles the question of "How much is too much?" without coming to any concrete answer.[118] By way of example, under the Geneva Convention, a school is a civilian object that is immune from attack; however, the Convention allows for certain exceptions.[119] If a civilian object loses its protection by making an effective contribution to a military action, it may become a legitimate military target. If a school has been taken over by hostile forces, it becomes a legitimate military target.[120] Presumably

116. *See* Bourbonnière & Lee, *supra* note 4, at 200–01; *see also* Yoram Dinstein, *Distinction and Loss of Civilian Protection in International Armed Conflicts*, 84 U.S. NAVAL WAR C. INT'L L. STUD. 183, 186 (2008) ("Yet it must be borne in mind that not every inconvenience to civilians ought to be considered relevant. In war-time, there are inevitable scarcities of foodstuffs and services. Indeed, food, clothing, petrol and other essentials may actually be rationed; buses and trains may not run on time; curfews and blackouts may impinge on the quality of life; etc. These do not count in the calculus of proportionality.").

117. Bourbonnière & Lee, *supra* note 4, at 201.

118. FINAL REPORT TO THE PROSECUTOR BY THE COMMITTEE ESTABLISHED TO REVIEW THE NATO BOMBING CAMPAIGN AGAINST THE FEDERAL REPUBLIC OF YUGOSLAVIA ¶¶ 48, 50, https://www.icty.org/en/press/final-report-prosecutor-committee-established-review-nato-bombing-campaign-against-federal [https://perma.cc/PA9D-T8ZB] [hereinafter NATO Bombing Report] ("The main problem with the principle of proportionality is not whether or not it exists but what it means and how it is to be applied. It is relatively simple to state that there must be an acceptable relation between the legitimate destructive effect and undesirable collateral effects. For example, bombing a refugee camp is obviously prohibited if its only military significance is that people in the camp are knitting socks for soldiers. Conversely, an air strike on an ammunition dump should not be prohibited merely because a farmer is plowing a field in the area. Unfortunately, most applications of the principle of proportionality are not quite so clear cut . . . . One cannot easily assess the value of innocent human lives as opposed to capturing a particular military objective . . . . It is suggested that the determination of relative values must be that of the 'reasonable military commander.'").

119. *Geneva Convention (IV) Relative to the Protection of Civilian Persons in Time of War*, INT'L COMM. RED CROSS (Aug. 12, 1949), https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/Treaty.xsp?documentId=AE2D398352C5B028C12563CD002D6B5C&action=OpenDocument [https://perma.cc/QT52-692Y].

120. Abdul Rehman Khan, *Space Wars: Dual-Use Satellites*, 14 RUTGERS J.L. & PUB. POL'Y 314, 320–21 (2017).

the school's operations are stilled during military operations and therefore, harm to the school is no longer a part of the proportionality analysis.[121] Yet, if there are children present while the military operations are taking place, those children must be accounted for in the proportionality analysis.[122] Children are civilians who cannot be deliberately attacked;[123] however, when the school becomes a military objective and children are present, the attack is lawful provided that the deaths of children are not excessive in relation to the military advantage expected to be gained by targeting the school.[124] Which begs the difficult question: How many children would there need to be present at the school to prohibit the attack on proportionality grounds?

Civilian harm and loss in the satellite context is particularly thorny. For one, it is onerous to determine whether satellites constitute civilian objects. While there are official classifications of whether a satellite is governmental, commercial, military, or civil, in practice these lines are much more blurred.[125] The presumption that a satellite is a civilian object may be easier to rebut if these satellites are dual-use. Many satellite functions are the same between civil and military satellites. For instance, both types of satellites engage in communications, navigation, meteorological, and geodetic functions.[126] In fact, there are several dual-use satellites which the United States uses for both military and civil purposes.[127] The information a satellite is transferring, or rendering may be civilian in nature, but easily taken over by necessary military objectives. Like the school that was a civilian object until it was taken over by hostile forces, here too,

121. Except to the extent that structural damage and future civilian use are calculated. *See, e.g.*, Amos S. Guiara, Symposium, *Determining a Legitimate Target: The Dilemma of the Decision-Maker*, 47 TEX. INT'L L.J. 315 (2012).

122. *See* Khan, *supra* note 120, at 334.

123. *See* GC IV, *supra* note 104 (providing throughout that children are a special class of civilian that requires additional protections from harm and attack).

124. AP I, *supra* note 105, art. 57.

125. *Satellite Database*, UNION OF CONCERNED SCIENTISTS, https://www.ucsusa.org/resources/satellite-database [https://perma.cc/27CL-XU5S] (Excel chart is on file with author).

126. *What Are Satellites Used For?*, UNION OF CONCERNED SCIENTISTS (Jan. 15, 2015), https://www.ucsusa.org/resources/what-are-satellites-used [https://perma.cc/V47L-FWDC].

127. Jane C. Hu, *The Battle for Space*, SLATE (Dec. 23, 2014), https://slate.com/technology/2014/12/space-weapon-law-u-s-china-and-russia-developing-dangerous-dual-use-spacecraft.html [https://perma.cc/88M9-8TZW].

satellites may be civilian in function but taken over by a State's military for certain, particular military actions. Thus, the civilian-military function is much more difficult to definitively ascertain. However, unlike the school example, civilians are not being directly killed in a satellite attack, rather the destruction civilian satellite capacities are indirectly harming civilian objects, and potentially civilian lives.[128] Second, what is a civilian purpose, and when does a satellite provide an essential civilian purpose to the civilian population? Is a geostationary satellite's ability to predict a forest fire an essential civilian purpose?[129] Is internet communication? Or mobile phone use? The satellite's civilian purpose that it supports ties directly into whether the resultant harm will be considered excessive.

Another wrinkle in the proportionality calculus is the determination of what exactly is "excessive" in relation to the expected military advantage. Part of the difficulty in this determination lies in the comparison between civilian casualties and military advantage—they are like "metaphorical apples and oranges."[130] One is a science, and the other an art. Civilian losses can be counted and civilian damages can be appraised, but quantifying military advantage is an undeniably more difficult task.[131] Fur-

128. *See What Are Satellites Used For?*, *supra* note 126.

129. Khan, *supra* note 120, at 336–37 (discussing whether satellites provide necessary information or just "really important" information).

130. *See* Dinstein, *supra* note 116, at 186; *cf.* Statement of Interest of the United States of America, Matar v. Dichter, 05 Civ. 10270 (WHP) (S.D.N.Y. Nov. 17, 2006); DIGEST OF UNITED STATES PRACTICE IN INTERNATIONAL LAW 465, 471–72 (2006) (ebook) ("Again, the rub lies in determining what counts as 'excessive.' Any number of intangibles must be [c]onsidered: How important is the military objective sought to be achieved? What are the pros and cons of each option available to achieve that objective? For each option, what is the probability of success? What are the costs of failure? What are the risks of civilian casualties involved in each option? What are the risks of military casualties involved in each option? How are casualties of either kind to be weighed against the benefits of the operation? In short, questions of proportionality are highly open-ended, and the answers to them tend to be subjective and imprecise.").

131. Bourbonnière & Lee, *supra* note 4, at 201; *see also* Hamutal Esther Shamash, *How Much Is Too Much? An Examination of the Principle of* Jus in Bello *Proportionality*, 2 ISR. DEF. FORCES L. REV. 103, 117–20 (2005) (discussing the attempts of several scholars to classify "military advantage" according to a sliding time scale which takes into account long-term damage as well as long-term military advantage).

thermore, some scholars have argued "excessive" is interchangeable with "extensive."[132] However, this is a misreading of the text.[133] Renowned international law of armed conflict scholar Yoram Dinstein acutely describes the difference between extensive and excessive:

> The fact that collateral damage is extensive does not necessarily render it excessive. The concept of excessiveness is not an absolute one. Excessiveness is always measured in light of the military advantage that the attacker anticipates to attain through the attack. If the military advantage anticipated is marginal, the collateral damage expected need not be substantial in order to be excessive. Conversely, extensive collateral damage may be legally justified by the military value of the target struck, because of the high military advantage anticipated by the attack.[134]

This distinction is critical in the outer space context where there will likely be extensive damage to civilian property if a satellite is targeted.[135] It is important not to conflate excessiveness with extensiveness and to evaluate the damage only in terms of its excessiveness.[136]

132. COMMENTARY ON THE ADDITIONAL PROTOCOLS, 626 (Yves Sandoz et al. eds., 1987), http://www.loc.gov/rr/frd/Military_Law/RC_commentary-1977.html [https://perma.cc/RCC8-D4ER] (asserting the AP I "does not provide any justification for attacks which cause extensive civilian losses and damages. Incidental losses and damages should never be extensive").

133. *See* YORAM DINSTEIN, THE CONDUCT OF HOSTILITIES UNDER THE LAW OF INTERNATIONAL ARMED CONFLICT 156–57 (2016); *accord* Dale Stephens & Cassandra Steer, *Conflicts in Space: International Humanitarian Law and Its Application to Space Warfare*, 40 ANNALS AIR & SPACE L. 1, 21–27 (2015).

134. THE PROGRAM ON HUMANITARIAN POLICY & CONFLICT RESEARCH, HPCR MANUAL ON INTERNATIONAL LAW APPLICABLE TO AIR AND MISSILE WARFARE 98 (2013).

135. The space environment's physical characteristics may result in an adverse effect to the global commons and negatively impact neutral states, orbits, and the global civilian population. Bourbonnière & Lee, *supra* note 4, at 201.

136. This Note advocates for a hybrid subjective-objective standard when determining whether a commander's proportionality evaluation was reasonable. *See* IAN HENDERSON, THE CONTEMPORARY LAW OF TARGETING: MILITARY OBJECTIVES, PROPORTIONALITY AND PRECAUTIONS IN ATTACK UNDER ADDITIONAL PROTOCOL I, at 222 (2009) ("An assessment of the proportionality of an attack is based on the circumstances of the commander and the information available to him or her. However, the *conclusions* to be reached on whether collateral damage is *expected* and whether it is *proportional* is then based on what a reasonable person would have concluded from that information." (emphasis in original)).

2. Additional Considerations Relating to the Environment and Proportionality

The rule on damage caused to the natural environment by military activities is codified in Additional Protocol I,[137] but for States who are not party to the Additional Protocol I,[138] customary international law treats natural environments as a civilian object—meaning, the natural environment may not be the object of an attack, and it is further protected from wanton destruction.[139] "Wanton destruction" constitutes action taken maliciously which cannot be justified by imperative military necessity.[140] However, a forest may come under deliberate attack if it conceals, for example, an armor division and therefore qualifies as a military objective.[141] Yet, even though the forest now qualifies as part of a military objective, the proportionality analysis will still need to account for the expected, additional, non-military-objective collateral damage to the environment.[142]

State practice comports with customary international law: there is general acceptance that damage to the natural environment is included in the proportionality principle calculation.[143] This notion is set forth by the Guidelines on the Protection of the Environment in Times of Armed Conflict, the *San Remo Manual on Naval Warfare*, and a number of official statements.[144] For instance, during the NATO bombing campaign against the Federal Republic of Yugoslavia, NATO stated "all possible collateral damage, be it *environmental*, human or to the civilian infrastructure" must be weighed and considered in the targeting decision.[145] (emphasis added). Reiterating this sentiment, the Committee Established to Review the NATO Bombing Campaign

137. *See* Boothby, *supra* note 13, at 190.

138. The United States is not party to Additional Protocol I, it has not accepted Articles 35(3) and 55, and it has "repeatedly expressed the view that these provisions are 'overly broad and ambiguous' and 'not a part of customary law.'" U.S. DEP'T OF DEF., *supra* note 23, § 6.10.3.1; *accord* Boothby, *supra* note 13, at 190 n.37 ("[I]t is clear that the United States regards environmental damage as only prohibited when it breaches proportionality.").

139. THE PROGRAM ON HUMANITARIAN POLICY, *supra* note 134, at 206.

140. *Id.*

141. *Id.* at 205.

142. *Id.*

143. *Rule 43. Application of General Principles on the Conduct of Hostilities to the Natural Environment*, INT'L COMM. RED CROSS, https://ihl-databases.icrc.org/customary-ihl/eng/docs/v1_rul_rule43 [https://perma.cc/96TT-GRYV].

144. *Id.*

145. *Id.* (citing NATO Bombing Report, *supra* note 118, ¶ 58).

Against the Federal Republic of Yugoslavia found the bombing campaign's environmental impact was "best considered from the underlying principles of the law of armed conflicts such as necessity and proportionality."[146] In addition to avoiding excessive civilian harm or injury, the military officer must also avoid targeting which causes grave environmental harm that is disproportionate to the legitimate military advantage expected to be gained. This consideration will necessarily take on a new format in the context of the outer space environment.

For any armed conflict occurring in outer space, the *jus in bello* regime will govern each parties' conduct. To that end, the proportionality principle will help define to what extent *jus in bello* applies and any military commander deciding to target a satellite will have to consider relevant terrestrial calculations such as civilian injury, the expected military advantage to be gained, and the environmental impact of targeting a satellite. However, these considerations are complicated by the physical nature of space and the lack of substantive treaties governing conduct in space. These gaps in the space law regime implicate an imperfect application of *jus in bello* to void outer space. Part II discusses these gaps and highlights divergent scholarship on how these gaps might be filled or avoided.

II. PITFALLS OF THE CURRENT SPACE REGIME AND ITS IMPLICATIONS FOR AN EFFECTIVE APPLICATION OF *JUS IN BELLO*

As previewed in Part I, there is divergent scholarship regarding the pitfalls of the current space regime and how those pitfalls may be appropriately patched. Therefore, the application of *jus in bello*'s proportionality principle to military space activities can only be a workable framework if it takes stock of these pitfalls and addresses them. For instance, the framework should consider how other global commons have dealt with the application of *jus in bello* to their territories, use sufficiently clear legal definitions for concepts in space law, and differentiate and account for the physical environment of space.

The two other global commons, the high seas and the Antarctic, are examples of other applications of *jus in bello* to a particular physical space. While it may be an imperfect comparison as both global commons are terrestrial, by using them as a foundation, it may be possible to analogize and draw inferences to

146. *Id.* (citing NATO Bombing Report, *supra* note 118, ¶ 63).

the use of force in space. The high seas and Antarctica are the terrestrial territories most like space for their physical characteristics as well as their legal regimes and governing treaties. Section A discusses two examples of the applicability of *jus in bello* in the high seas and Antarctica and draws conclusions about a similar space application. Next, the lack of legal definitions for concepts in space law make it difficult to apply international law and consequently, *jus in bello*. Section B explores the impact varying legal definitions may have on the application of *jus in bello* to the space law regime. Lastly, the special physical characteristics of void outer space create another set of considerations which must be accounted for. Section C deliberates space's physical environment and draws several noteworthy characteristics to the fore such as orbits, space debris, and space debris' cascading effects.

A. PARALLELS WITHIN THE GLOBAL COMMONS

While the "analogical approach" has not been unanimously accepted in the literature,[147] it is still worthwhile to compare outer space with two other global commons regimes which have been committed to "peaceful purposes": the legal regimes of the high seas and Antarctica.[148] Of the two, the high seas legal regime is a closer, yet still imperfect analogy. For example, both outer space and the high seas are outside the jurisdiction of any one State;[149] they are not subject to appropriation by States or

147. *Compare* Jeffrey Prevost, *Law of Outer Space—Summarized*, 19 CLEV. ST. L. REV. 595, 601 (1970) ("Unfortunately, the analogy is more romance than science. The sea, as relates to pertinent law, is a surface of two dimensions; space is a three dimensional volume within which man operates. Time itself contracts; gravity ceases. The shortest distance between two points is a curved line; navigation, as used on earth, is meaningless."), *and* Stephan Hobe, *Historical Background*, *in* 1 COLOGNE COMMENTARY ON SPACE LAW: OUTER SPACE TREATY 107, 113 (Stephan Hobe et al. eds., 2009) (stating "no analogies to air law or sea law should be made" (emphases omitted)), *and* Bourbonnière & Lee, *supra* note 4, at 200 (arguing in land and naval attacks the proportionality calculus is limited to the immediate attack area, whereas in space, the analysis is multi-dimensional and implicates effects on orbits, neutral states, and a potential global civilian population that relies on the space asset), *with* M.J. Peterson, *The Use of Analogies in Developing Outer Space Law*, 51 INT'L ORG. 245, 248–52 (1997) (discussing the process and function of analogical reasoning).

148. *See* United Nations Convention on the Law of the Sea art. 88, *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS]; *see also* The Antarctic Treaty art. 1, Dec. 1, 1959, 12 U.S.T. 794.

149. OST, *supra* note 32, art. 1; UNCLOS, *supra* note 148, art. 87.

individuals;[150] and they constitute vast spaces uninhabitable by humans independent of manmade vessels. Like outer space, the law of the high seas preserves the oceans as a common resource for all.[151]

Article 88 in the 1982 United Nations Convention on the Law of the Sea (UNCLOS) provides the analogous "peaceful purposes" provision.[152] Despite this "peaceful purposes" provision, historically, maritime spaces have not been considered immune to military activity or to *jus in bello* regulation.[153] This long-standing understanding was re-endorsed in the drafting work on UNCLOS and later in the 1994 *San Remo Manual*.[154] It follows that the "peaceful purposes" clause enshrined in UNCLOS does not preclude the conduct of military activities and *jus in bello* applies to such activities. However, it is not clear the "peaceful purpose" clause has attained a status as a general international law principle which would apply blanketly across distinct domains.[155]

The Antarctic Treaty provides an alternative reading of "peaceful purposes." While the high seas may be a closer analogy, Antarctica still shares several characteristics with outer space, which makes it a close runner-up analogy. First, any human inhabiting Antarctica will have to cope with an extremely harsh environment and a lack of resources, making them dependent on large logistical efforts.[156] Second, in the late 1950s,

150. OST, *supra* note 32, art. 2; UNCLOS, *supra* note 148, art. 89.

151. Jacob M. Harper, *Technology, Politics, and the New Space Race: The Legality and Desirability of Bush's National Space Policy Under the Public and Customary International Laws of Space*, 8 CHI. J. INT'L L. 681, 693 (2008).

152. UNCLOS, *supra* note 148, art. 88 ("The high seas shall be reserved for peaceful purposes.").

153. Kubo Mačák, *Silent War: Applicability of the* Jus in Bello *to Military Space Operations*, 94 INT'L L. STUD. 1, 17 (2018).

154. Third United Nations Conference on the Law of the Sea, 1973–82, 4th Sess., 67th plen. mtg. ¶ 81, U.N. Doc. A/CONF.62/SR.67 (Apr. 23, 1976), *reprinted in* 5 OFFICIAL RECORDS OF THE THIRD UNITED NATIONS CONFERENCE ON THE LAW OF THE SEA 62 (1976) ("The term 'peaceful purposes' did not, of course, preclude military activities generally."); *see also* SAN REMO MANUAL ON INTERNATIONAL LAW APPLICABLE TO ARMED CONFLICTS AT SEA ¶ 10 (Louise Doswald-Beck ed., 1995) ("[H]ostile actions by naval forces may be conducted in, on, or over . . . the high seas.").

155. Alexander Proelß, *Peaceful Purposes*, MAX PLANCK ENCYCLOPEDIA PUB. INT'L L. ¶ 22 (Nov. 2010), http://opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1453 [https://perma.cc/FT4N-Q2M8].

156. Peterson, *supra* note 147, at 257.

most of Antarctica remained unexplored.[157] The extent of natural resources in Antarctica was unknown and their location remote.[158] Lastly, the large distances separating Antarctica from other continents meant military installments were easy to establish but difficult to defend.[159] However, despite these similarities, the Antarctic Treaty's "peaceful purposes" provision is distinguishable from the high seas and outer space since the treaty was drafted prior to any military activity occurring in Antarctica. Therefore it is useful to note that in different global commons contexts, "peaceful purposes" can include both military activity and an absolute prohibition on military activity. As such, it must be discussed specifically in terms of outer space and a clear definition pronounced.

B. LEGAL DEFINITIONS

To ensure coherence and consistency across international law, there must be clear definitions of its key terms. Without clear definitions, the development of *jus in bello* for space will be plagued by inconsistencies and gaps. This Section details the development of the definition of "peaceful purposes" as well as which weapons are proscribed under the OST. Section B.1 discusses the varied definition of the OST's "peaceful purposes" and demonstrates its divergent implications. Section B.2 discusses the application of the OST's prohibitions on weapons in space to ASATs.

1. Peaceful Purposes

The legality of military actions in outer space turns on the interpretation of the term "peaceful purposes" found in Article IV of the OST. While the adjective "peaceful" may be found in nearly all U.N. documents relating to outer space, nowhere does there exist an authoritative definition of "peaceful."[160] Consequently, there emerged two competing schools of thought defining "peaceful purposes": one camp, headed by the United States, argued it should be interpreted as "nonaggressive," while the

157. *Id.*

158. *Id.*

159. *Id.* at 258.

160. Christopher M. Petras, *"Space Force Alpha" Military Use of the International Space Station and the Concept of "Peaceful Purposes,"* 53 A.F. L. REV. 135, 168 (2002).

other camp, led by the Soviet Union, argued it should be interpreted as "non-military."[161]

The official position of the United States has always been that "peaceful" means "non-aggressive."[162] This stance was a logical outgrowth of the fact that the United States already had military intelligence satellites in space prior to the OST.[163] Furthermore, the United States' two major policy goals pre-OST were to gain international recognition of the permissibility of such satellites, while simultaneously discouraging military space activities which threatened its satellites.[164]

In contrast to the United States, the Soviet Union interpreted "peaceful purposes" to mean "non-military" as part of its diplomatic attack to ban United States reconnaissance satellites.[165] This interpretation would totally bar all military activities in outer space. However, the U.S.S.R. consistently maintained that all its activities in space were "peaceful" and "scientific."[166] The Soviet Union's official position softened as its military satellite program grew and it became increasingly dependent on space technology for military planning.[167]

Yet, it is likely the drafters of the OST did not intend for "peaceful purposes" to mean "non-military." First, the OST permits certain military activities in areas explicitly reserved "exclusively for peaceful purposes" (the moon and other celestial bodies).[168] And second, the OST makes international law (including the right of self-defense) applicable to those same reserved areas.[169] Under the modern current of space law, there is tacit agreement amongst principal space powers that all military activities in space are permissible unless otherwise prohibited by international treaty or customary law.[170] A general consensus

161. *See* Kuplic, *supra* note 90, at 1145.

162. Richard A. Morgan, *Military Use of Commercial Communication Satellites: A New Look at the Outer Space Treaty and "Peaceful Purposes,"* 60 J. AIR L. & COM. 237, 304 (1994).

163. *See* Kuplic, *supra* note 90, at 1145.

164. Petras, *supra* note 160, at 170 n.224.

165. Kuplic, *supra* note 90, at 1145–46; *see also* Petras, *supra* note 160, at 171.

166. Petras, *supra* note 160, at 171.

167. Mitchell Ford, *War on the Final Frontier: Can Twentieth-Century Space Law Combat Twenty-First-Century Warfare?*, 39 HOUS. J. INT'L L. 237, 242–43 (2017).

168. OST, *supra* note 32, art. 4.

169. *Id.* art. 3.

170. Morgan, *supra* note 162, at 303.

has developed within the U.N. that "peaceful" more specifically equates to "non-aggressive" and this sentiment generally aligns with State practice.[171] Regardless of what side of "peaceful purposes" one falls on, States can still develop ground-based ASAT technology that can fire weaponry from earth.[172] The OST's failure to address technologies and weapons such as ASATs has resulted in a gap: What uses of weapons are prohibited in outer space?

2. Prohibited Weapons

The OST does not expressly prohibit deliberate attacks on satellites or prevent ASAT tests. Its sole stipulation prevents nuclear weapons and weapons of mass destruction.[173] Notably, this provision implicitly allows for the use of ASATs and other space weapons.

The basic term "space weapon" lacks a definition under international law.[174] Part of the definitional problematics arises over whether the international community should include in the definition of a space weapon "both weapons and targets located in space, direct and indirect applications of force, and the possibility of temporary impairment as well as permanent destruction."[175] However, since most space systems are used equally for military and civilian purposes, space objects designed for peaceful purposes may become space weapons and destroy or damage other space systems.[176] Additionally, it is not entirely obvious

171. Petras, *supra* note 160, at 172. No state has ever formally protested the U.S. version of "peaceful purposes" in the context of outer space activities. *Id.* at 171.

172. *See* Ford, *supra* note 167, at 244.

173. OST, *supra* note 32, art. 4.

174. *See* Ramey, *supra* note 84.

175. William Marshall et al., *Space Weapons: The Urgent Debate*, 1 J. SCI. & WORLD AFF. 19, 22 (2005). Certain technologies (kinetic-ASATs), specifically created with the capacity and intent of destroying satellites fit the traditional definition of space weapons. Andrew T. Park, *Incremental Steps for Achieving Space Security: The Need for a New Way of Thinking to Enhance the Legal Regime for Space*, 28 HOUS. J. INT'L L. 871, 882 (2006). However, other technologies are more difficult to categorically classify. By way of example, technologies which strategically and temporarily occupy orbits, or technologies merely used to disrupt space activities of other space actors through encryption or jamming. *Id.* at 883.

176. A. Ferreira-Snyman, *Selected Legal Challenges Relating to the Military Use of Outer Space, with Specific Reference to Article IV of the Outer Space Treaty*, in 18 POTCHEFSTROOMSE ELEKTRONIESE REGSBLAD § 4.3 (2015); *see also* Ramey, *supra* note 84.

how to distinguish space weapons from space objects or space debris. Objects in orbit may travel at roughly 17,000 miles per hour which gives them the inherent ability to destroy or interfere with satellites in space.[177] Since ASATs are not prohibited by the OST and there is no treaty regulating ASATs, this Note's framework works to curb the uncertainty surrounding the use of ASATs in outer space. The framework is needed to create parameters which consider the possible negative ramifications on civilians, industries, and environments.

C. PHYSICAL ENVIRONMENT

The fragility of outer space must be a principal concern in creating an effective legal regime governing armed conflict in space. Of particular note, the capacity of space is finite.[178] There are limited useful orbits and the density of debris may result in a chain reaction of collisions which render orbits unusable or deny access to space by spacecraft.[179] The impact on orbitals and the potential ignition of collisional cascading will likely alter the proportionality calculus.[180]

1. Location

A further complication is whether orbits are themselves legitimate military objectives. Since orbits are locations which may offer a direct military advantage during a conflict, there is uncertainty regarding their status as legitimate military targets.[181] Conversely, it may be argued that orbits are a natural environment which must be protected.[182] In an advisory opinion by the International Court of Justice on the legality of the use of nuclear weapons, the Court noted, "Respect for the environment is one of the elements that go to assessing whether an action is in conformity with the principles of necessity and proportionality."[183] Whether an orbit is considered a legitimate military object or a protected natural environment will impact the proportionality calculus. If a State actor found that the orbit is a legitimate military target, then the resulting debris field is not

177. Ramey, *supra* note 84.

178. JOINT STAFF-MN//ACT, *supra* note 59, ¶ 103.

179. *Id.*

180. *See supra* Part II.

181. Bourbonnière & Lee, *supra* note 4, at 201.

182. *Id.*

183. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 30 (July 8).

to be considered in the proportionality analysis because the effect of an attack on another legitimate military object is irrelevant. However, if it is found that the orbit is a natural environment to be protected, then resulting debris will need to be considered in the proportionality analysis.

2. Debris

Orbital debris has become a growing concern in recent years as space debris builds up in all three orbitals.[184] It is now recognized as a grave problem for current and future safe, successful operations in space.[185] Despite international recognition of space debris as a debilitating issue, there does not exist a comprehensive binding instrument at the regional or international level which regulates space debris.[186] Much of this debris is unintentional: comprised of decommissioned satellites, dropped tools from astronauts, failed components, and paint flecks.[187] More than 500,000 pieces of debris are tracked as they orbit the Earth.[188] Twenty-thousand pieces of debris are larger than a softball.[189] There are millions of pieces of debris which are untrackable due to their small size.[190] Each piece travels at speeds up to 30,000 kilometers per hour.[191] Yet, even tiny paint flecks

184. JOINT STAFF-MN//ACT, *supra* note 59, ¶ 121; *see supra* Part I.B.1.

185. *See* Koplow, *supra* note 43, at 1202.

186. The strongest regulatory piece of space debris legislation is the Inter-Agency Space Debris Coordination Committee's nonbinding Space Debris Mitigation Guidelines. *See, e.g.*, INTER-AGENCY SPACE DEBRIS COORDINATION COMM., SPACE DEBRIS MITIGATION GUIDELINES (2007), https://www.unoosa.org/documents/pdf/spacelaw/sd/IADC-2002-01-IADC-Space_Debris-Guidelines-Revision1.pdf [https://perma.cc/X7Z6-JM8G] (including considerations such as: (1) Limiting the amount of debris released during normal operations; (2) Minimizing the potential for break-ups during operational phases; (3) Minimizing potential for post-mission break-ups resulting from stored energy; (4) Limiting the long-term presence of spacecraft and launch vehicle orbital stages in the low Earth orbit (LEO) region after the end of their mission; and (5) Limiting the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous Earth orbit (GEO) region after the end of their mission).

187. *See* Koplow, *supra* note 43, at 1202.

188. Mark Garcia, *Space Debris and Human Spacecraft*, NASA (Sept. 26, 2013), https://www.nasa.gov/mission_pages/station/news/orbital_debris.html [https://perma.cc/LS5F-89WE].

189. *Id.*

190. *Id.*

191. *Id.*

can inflict catastrophic damage on spacecraft or obliterate satellites when traveling at these velocities.[192] Debris from an ASAT attack would generate thousands more random fragments and create a lethal orbiting cloud.[193] There is concern that as the orbitals become increasingly cluttered, collisional cascading will occur. Any increase in space debris—even nominal—has the potential to trigger the collision sequence.

The risk of cascading build-up debris is known as the Kessler Syndrome.[194] Scholars and scientists theorize that at some point, the cascading effects of debris collisions will create "deadly rings of debris" that are sufficiently dense to bar access to space by spacecrafts and any attempt would likely result in those spacecrafts simply adding to the morass of space debris.[195] While the "terminal condition" is not immediate, it would essentially prohibit the ability to launch new spacecraft, and damage existing satellites and space capacities in orbit.[196] There have been two events in recent years which have served to escalate concerns about space debris and ignite condemnation from the international community.[197] The first act occurred on January 11, 2007 when the Chinese intentionally launched a missile to destroy an inoperable weather satellite.[198] The ASAT system was

192. *Id.* ("In fact a number of space shuttle windows have been replaced because of damage caused by material that was analyzed and shown to be paint flecks.").

193. Koplow, *supra* note 43, at 1203 (referring to China's January 2007 ASAT test which created 2,600 trackable pieces and upwards of perhaps 150,000 smaller fragments. The fragments "created a swarm, moving through space like a high-speed lethal amoeba, stretching from 200 to 2350 kilometers in altitude, through which over 100 essential Earth observation satellites must repeatedly pass in the years to come").

194. JOSEPH N. PELTON, NEW SOLUTIONS FOR THE SPACE DEBRIS PROBLEM 2 (2015). The Kessler Syndrome was hypothesized in 1978 by astrophysicist Donald J. Kessler. Donald J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. GEOPHYSICAL RES. 2637 (1978) (concluding that over the next few decades, a significant amount of space debris will generate escalating collisions). See GRAVITY (Warner Bros. Pictures 2013) for a pop-culture representation of the effects of the Kessler Syndrome as it tracks a spacecraft's encounter with space debris and its debilitating effects.

195. PELTON, *supra* note 194, at 2.

196. *Id.*

197. Gene V. Milowicki & Joan Johnson-Freese, *Strategic Choices: Examining the United States Military Response to the Chinese Anti-Satellite Test*, 6 ASTROPOLITICS 1 (2008), https://www.tandfonline.com/doi/pdf/10.1080/14777620801907913 [https://perma.cc/L2ZM-8246].

198. *See supra* notes 17, 193–94 and accompanying text.

launched and reached its target at an altitude of 537 miles which triggered a new ring of debris of about 3,000 trackable pieces.[199] The second act occurred on February 10, 2009 when the defunct Russian Kosmos 2251 weather satellite collided with the Iridium 33 mobile communications spacecraft.[200] This random collision generated roughly 3,000 pieces of new debris in LEO.[201] While there is some debate as to whether Kessler syndrome is already ignited or yet to begin, the general consensus maintains that the density of derelict space objects has already exceeded the mathematical tipping point.[202] In terms of the proportionality calculation, this will require careful attention to the amount of emergent debris.

This Note has taken stock of the aforementioned problematics with the space law regime and the difficulties in application of *jus in bello* to the unique physical characteristics of space. Keeping these considerations in mind, this Note has developed a framework which ultimately, helps military officers think through the varied elements of the proportionality calculus as it relates to space.

III. A WORKABLE FRAMEWORK FOR STATES TO IMPLEMENT WHEN DETERMINING WHETHER THE EMPLOYMENT OF HIT-TO-KILL OR JAMMING ASATS IS COMPLIANT WITH INTERNATIONAL LAW

This Part unfolds in four Sections. First, this Note argues that *jus in bello* is the applicable legal framework which governs armed conflict in outer space despite space's non-terrestrial location. Then, this Note provides a framework for State actors to employ when deciding whether the employment of hit-to-kill ASATs or jamming ASATs will comply with international law. Ultimately, it proposes each State actor should sufficiently note and balance the answers to four informative questions. Next, the Note addresses alternative approaches and discusses the deficiencies regarding these approaches. Lastly, to demonstrate this

199. *See* PELTON, *supra* note 194, at 2.

200. *Id.*

201. *Id.* at 4.

202. Darren McKnight & Donald Kessler, *We've Already Passed the Tipping Point for Orbital Debris*, IEEE SPECTRUM (Sept. 26, 2012), https://spectrum.ieee.org/aerospace/satellites/weve-already-passed-the-tipping-point-for-orbital-debris [https://perma.cc/UD6E-LAV3].

framework's applicability, this Note walks through the framework's four questions and applies it to hit-to-kill and jamming ASATs.

A. *JUS IN BELLO* APPLIES TO OUTER SPACE

None of the provisions of *jus in bello* precisely apply to conduct in outer space.[203] The relevant rules and doctrines use terrestrial vocabulary. For instance, Common Articles 2 and 3 of the Geneva Conventions contain express references to the "territory" of a State.[204] Even still, States do not have total latitude to act as they please without expressly constraining rules.[205] Nor are a State's legal obligations necessarily conditioned upon a geographic location.[206] The lack of "black letter rules" which explicitly state outer space is governed by *jus in bello* does not render outer space lawless nor *jus in bello* presumptively inapplicable. Instead, generally applicable rules of international law follow a State's new activities even without specific instruments governing such activities.

This was certainly true in the context of cyberspace. In the 1990s it was argued that rules designed for the "offline world" did not reach to cyberspace.[207] Yet two decades later, States from all regions of the world affirmed that they considered international law applicable to conduct in cyberspace.[208] The same approach applies to the application of international law and *jus in*

203. Mačák, *supra* note 153, at 10.

204. GC II, *supra* note 104; GC III, *supra* note 104.

205. *See, e.g.*, Accordance with International Law of the Unilateral Declaration of Independence in Respect of Kosovo, Advisory Opinion, 2010 I.C.J. 403, ¶¶ 2–3 (July 22) (Simma, J., declaration) (arguing that reliance on the *Lotus* principle "reflects an old, tired view of international law" and amounts to an "anachronistic, extremely consensualist vision of international law").

206. Robert A. Ramey, *Armed Conflict on the Final Frontier: The Law of War in Space*, 48 A.F. L. REV. 1, 123 (2000).

207. *See generally* David R. Johnson & David Post, *Law and Borders—The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367 (1996) (arguing that cyberspace requires different laws than those applicable to physical, geographically-defined territories).

208. Mačák, *supra* note 153, at 13 n.65 (citing U.N. Secretary-General, *Developments in the Field of Information and Telecommunications in the Context of International Security* 15, U.N. Doc. A/65/154 (July 20, 2010) (United Kingdom); U.N. Secretary-General, *Developments in the Field of Information and Telecommunications in the Context of International Security* 6, U.N. Doc. A/66/152 (July 15, 2011) (Australia); *id.* at 18 (United States); U.N. Secretary-General, *Developments in the Field of Information and Telecommunications in the Context of International Security* 18, U.N. Doc. A/68/156 (July 16, 2013)

bello to State conduct in outer space. States clearly contemplated military action, and potentially armed conflict in outer space.[209] Without an express and persistent objection to the application of *jus in bello* to outer space, States have impliedly acquiesced to its application. This is bolstered by the fact that the OST explicitly references States' obligation to carry out activities in accordance with international law, including the United Nations Charter.[210] This explicit reference articulates States' acquiescence to *jus in bello* applying to outer space. It would seem axiomatic that international law would apply to an arena where international State relationships exist. Furthermore, excluding outer space from the application of international humanitarian law is contrary to the purpose of the *jus in bello* regime. *Jus in bello* seeks to ameliorate suffering and violence in armed conflict to the greatest extent possible.[211] As codified in Common Article 1, a provision widely considered to be binding on all State-actors, States have a specific obligation to ensure and respect *jus in bello* "in all circumstances," including conduct in outer space.[212] Since *jus in bello* is applicable, it is necessary to take stock of its unique features and determine how the proportionality calculus will operate in the outer space context.

B. THE FRAMEWORK'S FOUR GUIDING QUESTIONS

By reviewing the *jus in bello* regime, the outer space legal regime, and the unique physical characteristics of outer space, this Note synthesizes a workable framework into four main questions. Any State actor deciding whether to target a satellite in space should guide their decision according to the answers of the following four questions: (1) What is the operational nature of the target? (2) Where is the target situationally located? (3) What is the anticipated harm to civilians and the environment? (4) What is the military advantage expected to be gained?

(United Kingdom); U.N. Secretary-General, *Developments in the Field of Information and Telecommunications in the Context of International Security* 4, U.N. Doc. A/68/156/Add.1 (Sept. 9, 2013) (Canada); *id.* at 12 (Iran); *id.* at 15 (Japan); *id.* at 16–17 (Netherlands); U.N. Secretary-General, *Developments in the Field of Information and Telecommunications in the Context of International Security* 16, U.N. Doc. A/69/112 (June 30, 2014) (Switzerland)).

209. *Supra* Part II.2.

210. OST, *supra* note 32, art. 2.

211. *See* U.S. DEP'T OF DEF., *supra* note 23, at 60.

212. GC I, *supra* note 104.

1. Operational Nature of the Target

The starting point for the proportionality determination is the operational nature of the target. If the satellite is a military reconnaissance satellite, the offensive is likely compliant with international law, provided any resultant debris does not create excessive damage to civilian objects. The proportionality principle is only triggered if civilian injury or objects are implicated in the offense.[213] However, if the satellite is a dual-use satellite, there must be a further inquiry into the exact nature of the civilian use and whether it is essential to the civilian population. There are multiple lenses through which to view civilian use. One such lens may be the sort of information the satellite provides.[214] For instance, is the satellite simply a weather satellite, or is it used to support medical services? Or, what if it is a communications satellite? The loss of a weather satellite could put civilians and civilian objects at risk. For example, weather satellites notify users of potentially dangerous weather conditions. Such information is necessary to warn civilians of hurricanes, tornadoes, or other devastating natural disasters. Without the ability to know weather patterns and warn civilians, civilians would be at risk of death or bodily harm. The only constraint on this evaluation is foreseeability and whether the damage is too remote to include in the proportionality calculation. Similarly, the disruption to a satellite which supports medical services could directly impact civilian health and life. However, the death or injuries resulting from the destruction of a satellite that supports medical services are more foreseeable and closely linked to the destruction than a weather satellite. If a communications satellite was attacked, mobile networks and the internet would shut down. Cities would launch into chaos as traffic lights and railroad switches freeze.[215] Again, the only limit is whether the resulting damage was reasonably foreseeable to the military officer and the injury or harm was proximately caused by the satellite's disruption. The calamitous effects that damage to any one of the satellites could have on civilian life and property is significant regardless of the specific information it provides.

213. *See* U.S. DEP'T OF DEF., *supra* note 23, at 61.

214. *See What Are Satellites Used For*?, *supra* note 126.

215. *See* Sciutto, *supra* note 18, and accompanying text.

A second lens may be how many civilians use this satellite's services.[216] Are there thousands of users? Hundreds of thousands? Millions? And what is the difference between these numbers in practice? It is impossible to draw a line in the sand and say that disrupting the service for 10,000 civilian users is okay, but a disruption for 10,001 users is too much. Instead, using a third, hybrid lens affords a military officer the flexibility to consider both discrete hypothetical numbers and civilian and societal interests. The hybrid lens will consider together the satellite's civilian use and the effect of its disruption on essential civilian tasks and the sheer number of civilians using the satellite. The most balanced lens is a hybrid lens. A hybrid lens is better suited to balancing competing interests and forcing a more thoughtful analysis. For example, if a million people use the satellite but only for weather conditions, is that sufficient to breach proportionality? The answer to this question becomes clearer after answering the three following questions. Once a State actor has determined the operational nature of the target, then it must next consider the satellite's location.

2. Target's Location

There must also be due consideration of where the satellite is located. The proportionality analysis will look different depending upon whether the satellite occupies LEO, MEO, or GEO space.[217] This is, in part, because of the anticipated harm debris may cause in a more crowded orbit. This analysis is further expanded upon *infra* Part III.B.3. Additionally, the analysis will bifurcate depending on whether the orbital is considered a natural environment or a legitimate military target. Under a natural-environment approach, the officer must evaluate to what extent the environment will be affected.[218] Whereas under the legitimate-military-target approach, the officer need only determine the operational nature of the target and balance it with the expected military advantage to be gained. While State actors may be more inclined to view orbitals as military targets in order to circumvent the environmental harm analysis, this Note stresses that the orbital should be considered a natural environment due to the fact space is a global common and as such, the immediate effect of an attack will be detrimental and blanketly applied to

216. *See supra* notes 130–36 and accompanying text.

217. *See supra* Part I.B.1.

218. *See* Part I.C.2.

all nation-states. As such, any harm to the orbital must be considered in the proportionality analysis as an environmental harm.

3. Civilian and Environmental Harm

The resultant harm in the proportionality analysis will need to account for both civilian death, injury, damage, *and* environmental harm. For civilian harm, the analysis will need to evaluate whether injury to civilians and civilian objects is excessive. Bearing in mind, mere inconveniences associated with armed conflict are not sufficient to tip the scales in favor of a proportionality principle breach[219] because normal war-time inconveniences are to be expected.[220] In contemporary armed conflict situations, the crux of the issue is whether internet, general communications, and other types of satellite-service disruptions constitute a "mere inconvenience"—completely irrelevant to the proportionality analysis—or whether they constitute excessive damage. At this point in the analysis, it is important to recall the distinction between extensive from excessive.[221] Excessiveness is measured in light of the military advantage expected to be gained.[222] Therefore, targeting a satellite which causes extensive damage to internet communications, weather satellites, or other satellite services may be legally justified by the military value of the target.[223] But, just because it is not per se unlawful does not mean that it is lawful. Instead, because of our dependence on internet connections, weather satellites, and other communications for the full range of a wide variety of civilian tasks, it is likely that damage to a satellite which provides these services to a lot of people will be considered not only extensive, but also excessive. The amount and type of damage may vary depending on the satellite's function, but the more States come to rely on satellites for civilian and commercial purposes, as well as masked military purposes, the more attractive they become as targets, despite the prohibition on intentionally targeting civilians. In any case, the decision whether destroying a satellite will be excessive or simply extensive implicates a fact-dependent inquiry, and holding that distinction in mind, this Note will now turn to the compounded environmental harm.

219. *See* Dinstein, *supra* note 116.

220. *Id.*

221. *See supra* notes 130–36 and accompanying text.

222. *See* THE PROGRAM ON HUMANITARIAN POLICY, *supra* note 134 at 92.

223. *Id.*

Like civilian harm, the environmental harm must be accounted for—this determination turns on how many pieces of debris an attack would create and how many pieces are acceptable. While there likely is no magic number of debris pieces which would automatically bar military action under international law, the satellite's position in LEO, MEO, or GEO will influence the officer's calculation. For example, in the already-polluted LEO space, the proportionality threshold may be lower as any resultant debris could potentially ignite the Kessler Syndrome.[224] In the MEO or GEO, the threshold may be higher since there is less clutter.[225] Alternatively, the measurement of environmental harm could be catalogued as access to space, and thus, a breach turns upon whether resultant debris was sufficiently dense to bar access to space by spacecrafts. The environmental damage should be measured differently for each orbit as the number of trackable pieces which stay in orbit, including any debris from further collisions. This approach sufficiently considers the differences in orbitals and the real possibility any trackable debris piece could collide and create additional space debris. However environmental harm is calculated, that harm is compounded with civilian harm. Meaning, both are measured together against the military advantage expected to be gained.

4. Anticipated Military Advantage Expected to Be Gained

After detailing the prospective negative ramifications of an attack, the officer must balance those considerations against the military advantage expected to be gained. The standard will be a "reasonable military officer" similarly situated with the same amount of information available at the time.[226] As discussed in Part I.C.2, this calculation is highly subjective and imprecise.[227] But the following questions may help carve out some of the uncertainty and leave the military officer with a more complete idea of the military advantage expected to be gained.

224. *See supra* notes 184–202 and accompanying text.

225. *See* Silha et al., *supra* note 75; Stephens, *supra* note 79.

226. *See* HENDERSON, *supra* note 136 and accompanying text.

227. *See supra* Part I.C.2.

> [1.] How important is the military objective sought to be achieved?
>
> [2.] What are the pros and cons of each option available to achieve that objective?
>
> [3.] For each option, what is the probability of success?
>
> [4.] What are the costs of failure?
>
> [5.] What are the risks of civilian casualties involved in each option?
>
> [6.] What are the risks of military casualties involved in each option?
>
> [7.] How are casualties of either kind to be weighed against the benefits of the operation?[228]

These questions are not easily answered, but a military officer's answers are not required to predict the future or be foolproof. Rather, these answers should be reasonable based on the current intel the military officer has at their disposal and on the accepted military operational law the officer is applying. Military officers have been making these difficult calls for decades. Since warfare has transitioned from battlefields to populated urban areas, the principle of distinction and proportionality have been particularly prickly. As warfare adapts, so should military officers, and the proportionality principle in *jus in bello*. This new frontier is not a total departure from the *jus in bello* regime. It simply requires military officers to expand their concept of civilian casualty and property damage to its proper scope in the current satellite era. Therefore, when considering whether to target a dual-use satellite, the military officer should answer these questions with an eye towards a realistic perspective of the resultant harm. This is a more expansive perspective than a terrestrially-based proportionality calculus.[229] Yet, it is essential in this upcoming and current Space Age.

Considering the operational nature of the target, its location, the anticipated harm to civilians and the environment, and the military advantage expected to be gained, will provide a State actor with the necessary tools to make an appropriate determination in line with international law. To further demonstrate the comprehensiveness of this framework, this Note next discusses the deficiencies in alternative approaches. Namely, that other approaches sorely overestimate the political will of States to create binding, restrictive obligations regarding space.

228. *See* Statement of Interest of the United States of America, *supra* note 130, at 471.

229. *See supra* Part II.

C. THE DEFICIENCIES OF ALTERNATIVE APPROACHES TO REGULATING *JUS IN BELLO* IN OUTER SPACE

Opponents may argue that this framework does not sufficiently patch the disparate pieces of international law, which together are used to temper the use of force in space. Instead, opponents argue for a multilateral treaty defining the imprecise terms and creating different rules which account for outer space's unique physical character. However, this approach is misguided: alternative methods include theoretical rather than practical solutions. Multilateral treaties signed and ratified by space-faring nations are unlikely.[230] As the United States retreats from international obligations and treaties; while Russia, China, India, and North Korea will increase militarized space capacities, this shift creates divergent, at-odds interests which cannot be addressed by a comprehensive treaty.[231] Already there are the beginnings of an arms race and Cold-War-mentality reappearing. This is clearly evidenced from the most recent India ASAT test. Prime Minister Modi couched the ASAT test's justification in the same rhetoric that India uses to defend its nuclear arsenal, that it is a deterrent.[232] If anything, India's ASAT test demonstrates a "languishing international effort to ensure space

230. The success of a multilateral treaty would hinge upon China's accession, and if China refused (which it likely would), so would India; if India fails to accede, Pakistan would surely reject the limitations. David E. Sanger & William J. Broad, *U.S. Suspends Nuclear Arms Control Treaty with Russia*, N.Y. TIMES (Feb. 1, 2019), https://www.nytimes.com/2019/02/01/us/politics/trump-inf-nuclear-treaty.html [https://perma.cc/H8ZK-KTY2].

231. Effective February 2, 2019, the United States suspended its Intermediate-Range Nuclear Force Treaty obligations with Russia. *See* Julian Borger, *Donald Trump Confirms US Withdrawal from INF Nuclear Treaty*, GUARDIAN (Feb. 1, 2019), https://www.theguardian.com/world/2019/feb/01/inf-donald-trump-confirms-us-withdrawal-nuclear-treaty [https://perma.cc/U7FE-6SK4] (stating that Trump left the door open for the Treaty to be salvaged in the six-month period, but only if "Russia destroys all of its violating missiles, launchers and associated equipment"); *see also* Michele Kelemen & Steve Inskeep, *Trump Administration Announces U.S. Will Pull Out of INF Treaty*, NPR (Feb. 1, 2019), https://www.npr.org/2019/02/01/690649756/trump-administration-announces-u-s-will-pull-out-of-inf-treat [https://perma.cc/CQW5-DEJS] ("We provided Russia an ample window of time to mend its ways and for Russia to honor its commitment. Tomorrow that time runs out. Russia has refused to take any steps to return real and verifiable compliance over these 60 days. The United States will therefore suspend its obligations under the INF Treaty effective February 2.").

232. Arka Biswas et al., *What to Make of India's ASAT Test*, S. ASIAN VOICES (Apr. 1, 2019), https://southasianvoices.org/what-to-make-of-indias-asat-test/ [https://perma.cc/SWY9-3RRW].

remains a peaceful and secure environment."[233] It is important to note that this framework is not meant to prevent an arms race nor convince States that do not normally observe international law to begin observing the law. Rather, it provides law-observing States a workable framework to use to ensure they are compliant with international law and preserve space. As such, this framework effectively draws on accepted customary international law, *jus in bello* principles, and ratified space law to fill the gaps until such a meeting of the minds allows for a multilateral treaty. Its workability is further demonstrated through its application to hit-to-kill and jamming ASATs.

D. THE FRAMEWORK AS APPLIED TO HIT-TO-KILL AND JAMMING ASATS

Under the framework's questions, hit-to-kill ASATs require more consideration. While it is likely hit-to-kill ASATs are compliant with international law, it is dependent on the balance of military advantage, civilian losses, and environmental harm. The analysis begins with an inquiry of the operational nature of the satellite. If it is a dual-use satellite and civilians or their property is harmed, what is the extent and nature of that harm? More weight will be given to proximate and actual harm to civilian life, property, and the environment. The more remote the harm is, the less likely it will affect the proportionality calculation. Here, the type of information or service the satellite provides is critical. If it is a communications satellite which only supports one mobile phone company, it may not rise to the level of excessive. If it is a communications satellite which affects the lifeblood of the world's economy, it may rise to excessiveness. A satellite may have numerous functions; therefore, it is important to distinguish each function and view them in their totality. Next, where is the satellite located? And how much debris is caused? Depending on the satellite's location and causal debris, the damage may be disproportionate to the military advantage expected to be gained. It is important to keep in mind that any resultant debris automatically becomes another kinetic ASAT by virtue of its velocity and speed. For example, if it is in the LEO and it totally or partially bars access to space, it is disproportionate. If it is in the GEO and it does not secondarily affect any global positioning satellites, it is not disproportionate. It is true that the use of hit-to-kill ASATs will be a fact-dependent inquiry,

233. *See* Urrutia, *supra* note 8.

yet there is a greater likelihood this sort of kinetic ASAT would be prohibited under *jus in bello* than other forms of space weaponry due to the resultant debris and its potential to eviscerate secondary satellites and block access to space. While the civilian harm might not breach the proportionality principle, if the resultant debris is severe, then the compounded environmental harm would trigger the proportionality principle and bar action.

On the other hand, jamming ASATs are likely compliant with *jus in bello* since they do not create debris problematics. Of course, any disruption of civilian usage would have to be balanced against the military advantage. But even if there was extensive disruption of civilian services, that does not necessitate excessive civilian damage, which is dependent upon the military advantage. Ultimately, while the calculation appears manipulatable and subject to State discretion, walking through the framework causes State actors to deliberate and think about the ways in which international law may be breached and take precautions against such a breach.

CONCLUSION

As the world develops and more States gain spacefaring capabilities, it is likely conflicts will no longer be earth-bound and move into outer void space. As this shift in the world begins, it is essential States maintain viable laws of war applicable and well-adapted to space. While this Note echoes the hopes of other scholars that States renounce as unacceptable all acts of hostility in outer space, it is more likely States will instead, unlock this new domain and use it for war.[234] To that end, this Note's framework is a first step towards moderating State action during armed conflict by the limitations imposed by law. Namely, the undercurrent which courses through the laws of war's proportionality principle—humanity.

234. Boothby, *supra* note 13, at 214; *see, e.g.*, Mačák, *supra* note 153, at 37 ("[T]he question of whether the law of war applies to outer space should not be conflated with the separate question of whether war in outer space can be justified. Acknowledging that the law governs a certain type of conduct does not legitimate that conduct.").