
**CONFLICTS IN SPACE:
INTERNATIONAL HUMANITARIAN LAW
AND ITS APPLICATION TO SPACE WARFARE⁺**

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S Y N O P S I S

A B S T R A C T

This article discusses the ways in which International Humanitarian Law (IHL) applies to the domain of outer space. IHL is applicable as a matter of international law, yet outer space poses some challenges when it comes to specific principles and rules. A brief outline is given of some of the kinds of weapons that have been and might be used in space, as well as the ways in which space assets are used with respect to conflicts on Earth. This is followed by an in depth analysis of the core principles of IHL and how they apply: the principles of distinction, proportionality and precaution in attack. While it is imperative that States recognise that IHL is applicable to all their activities in space that involve conflicts on Earth and/or in space, care must be taken in weighing up the traditional principles and their application to this new domain. As the technology that increases war-fighting capability advances, so does the imperative to understand the applicable legal framework for the use of such technology.

R É S U M É

KEYWORDS :

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I. INTRODUCTION

The notion of space warfare may seem like the stuff of science fiction, however since the 1990s there has been a common understanding among the armed forces of many nations that modern conflict involves key space technologies. The first Gulf War is commonly regarded as being the first true 'space war'; while the Gulf War was not physically fought in outer space, it did rely heavily upon space-based assets to facilitate coalition fighting within the terrestrial environment.¹ Since that time, military doctrine accepts fully that future wars will be fought from, through or even in space. Recent events have fuelled speculation that it may not be long before space becomes a theatre of conflict, such as the 2014 Russian launch of an unidentified space object that was capable of making directed manoeuvres;² the tests of a space plane known as X-37B by the United States (US), which some believe to be a space weapon;³ and China's expanding space and counter-space programmes.⁴ Given this thinking, it is critical to understand what law would apply to regulate such warfare and in what manner it would apply.

While some literature on the matter exists,⁵ an up-to-date assessment of specific issues and the applicable law is in order. This article will therefore briefly examine the development of weapons systems in space in Section II; followed by a discussion in Section III on the application of international humanitarian law (IHL) to outer space.

¹ Major Robert A Ramey, "Armed Conflict on the Final Frontier: The Law of War in Space" (2000) 48 *The Air Force Law Review* 1 at 4, fn 4.

² Michael Listner & Joan Johnson-Freese, "Object 2014-28E: Benign or Malignant?", *Space News* (8 December 2014), online: Space News <spacenews.com/42895object-2014-28e-benign-or-malignant/>.

³ Subrata Ghoshroy, "The X-37B: Backdoor weaponization of space?" (2015) 71: 3 *Bulletin of the Atomic Scientists* 19, online: thebulletin.org/2015/may/x-37b-backdoor-weaponization-space8292.

⁴ See US China Economic and Security Review Commission, *2015 Annual Report*, ch 2, sect 2, online: US China Economic and Security Review Commission <www.uscc.gov/Annual_Reports/2015-annual-report-congress>.

⁵ Steven Freeland, "In Heaven as on Earth-The International Legal Regulation of the Military Use of Outer Space" (2011) 8 *US-China Law Review* 272; Jackson N Maogoto & Steven Freeland, "From Star Wars to Space Wars - The Next Strategic Frontier: Paradigms to Anchor Space Security" (2008) 33:1 *Journal of Air & Space Law* 10; Jackson N Maogoto & Steven Freeland, "The Final Frontier: The Laws of Armed Conflict and Space Warfare" (2007) 23:1 *Connecticut Journal of International Law* 165; Michel Bourbonniere, "Law of Armed Conflict (LOAC) and the Neutralisation of Satellites or *Ius in Bello Satellitis*" (2004) 9 *J Conflict & Sec L* 43; Ramey, *supra* note 1.

Section IV will then canvass key IHL principles of distinction, proportionality and precautions in attack as they may apply to the particular circumstances of space warfare. The intention of this article is to give an overview of the current technical and legal status quo of IHL and its application to potential space warfare. Such inquiry is critical given the unique nature of the space environment and the challenges posed within this environment. Given the novel nature of many of the issues posed for waging war in space, such challenges require deft navigation of the legal framework by decision-makers and the exercise of careful discretion.

II. THE WEAPONISATION OF SPACE

The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty)⁶ prohibits the placement in orbit around the Earth any nuclear weapons or any other kinds of weapons of mass destruction.⁷ Additionally, it prohibits the placement of such weapons on celestial bodies or the stationing of such weapons in outer space.⁸ Outside of this express proscription, States are not bound by any treaty or customary international law regarding the weaponisation of space. Significantly, the Treaty also does not prohibit the *partial* orbit of a weapon of mass destruction, such as the flight of an Intercontinental Ballistic Cruise Missile, for it only prohibits the full orbit of such a weapon.⁹

Article IV of the Outer Space Treaty declares that the Moon and other celestial bodies shall be used exclusively for peaceful purposes. Despite some initial conjecture as to what was meant by “exclusively” peaceful purposes, it is now generally accepted that “peaceful purposes” should be interpreted as non-aggressive, meaning that there are many military activities which are considered acceptable under the terms of the Treaty.¹⁰

It is clear that modern military doctrine accepts that space-based systems will factor significantly in maintaining national security

⁶ *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, 27 January 1967, 610 UNTS 205, 18 UST 2410, TIAS No 6347, 6 ILM 386 (entered into force on 10 October 1967) [*Outer Space Treaty*].

⁷ *Ibid.*, art IV.

⁸ *Ibid.*

⁹ US Department of Defense, *Law of War Manual* (Office of General Counsel, Department of Defense, June 2015), at 925-6, para 14.10.3.1.

¹⁰ Carl Christol, *The Modern International Law Of Outer Space* (New York: Pergamon Press, 1982) at 22.

priorities.¹¹ Western nations such as the US and the United Kingdom (UK) have developed significant network-centric warfare concepts that rely heavily on space-borne assets for success,¹² such as intelligence gathering by remote sensing, GPS-guided weapons, satellite telecommunications, and drone technologies. Indeed, it has been recognised by senior US military leaders that the ultimate high ground is space and that correlatively, “[s]pace superiority is the future of warfare”.¹³ It is equally evident that other nations are fast improving their capabilities in space. To that end recent decades have seen the development of numerous space weapons systems. These technologies include kinetic anti-satellite (ASAT) weapons, co-orbital ASATs, electromagnetic pulse (EMP) and radiation weapons and ‘soft kill’ weapons, relating to cyber and laser capabilities. Each of these will be briefly canvassed below to provide a context for understanding the need to effectively articulate which rules of law apply to regulate conflict in outer space.

A. KINETIC ANTI-SATELLITE (ASAT) WEAPONS

Anti-satellite (ASAT) weapons are primarily surface-to-space and air-to-space missiles. The US, the People’s Republic of China, and Russia have all demonstrated military ASAT capabilities.¹⁴ Such capability is well within the grasp of many other nations given the accessible nature of technology underpinning the modified standard missiles used.

In 2007, China launched a direct ascent ASAT missile to destroy an ageing Chinese weather satellite. The event signalled a public display of Chinese capability. It also revealed the consequences of this type of weapon system. The targeting created a debris field of more than two million pieces up to 10 cm in size.¹⁵ By 2009, the US was still tracking almost 2,400 fragments that could be detected with Earth-based sensors.¹⁶ Such objects pose a significant safety danger for, depending on their altitude, they can travel in orbit at speeds of between 3,000 to 7,600 metres per second (approximately 27,000 kilometres per hour). In contrast, the

¹¹ US Joint Chiefs of Staff, *Space Operations- Joint Publication 3-14* (2013), online: Defense Technical Information Center <www.dtic.mil/doctrine/new_pubs/jp3_14.pdf>.

¹² Jan Kallberg, “Designer Satellite Collisions from Covert Cyber War” (2012) 6(1) *Strategic Studies Quarterly* 124 at 125.

¹³ General Lance Lord, “Space Superiority” (2015) 1(3) *High Frontier* 4 at 5.

¹⁴ Michael Haas, “Vulnerable frontier: militarized competition in outer space” in Thränert Oliver & Martin Zapfe, eds, *Strategic Trends 2015: Key Developments in Global Affairs*, (Center for Security Studies: 2015) at 63, 64.

¹⁵ *Ibid.*

¹⁶ NASA, *Fengyun-1C Debris: One Year Later*, *Orbital Debris Quarterly News* (January 2008) at 3, online: NASA <orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv12i1.pdf> in PJ Blount, “Targeting in Outer Space: Legal Aspects of Operational Military Actions in Space” (2012) *Harvard National Security Journal Features* 1 at 18.

speed of a 5.56mm bullet fired from a standard issue military rifle is 940 metres per second.¹⁷

In 2008, the US used an ASAT to destroy a malfunctioning US satellite that was de-orbiting.¹⁸ It was done under the justification of avoiding environmental damage by the burning of on-board toxic fuel, however the Pentagon had made earlier statements that if the satellite were to re-enter Earth's atmosphere it would pose no threat, leading to some conjecture that this, too was an ASAT test.¹⁹ Either way, the action of the US made the geostrategic point that ASATs are already in the arsenals of more than one State, and are known to be effective.

Haas identifies a military confrontation involving the use of kinetic ASAT weaponry as "the most serious threat to the continued accessibility of the space environment",²⁰ not least due to the increasing number of States that possess the required technology to build ASATs. Given the potential for extensive fragmentation damage resulting from the space debris caused by an ASAT attack, the use of kinetic ASATs can severely impair orbital planes – conceivably rendering them effectively unusable for extended periods of time, causing severe implications for commercial and military users.

B. CO-ORBITAL ASATS

Co-orbital ASAT weapons are rocket-launched objects that achieve a similar orbital plane as the intended target. Once within orbit, an ASAT can be steered until it is in close proximity of the target – close enough to physically collide with it. Given the hyper velocity at which objects can travel in space orbit, such collisions create significant destructive impact. Whilst reported as an "unfortunate but inevitable" accident, the 2009 collision of the Soviet-era Cosmos 2251 satellite and an Iridium communications satellite demonstrates the enormous destructive potential of co-orbital ASATs.²¹

¹⁷ Kallberg, *supra* note 12 at 126-7.

¹⁸ Thom Shanker, "Missile Strikes a Spy Satellite Falling From Its Orbit", *New York Times* (21 February 2008), online: [New York Times <www.nytimes.com/2008/02/21/us/21satellite.html?_r=0>](http://www.nytimes.com/2008/02/21/us/21satellite.html?_r=0).

¹⁹ James Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests* (Stanford, Cal: Stanford University Press, 2011) at 301.

²⁰ Haas, *supra* note 14 at 64.

²¹ Paul Marks, "Satellite collision 'more powerful than China's ASAT test'", *New Scientist* (13 February 2009), online: [New Scientist <www.newscientist.com/article/dn16604-satellite-collision-more-powerful-than-chinas-asat-test/>](http://www.newscientist.com/article/dn16604-satellite-collision-more-powerful-than-chinas-asat-test/).

In addition to being used as direct collision weapons, co-orbital ASATs may also take the form of explosive proximity weapons. Once in orbit alongside a target, an explosive charge aboard an ASAT may be detonated, dispersing a “cloud of shrapnel at high speed” to destroy it.²²

C. ELECTROMAGNETIC PULSE AND RADIATION WEAPONS

An electromagnetic pulse (EMP) is created when a high-altitude nuclear explosion in space sends a cascade of gamma rays to collide with the upper atmosphere of Earth.²³ Resultant charge imbalances from these rays create an electrical current that has the potential for the destruction of sensitive circuitry, despite lasting a mere millionth of a second. Any unshielded electronic devices within a several hundred-mile radius of the epicentre may be affected, or even disabled, by such a pulse.²⁴

Gamma rays, a form of electromagnetic radiation, also have the potential to cause extensive alterations in the ionosphere – weakening radio and radar waves.²⁵ This can cause high-frequency blackouts and periods of impaired radio and radar performance across broad areas, providing clear military advantages for the use of electromagnetic pulses and radiation in space.²⁶ However, as tests undertaken during the Cold War period by both the US and the Soviet Union proved, while EMP weapons could be effective at interfering with a belligerent’s satellite communications, they are indiscriminate and affect all satellite operations within their proximity.²⁷ A State’s own satellites and those owned or operated by their allies will also be affected.

D. ‘SOFT KILL’ WEAPONS: CYBER ATTACKS, JAMMING, ALTERING, MONITORING OF DATA COMMUNICATIONS, AND ‘DAZZLING’ BY LASERS

The ‘soft kill’ category of weapons includes those designed to disable the functionality of a satellite rather than destroy it. Such disabling

²² Paul B Stares, “Space and National Security” (1987) at 99, cited in in Ramey, *supra* note 1 at 27.

²³ John M Collins, “Military Space Forces: The Next 50 Years” (1989), cited in Ramey, *supra* note 1 at 20.

²⁴ *Ibid.*

²⁵ *Ibid.* The ionosphere is a region of Earth’s atmosphere, lying 60-1,000km above the Earth’s surface.

²⁶ *Ibid.*

²⁷ Moltz, *supra* note 19 at 131.

missions may be undertaken covertly, often mimicking routine failures and making them difficult to detect or attribute to a source.²⁸ Directed energy weapons systems are beginning to mature in their development. Air-borne laser testing has proven to be extremely effective and accurate. The concentration of energy can target complex circuitry without causing the fragmentation effect of a kinetic attack. The weapons system can literally engage at the speed of light and does not require the intensive supply and maintenance logistical 'tail' of most deployed kinetic weapons systems. Such lasers may be deployed in orbit or be ground-based.

One of the reasons such 'soft-kill' weapons pose a particular threat is that while ASAT technology may be beyond the grasp of non-State actors, access to cyber capacity is not. Indeed, analyst Peter Singer has noted that when it comes to malevolent activity in space,

It's not just the big boys who can play at it...Anti-satellite missiles - that's been within the realm of great powers, like a Russia, a China, a US. It's not something that a Hezbollah or an al-Qaeda or an ISIS could pull off. With cyber warfare, the barrier to entry is a lot lower.²⁹

It is evident that any warfare in space will undoubtedly include cyber operations as part of the arsenal of weapons deployed. One example is China's People's Liberation Army, which has reportedly been engaged in 'blinding' US imaging satellites using terrestrial laser systems.³⁰

All the weapon systems described here are not prohibited by the Outer Space Treaty and do not fall foul of any other specific weapons-based treaty or IHL treaty of general application. They represent current and very advanced developing technology and would undoubtedly factor in any future armed conflict in space. This short survey provides a useful context for assessing the manner in which IHL would apply to regulate the deployment and application of these weapons systems. Such analysis will be undertaken in the following section.

III. INTERNATIONAL HUMANITARIAN LAW (IHL) IN SPACE

²⁸ Ivan Beyek, *Force Projection from Space*, in (unnumbered Space Applications Volume) "New World Vistas: Air and Space Power for the 21st Century" (1995) at 87, cited in Ramey, *supra* note 1 at 27.

²⁹ See Chris Bowlby, "Could a War In Space Really Happen", *BBC News* (19 December 2015), online: BBC News <www.bbc.co.uk/news/magazine-35130478>.

³⁰ Haas, *supra* note 14 at 73.

IHL is a vast body of law covering the general limits of warfare including permissible methods and means, the protection of civilians and civilian objects. This body of law is voluminous and may be characterised by its denseness of regulation. It also comes with its own interpretative commitments and architecture. The style of modern IHL is one of resolute categorisation. IHL is comprised of a series of definable categories, placement within which ignite packets of legal rights and obligations. Hence, numerous discretionary moments occur in practice when military commanders, lawyers and operators are constructing the legal artifice that underpins the waging of war. Each determination carries with it a cascade of legal responses and consequences.

In assessing how IHL would apply to regulate warfare from, through and within space, it is first critical to assess whether existing IHL does indeed even apply to that environment. This question may seem paradoxical, since the density of regulation in this field would intuitively lead to the conclusion that it would apply, yet this is not so self-evident. The conduct of warfare and its legal regulation has been largely compartmentalised into theatres on land, at sea and in the air. While there is obvious overlap, since many conflicts are fought over geographical boundaries and across land, sea and air, and while general legal principles apply across all environments, it is still possible to conceive of a differentiation between each. There is no stand-alone regulation of warfare in space; in fact, the space environment finds very limited expression in the existing corpus of IHL.

While there are over 60 treaties dealing with weapons, methods and means of warfare, the foundational treaties of modern IHL are the four Geneva Conventions, signed in 1949 shortly after the Second World War.³¹ In 1977, two Additional Protocols were negotiated in order to update IHL with respect to international armed conflict and non-international (or internal) armed conflict respectively.³² While not all

³¹ *Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field*, 12 August 1949, 75 UNTS 31, [1958] ATS No 21 (entered into force 21 October 1950) [*Geneva Convention I*]; *Geneva Convention for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea*, 12 August 1949, 75 UNTS 85, [1958] ATS No 21 (entered into force 21 October 1950) [*Geneva Convention II*]; *Geneva Convention relative to the Treatment of Prisoners of War*, 12 August 1949, 75 UNTS 135, [1958] ATS No 21 (entered into force 21 October 1950) [*Geneva Convention III*]; *Geneva Convention relative to the Protection of Civilian Persons in Time of War*, 12 August 1949, 75 UNTS 287, [1958] ATS No 21 (entered into force 21 October 1950) [*Geneva Convention IV*] (collectively known as the Geneva Conventions).

³² *Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, 8 June 1977, 1125 UNTS 3, 1991 ATS No 29/ 16 ILM 1391 (1977) (entered into force 7 December 1978) [*Additional Protocol I or API*]; *Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of*

States have signed and/or ratified the Additional Protocols, many provisions in these documents are considered to be reflective of customary international law.³³

One way in which these Protocols may apply to space is that under Articles 35(3) and 55 of Additional Protocol I, obligations are imposed in relation to the environment. In the former, these obligations are owed to the environment generally, and in the latter they are owed to the environment where there is a correlative risk to “the health or survival of the population”. In both instances the level of damage required to enliven the provisions is predicated upon causing “widespread, long-term and severe damage”. While neither provision explicitly makes reference to outer space, it would be a logical deductive conclusion. More expressly, the 1976 Convention on the Prohibition of Military or Any Other Hostile Use of the Environmental Modification Techniques prohibits the military use or modification of the environment that causes “widespread, long-lasting or severe effects”.³⁴ Critically, “environmental modification techniques” are defined in Article II as “any technique for changing ... the dynamics, composition or structure of the Earth including its biota, lithosphere, hydrosphere, or of outer space”.³⁵ Hence there is, somewhat uniquely, express recognition of the space environment.

Outside of these references to the space environment, direct or implied, there is very little specific treaty law that regulates armed conflict in space. Some would argue that space is therefore a lawless frontier, and the lack of direct regulation allows for a *Lotus*-like interpretative posture that “restrictions upon the independence of States cannot therefore be presumed”.³⁶ However, such a conclusion runs not only counter to the express statement by the International Court of Justice (ICJ) itself that this interpretative trope is now outdated,³⁷ it also goes against the progressive thrust and reasoning underpinning the historic trajectory of IHL.

Victims of Non-International Armed Conflicts, 8 June 1977, 1125 UNTS 609 [1991] ATS 30/16 ILM 1442 (1977) (entered into force 7 December 1978) [*Additional Protocol II* or *APII*].

³³ See e.g. Jean-Marie Henckaerts, “Study on customary international humanitarian law: A contribution to the understanding and respect for the rule of law in armed conflict” (2005) 87:857 *International Review of the Red Cross* 175; and International Committee of the Red Cross (ICRC), *Customary International Humanitarian Law*, Volume I: Rules (2005) [*ICRC Rules*], online: ICRC <www.icrc.org/customary-ihl/eng/docs/v1>.

³⁴ *Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques* (10 December 1976), 1108 UNTS 151, [1984] ATS 22, UN Doc A/RES/31/72 (entered into force on 5 October 1978) [*ENMOD*], art I(1).

³⁵ *Ibid.*

³⁶ *The Case of the S.S. Lotus (France v Turkey)*, (1927) PCIJ Ser A, No 10.

³⁷ Judges Higgins, Kooijmans and Buergenthal have opined that the ‘*Lotus*’ principle “represents the high water mark of *laissez-faire* in international relations, and an era that has been significantly overtaken by other tendencies”. See *Joint separate opinion of Judges Higgins*,

IHL seeks to ameliorate violence in armed conflict to the greatest extent, with particular focus on the victims of warfare.³⁸ The 1949 Geneva Conventions still rate as the only treaty series to receive universal ratification by all States. While not explicitly addressed to warfare occurring in outer space, all the 1949 Geneva Conventions provide in Article 1 that “The High Contracting Parties undertake to respect and to ensure respect for the present Convention in *all* circumstances”.³⁹ Such phraseology speaks to the broadest ambit of anticipated and unanticipated armed conflict.

In assessing whether IHL would apply to an environment where it is not expressly referenced in the existing ‘black letter rules’, it is notable that the tradition of the ICJ is to assimilate legal principles to fill apparent voids whenever encountered, especially in the context of armed force. In the first case ever considered by the Court, the Court determined in *Corfu Channel* that an obligation by Albania to warn of naval mines placed in a territorial sea arose not from a ‘black letter’ rule, but rather from “certain general and well-recognized principles, namely: elementary considerations of humanity, even more exacting in peace than in war”.⁴⁰ Similarly, in the *Nicaragua* decision, the Court relied upon “underlying” principles of IHL to provide a threshold of prohibition regarding the laying of naval mines, even in the absence of a specific treaty rule applicable in peacetime.⁴¹

Most profoundly though has been the ICJ’s deliberation on IHL in the *Nuclear Weapons Advisory Opinion*.⁴² In that instance the Court determined that this body of law was “permeated” with an “intrinsically

Kooijmans and Buergenthal in Case Concerning the Arrest Warrant of 11 April 2000, (Democratic Republic of Congo v. Belgium), [2002] ICJ Rep 3 at 78.

³⁸ A former ICRC Director observed:

[t]he sole function of humanitarian law is to protect the individual as such, to the exclusion of political, military, ideological, religious, racial, economic or any other considerations. Humanitarian law establishes only one equality, namely that founded on the right of all victims of war to be treated in accordance with the principle of humanity.

Francois Bugnion, “Just Wars, Wars of Aggression and International Humanitarian Law”, (2002) 84 *International Review of the Red Cross* 523 (original in French), at 1, 13, online: ICRC (www.icrc.org/eng/assets/files/other/irrc-847-2002-bugnion-ang.pdf).>

³⁹ GC I – IV, *supra* note 31, art 1 [emphasis added].

⁴⁰ *Corfu Channel (United Kingdom of Great Britain and Northern Ireland v. Albania)*, [1949] ICJ Reports 4 at 22.

⁴¹ *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)*, [1986] ICJ Rep 14 [Nicaragua] at 112, para 215.

⁴² *Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion*, [1996], ICJ Reports 226 [Nuclear Weapons].

humanitarian character"⁴³ and ultimately that at the centre of all the rules and principles applicable in armed conflict "is the overriding consideration of humanity".⁴⁴ Importantly in that instance, the Court also broadly opined that IHL "applies to all forms of warfare and to all kinds of weapons, those of the past, those of the present and those of the future".⁴⁵

Such reasoning by the ICJ makes plain that there is not likely to be a legal void in outer space when it comes to the law relating to armed conflict. Indeed, the late Manfred Lachs, former judge of the ICJ and considered by many to be the foremost expert in space law of his time, wrote that outer space has never been a lawless area, but rather has always been subject to international law, though the matter could never have been put to the test before.⁴⁶ While treaty law makes scant reference to warfare in outer space, undoubtedly customary international law and relevant general principles of law would apply to regulate such armed conflict. To this end, much customary international law in this field follows extant treaty rules and standards.⁴⁷ While the application of such rules and standards have thankfully not yet been reflected in actual State practice in engaging in armed conflict outer space, the specific principles underpinning the rules and standards themselves must certainly apply. This is determined in Article III of the Outer Space Treaty which provides that all activities in outer space shall be conducted "in accordance with international law",⁴⁸ of which IHL is part.

Similarly, in the absence of treaty and/or customary international law, then general principles of law must apply to fill any gaps. Article 38 (1)(c) of the Statute of the ICJ⁴⁹ lists general principles as a source of law, following treaties and international customary law. While general principles are open-ended and often lack specificity, they do carry legal weight.⁵⁰ Unlike treaty rules or standards, general principles exist within an unbounded realm of decision-making and may be relied upon at any time to justify or augment a particular decision. Principles often travel in

⁴³ *Ibid* at 259, para 86

⁴⁴ *Ibid* at 262, para 95.

⁴⁵ *Ibid* at 259, para 86.

⁴⁶ Manfred Lachs, *The Law of Outer Space: An Experience in Contemporary Law-Making, Reissued on the Occasion of the 50th Anniversary of the International Institute of Space Law*, (Leiden: Brill, 2010) at 125.

⁴⁷ *Nuclear Weapons*, *supra* note 42 at 257, para 79.

⁴⁸ *Outer Space Treaty*, *supra* note 6, art III.

⁴⁹ *Statute of the International Court of Justice*, 26 June 1945, 3 Bevens 1179, 59 Stat 1031, TS 993, 39 AJIL Supp 215 (entered into force 24 October 1945).

⁵⁰ Joseph Raz, "Legal Principles and the Limits of Law" (1972) 81 Yale LJ 823.

pairs, such as humanity and military necessity, or coastal State sovereignty and the freedom of navigation, or non-intervention and self-defence. This requires, therefore, an exercise of a dichotomous discretion to prioritise one principle over another in pursuit of a legal outcome.

The general principles of humanity and military necessity are well-known features of IHL, and they form the basis for making operational decisions during a conflict; decisions as to who or what may be targeted, what weapons or means may be acceptable, and what limits and precautions must be taken. Since such decisions are circumstantial, and will be dependent on many variable factors, there is no simple formula to determine the correct course of action. Rather, the core principles must be weighed up against each other, as two opposite sides of a coin. These general principles apply, due to their general nature, to all forms of conflict; on land, on the sea, in the air and, also in space. Given the preponderance of judicial determination, as well the momentum of legal reasoning in this field, there is ample basis to support the articulation of a reasoned IHL framework applicable to the conduct of armed hostilities in outer space. The more immediate challenge then is to develop a durable taxonomy of application. The following section will canvass three core features of IHL, namely the principles of distinction, proportionality and precautions in attack, as these concepts would inevitably apply to warfare in outer space. However, while the concepts are reasonably well-established in law, their application to the space environment throws up numerous potential anomalies. The next section will grapple with these and propose a number of possible solutions.

IV. IHL PRINCIPLES AND WARFARE IN OUTER SPACE

The two core principles mentioned above, of military necessity and humanity, form the basis of IHL, or as the ICJ has put it, “the fabric of humanitarian law”.⁵¹ Military necessity requires that the use of force during a conflict can be justified as indispensable or imperative to the direct aims of the conflict, such as the submission of the adversary; that such force is proportionate to these aims; and that no unnecessary suffering is caused by such force. These terms and definitions are reflected in the Hague Regulations of 1907,⁵² the Geneva Conventions, the Cultural

⁵¹ *Nuclear Weapons*, *supra* note 42 at 257, para 78.

⁵² E.g. the *Hague Convention Respecting the Laws and Customs of War on Land*, 18 October 1907, 205 CTS 305, (entered into force 26 January 1910).

Property Convention of 1954,⁵³ and Additional Protocol I. They can also be found in a number of domestic military manuals.⁵⁴ Military necessity therefore limits what actions can be undertaken in a conflict, since everything must be justified as necessary to the attainment of a discernible military advantage.⁵⁵ The flip side of this is the principle of humanity, which requires that any actions undertaken during a conflict are done so with a minimum loss of life, a minimum standard of humanity towards wounded or captured soldiers, and a maximum possible protection of civilians who are not engaged in the conflict. Humanity puts a break on actions which might otherwise be justified as militarily necessary.⁵⁶

Since these two general principles represent two potentially opposing norms, and due to their inherently general nature, resolving their application in a specific situation can be difficult. In order to aid in this, three 'sub-principles' or operational principles can be derived from the two core general principles; namely distinction, proportionality and precaution in attack. These three guiding principles offer some more guidance, however they are still formulated as principles and remain fairly general in nature; their application in each situation requires a casuistic appraisal. With respect to the domain of outer space, when conflict involves or takes place in this new environment, there are still many variables and uncertainties which may play out differently than in the more traditional domains of land, sea and air.

A. DISTINCTION

The rule of distinction is most clearly derived from the principle of humanity. Customary law has always made a distinction between combatants and civilians, or at least those civilians such as women and children and 'unarmed priests', who should be protected from the ravages of war.⁵⁷ The rule can be said to have found codification in the American civil wartime Lieber Code,⁵⁸ and in the preamble of the St Petersburg Declaration of 1868, where it is stated that "the only legitimate object which States should endeavour to accomplish during war is to weaken the

⁵³ *Convention for the Protection of Cultural Property in the Event of Armed Conflict*, 14 May 1954, 249 UNTS 240, [1984] ATS 21 (entered into force 7 August 1956).

⁵⁴ Anthony Peter Vernon Rogers, *Law on the Battlefield* (Manchester: Manchester University Press, 2004) at 5.

⁵⁵ Yoram Dinstein, *The Conduct of Hostilities Under the Law of International Armed Conflict* (Cambridge: Cambridge University Press, 2004) at 4.

⁵⁶ Rogers, *supra* note 54 at 7.

⁵⁷ *Ibid* at 8.

⁵⁸ Instructions for the Government of Armies of the United States in the Field, prepared by Francis Lieber, LL.D., Originally Issued as General Orders No. 100, Adjutant General's Office, 1863, art 22, online: Avalon Project <avalon.law.yale.edu/19th_century/lieber.asp>.

military forces of the enemy”⁵⁹ – that therefore the civilian population and civilian objects should not be deliberately targeted.

Today, the rule of distinction is clarified in Article 48 of Additional Protocol I, which is denoted as the ‘Basic Rule’, and which provides:

In order to ensure respect for and protection of the civilian population and civilian objects, the Parties to the conflict shall at all times distinguish between the civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives.⁶⁰

This basic rule applies to all parties to a conflict, whether or not they have signed the Additional Protocol, due to its status as a customary rule.⁶¹ In fact, the International Committee of the Red Cross (ICRC) recognises it as the cardinal rule of IHL.⁶²

1. DISTINCTION BETWEEN CIVILIANS AND COMBATANTS

This basic rule has two aspects. In the traditional theatres of conflict the first aspect, the protected status of civilian non-combatants, has an extremely important role to play. However in the domain of space, where there are not many humans at any given time, this aspect will not likely come into play very often in the near future with respect to conflicts in space. Nonetheless there is one notion of contention, which is the status of military astronauts in a time of conflict.

Article 50 of Additional Protocol I gives a negative definition of civilians and civilian populations as those individuals and populations which do not fall under the categories of “armed forces”. Armed forces are defined as “all organized armed forces, groups and units which are

⁵⁹ *Declaration Renouncing the Use, in Time of War, of Explosive Projectiles under 400 Grammes Weight*, 29 November - 11 December 1868 (entered into force 11 December 1868), online: ICRC

<www.icrc.org/ihl/INTRO/130?OpenDocument>.

⁶⁰ *Additional Protocol I*, *supra* note 32, art 48.

⁶¹ Yves Sandoz, Christophe Swinarski & Bruno Zimmerman, eds, *Commentary On The Additional Protocols Of 8 June 1977 To The Geneva Conventions Of 12 August 1949* (Geneva: International Committee of the Red Cross, 1987) at 598 [*Commentary on Additional Protocol I*]; see also Eritrea-Ethiopia Claims Commission, *Partial Award, Western Front, Aerial Bombardment and Related Claims*, (2007) 45 ILM 396 at 417, 425.

⁶² *ICRC Rules*, *supra* note 33, Rule 1.

under a command responsible to" a party to the conflict,⁶³ and all members of the armed forces other than medics and chaplains are considered to be combatants.⁶⁴ In case of doubt, a person shall be presumed to be a civilian and protected under IHL.⁶⁵

There is a question as to what the status of military astronauts would be if their State of nationality were to enter a conflict. Under IHL they would be considered combatants, but international space law astronauts are considered to be "envoys" of humankind, guaranteed of protection, aid and assistance at all times.⁶⁶ Which of the two bodies of law should be considered to be *lex specialis*? While in generalist terms, IHL should prevail, since it is the body of law established to deal with conflicts, and from which derogation is almost never permitted, on the other hand there are strong arguments to be made that space law should prevail as the *lex specialis*. Astronauts undergo a highly specialised training, and risk their lives with every mission by virtue of the uniqueness of the domain of space. Today much human space flight requires international cooperation, even between States which might otherwise harbour some tensions, meaning that the survival and well-being of these astronauts depends upon the good will of States. The very existence of the Rescue and Return Agreement demonstrates that even during the Cold War period there was willingness between adversary States to offer protections to individual astronauts regardless of their nationality.

To some extent the rules might be assimilated under the notion of a modified *hors de combat* concept. Hence, where military personnel are astronauts during a time of armed conflict and they are themselves not engaged in belligerent actions, there could be resort to the more specific recognition of the "envoy" of humanity status. Historically, there are examples of such forbearance, such as the encounter between Captain Matthew Flinders (UK - *HMS Investigator*) and Captain Nicolas Baudin (France - *Le Géographe*) who met at a bay in South Australia in 1802 when their respective ships crossed paths during a time when their respective countries were at war. Despite exercising extreme caution, neither captain resorted to force when approaching the other. Factors such as the great

⁶³ *Additional Protocol I*, *supra* note 32, art 43(1).

⁶⁴ *Ibid*, art 43(2).

⁶⁵ *Ibid*, art 50(1).

⁶⁶ *Outer Space Treaty*, *supra* note 6, art V. See also the *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, GA Res 1962(XVIII), UNGAOR, 18th Sess, UN Doc A/RES/18/1962(XVIII) (1963), para 9; and generally, the *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched Into Outer Space*, 22 April 1968, 672 UNTS 119, 19 UST 7570, TIAS No 6599, 7 ILM 151 (entered into force 3 December 1968) [*Rescue and Return Agreement*].

distance from their homelands, the sense of shared peril in a new environment and the uniqueness and coincidence of the meeting no doubt contributed to the restraint. Indeed as both were engaged in exploration and scientific missions, they saw their status as being *sui generis*. In fact, Flinders boarded the French ship and the two captains exchanged information about their voyages before proceeding in their respective directions to complete their respective missions.⁶⁷

2. DISTINCTION BETWEEN MILITARY AND CIVILIAN OBJECTS

Aside from this question of astronaut status, in the domain of space it is the second aspect of the principle of distinction that will come into play more often, namely the requirement to distinguish between civilian and military objects.

The term “military objective” was first coined in the 1923 Hague Rules of Air Warfare,⁶⁸ a set of non-binding rules that emerged after the First World War. Article XXIV(1) provides that

Aerial bombardment is legitimate only when directed at a military objective, that is to say, an object of which the destruction or injury would constitute a distinct military advantage to the belligerent.⁶⁹

Today, this definition has been refined somewhat, as reformulated in Article 52(2) of Additional Protocol I, which provides:

Attacks shall be limited strictly to military objectives. In so far as objects are concerned, military 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.⁷⁰

⁶⁷ “Encounter 1802”, online: State Library of South Australia <www.slsa.sa.gov.au/encounter/1802.htm>.

⁶⁸ *The Hague Rules of Air Warfare*, December 1922-February 1923, online: Law of War <lawofwar.org/hague_rules_of_air_warfare.htm>.

⁶⁹ art XXIV,

⁷⁰ *Additional Protocol I*, *supra* note 32, art 52(2).

This article is recognised as reflecting customary law,⁷¹ even by a State such as the US which is not a party to Additional Protocol I.⁷² Even though this definition is refined, it still leaves much open to interpretation.

There are two cumulative aspects, namely (a) that the object must make an effective contribution to military action, and this must be by virtue of its nature, location, purpose or use; and (b) the total or partial destruction, capture or neutralisation must offer a definite military advantage under the circumstances ruling at the time.

Under (a), the “nature” of an object means that the object must be used by the armed forces;⁷³ this could apply to any satellite used by the military, be it for military purposes or for other purposes, which leaves open the question whether a satellite sending broadband TV signals to a military base for entertainment purposes could also fall under this definition. “Location” means that an object which does not have a military function may, by virtue of its location, still offer an effective contribution to military action, such as a bridge, a building or site or area of land of tactical importance.⁷⁴ Thus a satellite which is not used by military, but which may be in close proximity to a military satellite, and whose total or partial destruction, capture or neutralisation may affect a military need due to its proximity to any other military object, may become a legitimate target. “Purpose” has to do with intended future use, while “use” means the present function of an object.⁷⁵ In this respect, the present use of a satellite may be relatively easy to determine, and thus it would be unproblematic to determine whether or not it could be a military objective, however, the future intended use of a satellite may be near impossible to determine. It is not permissible to target an object based on its *potential* use by an adversary; there must be sufficient intelligence and information

⁷¹ The article is repeated verbatim in Additional Protocols II and III; and in the 1999 *Second Protocol to the 1954 Convention for the Protection of Cultural Property in the Event of Armed Conflict*, 26 March 1999 UNESCO Doc. HC/1999/7 (entered into force 9 March 2004). The Eritrea-Ethiopia Claims Commission recognised the principle enshrined in this provision as customary law: see *Western Front, Aerial Bombardment and Related Claims*, *supra* note 61 at 418. It has also been reiterated in the preamble of the Convention on Cluster Munitions, 30 May 2008, 2688 UNTS 39 (entered into force 1 August 2010); and in Article 40 of the *San Remo Manual on International Law Applicable to Armed Conflicts at Sea*, (1995) 309 International Review of the Red Cross 583; see further William H Boothby, *The Law of Targeting* (Oxford: Oxford University Press, 2012) at 101.

⁷² As recognised in, US Navy, *The Commander's Handbook on the Law Of Naval Operations*, NWP 1-14M (2007) [*Navy Commander's Handbook*], art 8.1.1, online: Law of War <www.lawofwar.org/naval_warfare_publication_N-114M.htm>.

⁷³ *Commentary on Additional Protocol I*, *supra* note 61, para 2020. See also Boothby, *supra* note 71 at 103.

⁷⁴ *Commentary on Additional Protocol I*, *supra* note 61, para 2021.. See also Boothby, *supra* note 71 at 103.

⁷⁵ *Commentary on Additional Protocol I*, *supra* note 61, para. See also Boothby, *supra* note 71 at 103.

upon which an attacker can base the belief that an adversary *in fact* intends to use the object in a particular military way.⁷⁶ This poses problems again in the space domain, where intended uses of space objects are often not communicated, or only partially, or even falsely.

Under (b) the circumstances ruling at the time must govern the final determination of whether an object may lawfully be targeted as a military objective. All of the above factors mean that an object might be a military objective at one moment in time, and may no longer be so at another moment in time. For example, if the space object's location were to shift, not only due to extremely high velocity in an orbital paths, but perhaps due to a necessary station movement to avoid unintended collision; or if the use or ownership of a satellite were to shift; or if the circumstances were to change such that it no longer offered a definite military advantage.

The vast number of "dual-use" satellites poses a particular problem with respect to the categories of "use" and "purpose". It would seem that today the number of satellites which provide services both for military and civilian purposes is significant, and is only on the rise.⁷⁷ Furthermore, there are satellites which may be dedicated to the military, but which provide non-military services, such as TV and internet broadband for the private use of military personnel. In such a case, it may not be easy to justify that the total or partial destruction, capture or neutralisation of such a satellite would provide a definite military advantage.

Dual-use technologies and objects also exist on land, at sea and in the air, and may provide some useful analogies. Civilian infrastructure such as energy plants, telecommunication centres, railroads, petrol or oil refineries, and even forms of transport, can all have dual-uses, serving military as well as civilian needs.⁷⁸ For the purposes of identifying a military objective according to Article 52(2) of Additional Protocol I, these objects can all be lawfully targeted, and their civilian purposes can essentially be ignored. Factories and industry may produce goods used by the armed forces, which are also used by civilians, and thus also fall under the definition of a military objective, however the extent to which industry

⁷⁶ See Boothby, *supra* note 71 at 104.

⁷⁷ See for example Joseph Pelton, "Satellite Security and Performance in an Era of Dual Use" (2004) 6 Online Journal of Space Communication, online: Online Journal of Space Communication <spacejournal.ohio.edu/issue6/perspectives1.html#top>.

⁷⁸ Henry Shue & David Wippman, "Limiting attacks on dual-use facilities performing indispensable civilian functions" (2001) 35 Cornell Int'l LJ 559 at 562.

can be targeted is questionable.⁷⁹ This is where the second part of the cumulative test must be carefully applied, since targeting these objects must, in the words of the St Petersburg Declaration, contribute to “weakening the military forces of the enemy” and thereby represent a clear military advantage.⁸⁰

As well the principle of proportionality, discussed below, must also come into play when targeting dual-use objects. Where some collateral damage is expected by targeting a dual-use object, it may still be permissible to go ahead if the “definite military advantage” to be gained outweighs the effects on civilians. However, the “reverberating collateral effects” may be catastrophic in some cases, meaning that even if an object can be considered a military objective, it should not be targeted.⁸¹ The challenge is making the calculation ahead of time, and there are debates as to whether only immediate, direct effects such as civilian loss of life or damage to property need to be taken into account, or whether other indirect, long-term affects should also be part of the calculus.⁸² Although it may be difficult to anticipate what such indirect or long-term effects might be, in the case of targeting dual-use satellites, it would seem that there are many potential significant indirect effects, for instance disrupting GPS used for civilian aviation; financial transactions; telecommunications which are highly dependent on satellite signals; dams and other major waterworks which are automated, etc.

Another factor which makes space so different as a theatre of conflict is that the operators are physically very distant from their weapons and from the impact of their weapons – between 100 and 22,500 miles away.⁸³ While it is true also of drone pilots that they are removed from their weapons and their targets, these pilots usually have very good visual coverage of their targets by way of cameras attached to the unmanned aerial vehicles (UAVs), whereas once an object is launched into space, tracking and recognition is dependent on non-visual data. Kinetic weapons used to destroy a space asset, or non-kinetic weapons used to interfere with or temporarily disable space asset communications do not rely on direct visual identification by an operator. Many objects launched into space are not visibly marked in order to identify them as military or civilian, and most of the information gathered regarding the nature, purpose or use of a space object depends upon correct registration

⁷⁹ Rogers, *supra* note 54 at 67.

⁸⁰ *Ibid* at 62.

⁸¹ Shue & Wippman, *supra* note 78 at 566; Boothby, *supra* note 71 at 103.

⁸² Shue & Wippman, *supra* note 78 at 566.

⁸³ Ramey, *supra* note 1 at 2.

according to the 1974 Registration Convention,⁸⁴ which does not always take place. This means that identifying a space object as a legitimate military objective is very difficult. In the case of dual-use satellites, which comprise several transponders, each of which may handle the communications or other needs of more than one user, an attack targeting the military use will potentially interrupt or destroy the civilian use, or use by neutral countries. Any such an attack would need to be assessed carefully for proportionality, as will be discussed below.⁸⁵

3. SPECIAL CATEGORIES

Some satellites may also come under special protection if they could be considered to be “objects indispensable to the survival of the civilian population”. Following from Article 54(1), which prohibits starvation as a method of warfare, Article 54(2) determines that to “attack, destroy, remove or render useless” objects indispensable to the survival of the civilian population for the purpose of denying them for their sustenance value to the civilian population or the adverse party is prohibited altogether. A non-exhaustive list follows, to include objects “such as foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works”.⁸⁶ It is therefore possible that objects not listed here could fall under the same category of special protection, such as a space object, if the technology or services provided by a specific satellite or space application would amount to something indispensable to the survival of the civilian population. Examples could include disaster management applications, or the remote monitoring of dams and drinking water installations.⁸⁷

The fact that the principle of distinction must be assessed on a case-by-case basis means that there is always some margin of discretion on the part of a commander or targeting operator. There may also be cause for concern where States unilaterally expand upon the customary law definitions given here. For example, with respect to the first cumulative requirement in the definition of a military objective under Article 52(2) of Additional Protocol I, requiring the object identified must make “an effective contribution to military action”, the US interpretation of this rule

⁸⁴ *Convention on Registration of Objects Launched into Outer Space*, 6 June 1975, 28 UST 695, 1023 UNTS 15 (entered into force 15 September 1976) [*Registration Convention*].

⁸⁵ Boothby, *supra* note 71 at 370.

⁸⁶ *Additional Protocol I*, *supra* note 32, art 54(2).. See also *ICRC Rules*, *supra* note 33, Rule 54.

⁸⁷ See for example Canadian Space Agency, *Space Utilization, Earth Observation: Space Applications Linked to Government Priorities/Departments* (2012), online: Canadian Space Agency <www.asc-csa.gc.ca/pdf/solintermed-manuel-eng.pdf>.

goes further than the customary law definition, and includes any object which contributes to the adversary's "war-fighting or war-sustaining capability".⁸⁸ This dates back to the American Civil War, when US courts recognised the justification for destroying Confederate cotton fields, since cotton sales provided the necessary funding for importing arms and ammunition.⁸⁹ This has been interpreted in modern commander's handbooks on the law of armed conflict to mean that "economic targets of the enemy that indirectly but effectively support and sustain the enemy's war-fighting capacity may also be targeted".⁹⁰ If such an expansive reasoning were to be applied when identifying which satellites could be targeted, it would seem that almost any satellite providing commercial profits to an adversary State, or to suppliers in an adversary State, could fall under this category. Clearly this would go too far, and significantly the attempt to include this wording in the San Remo Manual on International Law Applicable to Sea Warfare was not accepted⁹¹ further underlining that this is not the customary law definition accepted universally.

With all of these difficulties in the identification of a military objective in the space domain, it should be noted that in case of doubt Article 53(3) of Additional Protocol I provides an object shall be presumed to be civilian and therefore protected from legitimate targeting. This acts as a limit on the discretion given to military commanders. How this rule will apply to satellites where identification is so problematic given the preponderance of non-visual data raises obvious practical issues.

B. PROPORTIONALITY

The principle of proportionality has been textualised within Additional Protocol I, which provides the following relevant recitation of the principle under the heading "Protection of the civilian population". Specifically, Article 51(5)(b) prohibits indiscriminate attacks, defined as:

An attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof,

⁸⁸ *Navy Commander's Handbook*, supra note 72, art 8.1.1. See also US Department of the Air Force, *Commander's Handbook on the Law of Armed Conflict*, (AFP 110-34) (1980) [*Air Force Commander's Handbook*] at 2.

⁸⁹ Rogers, supra note 54 at 59.

⁹⁰ *Navy Commander's Handbook*, supra note 72, art 8.1.1. See also *Air Force Commander's Handbook*, supra note 88 at 2.

⁹¹ *San Remo Manual* supra note 71 at 150.

which would be excessive in relation to the concrete and direct military advantage anticipated.⁹²

The principle is also contained in Article 57(2)(b) which is listed under the chapeau of "Precautions in attack". As with distinction, the principle of proportionality occupies a distinctive and central place within the IHL framework.

The principle of proportionality is contained within the terms of Additional Protocol I, and is regarded as constituting customary international law by non-parties.⁹³ The principle of proportionality reflects a legal standard which stipulates that collateral damage to property and incidental injury to civilians need to be balanced and weighed against "concrete and direct military advantage". The principle is one that has not easily been reconciled. Dinstein notes, for example, that there has always been a fundamental disconnect between balancing military considerations against civilian losses, as they are "dissimilar considerations".⁹⁴

Numerous States parties to the Additional Protocol have made declarations seeking to assure a more expansive (and militarily advantageous) formalist architecture, including for example declarations that the security of the attacking force may be a factor that may be taken into account when balancing against "excessive" civilian loss. Similarly, declarations have been made that proportionality assessments should be undertaken with respect to the "attack as a whole and not individualized aspects of the attack".⁹⁵ Dinstein acknowledges the criticism levelled at the

⁹² *Additional Protocol I*, *supra* note 32, art 51(5)(b).

⁹³ See *Navy Commander's Handbook*, *supra* note 72, art 5.3.3, that re-states the principle of proportionality, for the US as a non-party to API, in identical terms to the formula expressed in AP I:

The principle of proportionality requires the commander to conduct a balancing test to determine if the incidental injury, including death to civilians and damage to civilian objects, is excessive in relation to the concrete and direct military advantage expected to be gained.

⁹⁴ Dinstein, *supra* note 55 at 122.

⁹⁵ Several States made declarations with regards to Additional Protocol I. For example, Australia declared:

In relation to paragraph 5(b) of Article 51 and to paragraph 2(a)(iii) of Article 57, it is the understanding of Australia that references to the "military advantage" are intended to mean the advantage anticipated from the military attack considered as a whole and not only from isolated or particular parts of that attack.

principle as elaborated within Additional Protocol I as permitting possibly too great a subjective assessment by military commanders when undertaking the balancing requirement.⁹⁶ As with the principle of distinction, a somewhat linear formulation of assessment is undertaken. Hence civilians and civilian objects are accorded a 'value' and an exchange is processed along consequentialist lines, whereby an attack may proceed on the basis that "anticipated concrete and direct military advantage" is not "excessive" in relation to civilian loss. Some texts also remind audiences that the term is "excessive" and not "extensive".⁹⁷ The type of judgment to be exercised is an evaluative one, where broader policy type considerations may be given effect in determining whether an "anticipated military advantage" is or is not proportionate to the incidental civilian loss or damage to civilian objects (or a combination thereof) expected. Not unlike distinction calculations, an assessment is to be made as to the military significance of an attack in terms that invite a wide, but nonetheless bounded, level of discretion.

In the context of warfare in outer space, the principle of proportionality has both an obvious but also elusive quality. As noted above, there are no civilian populations living in space that would attract a more traditional application of the principle. In this respect, it could be said that a conflict which focuses on targeting unpopulated space objects would already fulfil the aim of minimising human suffering, and would therefore in principle fulfil the notion of proportionality.⁹⁸ There are, however, civilian objects that do require a direct assessment of potential damage. Moreover, just as the destruction of electricity-generating stations or water purification facilities that supply both military and civilian purposes require an assessment of the consequential impact of destruction of a lawful military object on Earth, the same requirement exists when assessing a target in space and the potential impact on a civilian population as a result of that object's destruction.

See Declaration of Australia on 24 June 1991, online: ICRC
<www.icrc.org/applic/ihl/ihl.nsf/Notif/470-AU?OpenDocument&>. The United Kingdom declared:

In relation to paragraph 5(b) of Article 51 and paragraph (2)(a)(iii) of Article 57, that the military advantage anticipated from an attack is intended to refer to the advantage anticipated from the attack considered as a whole and not only from isolated or particular parts of the attack.

Declaration of the United Kingdom of Great Britain and Northern Ireland on 2 July 2002, online: ICRC
<www.icrc.org/ihl.nsf/NORM/0A9E03F0F2EE757CC1256402003FB6D2?OpenDocument>.

⁹⁶ Dinstein, *supra* note 55 at 122.

⁹⁷ *Ibid* at 120.

⁹⁸ Ramey, *supra* note 1 at 4.

4. GLOBAL NAVIGATION SATELLITE SYSTEMS

One obvious area of potential contestation relates to the use of Global Navigation Satellite System (GNSS). Numerous nations have developed their own systems: Russia has the GLONASS, the EU is developing the Galileo system, China the BeiDou system,⁹⁹ and of course the US has the Global Positioning System (GPS). These systems all require the placement of at least 31 satellites in geosynchronous orbit. The importance of GNSS cannot be underestimated in the contemporary world.

The US GPS is presently the most utilised GNSS in the world. It began as a military asset to ensure greater navigational and targeting precision but has over the decades fulfilled numerous civilian roles. Much of modern civilian life is dependent upon civilian GPS frequencies for navigation purposes, but also for precision timing synchronisation used in most modern technology. The internet relies heavily upon GNSS to provide the relevant signature time stamp to provide for the synchronisation of 'packets' of data.¹⁰⁰ Modern aviation, maritime and land systems rely upon GPS for safe and efficient transport and the modern economic order in areas as diverse as mining and agriculture are all guided by GPS. GNSS directly impacts the efficacy and capability of global financial systems, water supply and associated infrastructure, information and communication systems, health services, energy production and military and security functions. It has been estimated that 6 to 7 % of the GDP of Western countries is dependent upon GPS.¹⁰¹

GPS also has an encrypted military function and hence as a dual-use object may be lawfully targeted under the principle of distinction, as discussed above. The question, then, is whether the targeting of the system in a specific situation also satisfies the test of proportionality. The elements at play require a balancing of military advantage against anticipated civilian loss. This formulation is necessarily speculative in one sense as

⁹⁹ GPS, "Joint Statement U.S.-China Civil Global Navigation Satellite Systems (GNSS) Cooperation" (19 May 2014), online: GPS <www.gps.gov/policy/cooperation/china/2014-joint-statement/>.

¹⁰⁰ Dr James Carroll & Kirk Montgomery, "Global Positioning System Timing Criticality Assessment - Preliminary Performance Results", (Paper presented at the 40th Annual Precise Time and Time Interval (PTTI) Meeting), Virginia, USA, 1 - 4 December 2008, 485, 490, online: Resilient Navigation and Timing Foundation <rntfnd.org/wp-content/uploads/2013/09/GPS-Timing-Criticality-Volpe-Paper-2008.pdf>.

¹⁰¹ Global Navigational Space Systems: Reliance and Vulnerabilities', *The Royal Academy of Engineering*, (March 2011), 1 at 3, online: Royal Academy of Engineering <www.raeng.org.uk/publications/reports/global-navigation-space-systems>.

there will almost certainly be no direct loss of civilian lives in any actual kinetic attack in outer space. The law does require, however, that foreseeable and proximate losses are factored into any calculation. In this instance, there is a level of quantitative data relating to civilian reliance on the GPS (and equivalent systems), as outlined above, that informs any assessment. Critically, it is also clear that there have been no actual attacks on any GNSS, hence no judicial determination or other formally authoritative review of the proportionality equation on this target set has been undertaken.

5. DISCRETION IN APPLICATION

In starting any assessment it needs to be recognised that IHL does allow a large degree of military discretion. This is revealed in a number of situations. Hence, as mentioned previously, when determining whether an attack potentially causing “widespread, long-term and severe damage” may be undertaken, the relevant test requires an assessment of whether the “long term” component of this formulation can be measured in “decades”.¹⁰² Accordingly, any attack resulting in significant environmental damage that is measured in years not amounting to “decades” would seem to be outside the prohibition. Similarly, in the area of protecting cultural heritage, the prevailing law allows for wide military discretion. Even under the Second Protocol to the 1954 Hague Convention on Cultural Property, those cultural artefacts of the greatest importance to humanity acquiring “enhanced protection”, may nonetheless be attacked under IHL where “imperative military necessity” demands.¹⁰³ The point of this brief survey is not to critique the extent of military discretion, but rather to signal the manner in which it is accommodated under key IHL provisions.

Even under international criminal law, the International Tribunal for the Former Yugoslavia (ICTY) has determined that the test for the mental element of whether a Commander has violated the proportionality principle is one of “reasonableness”. That is, in determining criminal liability for breaching the principle of proportionality, the Tribunal must ask what the reasonable Commander in the situation of the defendant would have decided.¹⁰⁴ While providing a level of external confidence, the

¹⁰² *Commentary on Additional Protocol I*, *supra* note 61, para. 1455.

¹⁰³ *Second Protocol to the 1954 Convention for the Protection of Cultural Property in the Event of Armed Conflict*, *supra* note 71, art 6. For more on “Enhanced Protection”, see generally Chapter 3 of the Second Protocol.

¹⁰⁴ As the ICTY held in *Prosecutor v Stanislav Galic*:

[i]n determining whether an attack was proportionate it is necessary to examine whether a reasonably well-informed person in the circumstances of the actual

difficulty with this legal test is its relativism. As legal theorist Koskenniemi has generally observed, while the legal test of “reasonableness” is not problematic *per se*, it provides little definitive guidance and conceptually operates to elevate the subjective to the objective, so as to appear a ‘natural’ outcome with relative ease.¹⁰⁵

While destruction of the GPS would undoubtedly cause major civilian loss, directly and indirectly, the level of discretion afforded to military planners when determining correlative “military advantage” remains extremely broad. The question is whether the anticipated civilian loss would be “excessive”, and this itself allows for a broad range of factors to be incorporated into the decision-making calculus. Even when it comes to nuclear weapons, which the ICJ determined were scarcely reconcilable with the tenets of IHL, the Court could not itself determine definitively “in all cases” whether nuclear weapons would be unlawful where State survival was at stake.¹⁰⁶ Hence, the likelihood of being able to satisfy the proportionality test when determining to attack the GNSS/GPS would, *prima facie*, be defensible if the “direct military advantage anticipated” can be properly justified.

Against this conclusion however, is the fact the GNSS/GPS allows for the accurate targeting of military objectives in the first place. Numerous tactical and strategic weapons systems have come to rely upon GPS/GNSS to target precisely, thus acting to minimise civilian loss in an actual attack.¹⁰⁷ As will be discussed in the following section, principles relating to precautions in attack would mitigate against a conclusion that the GPS is a legitimate target given the obligation imposed upon belligerent States to minimise civilian casualties. However, counter to this proposition is the specific conclusion reached by the experts drafting the Harvard Manual on International Law Applicable to Air and Missile Warfare,¹⁰⁸ that provides that when defending against an attacking aircraft

perpetrator, making reasonable use of the information available to him or her, could have expected excessive civilian casualties to result from the attack.

Case No. IT-98-29-T of 5 December 2003, para 58, online: ICTY <www.icty.org/case/galic/4>.

¹⁰⁵ Martii Koskenniemi, “Hierarchy in International Law” (1997) 8 *European Journal Of International Law* 566 at 597.

¹⁰⁶ *Nuclear Weapons*, *supra* note 42 at 263, para 97.

¹⁰⁷ In 2013, Boeing had produced over 250,000 Joint Direct Attack Munition (JDAM) kits that rely upon GPS for accurate targeting: see JDAM Weapon Program Reaches 250,000-kit Milestone, *Deagle.com* (20 August 2013), online: Deagle.com www.deagle.com/news/JDAM-Weapon-Program-Reaches-250000-Kit-Milestone_n000011820.aspx>.

¹⁰⁸ *Harvard Manual of International Law Applicable to Air and Missile Warfare*, Program on Humanitarian Policy and Conflict Research at Harvard University [*Harvard Manual*], online:

or UAVs, defenders are not obliged to undertake a proportionality evaluation with respect to determining losses to their own nationals when downing such aircraft.¹⁰⁹ Presumably this would by analogy apply to disruption of satellite links for GNSS/GPS-linked UAVs and munitions.

Ultimately, the vagaries of legal expression and the impossible nature of the existing formula to provide any kind of mathematical solution to the proportionality analysis means that it remains arguable whether an attack on the GPS/GNSS would violate the proportionality prohibition. It would seem that despite this legal uncertainty, modern military forces operate within a realm of considerable constraint dominated by both legal and policy factors. Questions of legitimacy – whether source, procedural and/or substantive (outcome driven) – are assimilated into questions of legal construction and articulation under IHL, and they combine to shape military decision-making. Especially for professional military forces from liberal democratic societies, there is significant influence by relevant domestic populations as well as key external constituencies.¹¹⁰ Such influence overlays any legal analysis and provides an extra layer of restraint. Hence, any decision to attack the GNSS under the tenets of the law relating to proportionality will be carefully parsed, but it is likely that broader social and policy considerations as to perceived legitimacy will act as a further constraint to any decision made. Given this likelihood, it would seem inevitable that the GPS/GNSS would retain a level of ‘protection’ based upon both legal and policy factors, at least those systems that are made available and employed by significant civilian users.

C. PRECAUTIONS IN ATTACK

Article 57(2)(ii) of Additional Protocol I (and its customary international law equivalent)¹¹¹ requires that when undertaking attacks on land, belligerents shall:

Take all feasible precautions in the choice of means and methods of attack with a view to avoiding, and in any event to minimizing, incidental loss of

International Humanitarian Law Research Initiative
<ihlresearch.org/amw/HPCR%20Manual.pdf>.

¹⁰⁹ *Commentary HPCR Manual on International Law Applicable to Air and Missile Warfare* (The Program on Humanitarian Policy and Conflict Research at Harvard University, 2013), para 39(4).

¹¹⁰ David Kennedy, *Of War and Law* (Princeton: Princeton University Press, 2006) at 96-7.

¹¹¹ *Navy Commander's Handbook*, *supra* note 72, para 8.1.

civilian life, injury to civilians and damage to civilian objects.

Article 57(4) provides a slightly modified test in relation to military operations at sea or in the air as mandating “reasonable precautions”. According to the ICRC, the test contained under Article 57(4) is “a little less far-reaching” than “all feasible precautions”.¹¹² It is difficult to know which context would apply to the conduct of warfare in outer space, though operationally it may be a nuance that has no practical effect.

The general requirement to take precautions in planning and executing an attack is a requirement that has particular resonance within the space domain. As was outlined in Section I above, the use of weapons systems within outer space consist of many effects not present within the terrestrial environment. Such effects must be taken into account when planning or executing any attack. Unlike the terrestrial environment, any kinetic attack upon a military objective within space will, at the right altitude, result in considerable debris circling the Earth as such debris maintains its own orbit. As was discussed in Section I, China’s targeting of its own weather satellite caused the creation of an enormous orbiting debris field. Indeed, it has been noted that China is responsible “for nearly half of all known and tracked satellite breakup debris currently in Earth orbit”.¹¹³

Accordingly, planners must account for the fact that in any given kinetic attack, thousands of pieces of debris will likely rotate the Earth at speeds of up to 27,000 kilometres per hour, and hence are capable of the destruction of all objects in their path. The projected trajectories of the debris and planned orbits, and possible resulting collisions, must be taken into account. Additionally commanders must take into account the Kessler syndrome when analysing a consequence of resulting debris. Donald Kessler *et al* stressed in the 1970s that when debris is travelling at hyper-velocity in an area of dense satellite or other space object concentration, there is significant potential for space debris to multiply as a result of subsequent collisions. Such potential has exponential effect and is theoretically mappable to an infinite scale.¹¹⁴

¹¹² *Commentary on Additional Protocol I*, *supra* note 61, para 2230.

¹¹³ *Fengyun-1C Debris: One Year Later*, *supra* note 16.

¹¹⁴ Donald J Kessler & Burton G Cour-Palais, “Collision Frequency of Artificial Satellites: The Creation of a Debris Belt” (1978) 83 *Journal of Geophysical Research* 63.

In armed conflict, the potential for such an impact needs to be lawfully mitigated through the employment of feasible precautions. This necessarily invites consideration of the types of weapon systems that might be employed to engage in an attack. One logical choice would be the use of laser weapons that might be used to destroy particular circuitry on a military or dual-use satellite without destroying the satellite itself. At present, such weapons systems are only now reaching initial deployable status on Earth-based platforms, and so far are proving successful in their intended design task.¹¹⁵ However, there is still some way from the technical capability to deploy such laser weapons in space, or from Earth to space.

Another solution may be the use of cyber operations to disable or disrupt functionality of a satellite that is assessed as constituting a military objective. The development of cyber means of conducting warfare is a current operational reality. The Stuxnet computer virus and computer attacks that occurred during the Georgia/Russia conflict of 2008 are a testament to this contemporary phenomenon. The 2013 Tallinn Manual on the International Law Applicable to Cyber Warfare¹¹⁶ represents a recent attempt by a group of legal experts at an articulation of the law applicable in this cyber realm. While not stated within the Rules or Commentary itself, it would appear a logical deduction from the obligations enumerated in Article 57 (and supporting customary international law) that, where feasible, cyber means of attack are lawfully obliged over kinetic means, due to the fact that a cyber-attack will cause less damage than a kinetic one. The Tallinn Manual highlights that feasibility is to be interpreted in accordance with what is “practicable or practically possible, taking into account all circumstances ruling at the time, including humanitarian and military considerations”.¹¹⁷ Hence, where a choice can be made between deploying kinetic means to destroy a satellite or cyber means, then there is likely to be a legal obligation to utilise the latter to ensure that any collateral damage is kept to a minimum.

In determining whether there is such an obligation, much turns on what is “feasible”. Hence unlike kinetic means, which may be used

¹¹⁵ Jon Skillings, “U.S. Navy sees shipboard laser weapon coming soon”, *CNET* (8 April 2013), online: CNET <www.cnet.com/news/u-s-navy-sees-shipboard-laser-weapon-coming-soon/>.

¹¹⁶ Michael N Schmitt & NATO Cooperative Cyber Defence Centre of Excellence, *Tallinn Manual on the International Law Applicable to Cyber Warfare: Prepared by the International Group of Experts at The Invitation of the NATO Cooperative Cyber Defence Centre of Excellence* (Cambridge: Cambridge University Press, 2013) [*Tallinn Manual*].

¹¹⁷ *Ibid* at 168.

repeatedly to achieve military effect, cyber operations may only have a life span of one use before the opposition is able to devise an adequate cyber defence. In such circumstances whether it is “practicable” to use this means of warfare, having regard to possible future uses of a potentially unique cyber capability, is a question of both qualitative and quantitative significance. However, where a satellite is part of a broader dual-use civilian network, it may be preferable (indeed lawfully required) to temporarily disrupt the functionality of that network (where the civilian loss is not excessive to military advantage anticipated) through a cyber-attack, rather than to destroy it. Such a choice achieves the same military effect but avoids the resulting debris that comes from physical destruction as well as the need to re-deploy satellites to resume significant civilian functions. Similar choices were in fact made during operations against Iraq in 1991 and Serbia in 1999, where electricity power grids were disrupted/short-circuited through the use of ‘carbon graphite bombs’ rather than physically destroyed.¹¹⁸

In sum, the obligation to employ precautions when planning an attack does impose obligations beyond those mandated through the principle of proportionality. While this body of law does not require that civilian casualties or property loss be reduced to zero, it does require that choices be made to reduce, to the maximum extent feasible, such loss. The dynamics of the space environment give particular force to this principle, given the unique consequences of physical kinetic attack and the serious problems associated with dual-use satellites and vast debris fields in space. There is a compelling case for finding innovative and durable solutions under existing tenets of IHL, particularly due to the obligation to observe precautionary measures that will inform military decision-making in the future.

V. CONCLUSION

The above discussion demonstrates that the principles and laws of IHL applies in space, despite the fact that no hard, binding rules have yet been written for specific application in this particular domain. However, due to the heritage and trajectory of IHL, a clear judicial preference for IHL to apply to ‘fill gaps’, and the all-encompassing definition under Article III of the Outer Space Treaty, there can be little doubt that IHL applies as a matter of customary international law, and that certain general principles must also apply.

¹¹⁸ CBS-94 “Blackout Bomb, BLU- 114/B “Soft Bomb”, online: Federation of American Scientists <fas.org/man/dod-101/sys/dumb/blu-114.htm>.

It is also true that there are certain specificities in the space domain which make it difficult to translate all rules of IHL in a classically understood manner. What emerges from the above analysis of the application of certain fundamental principles of IHL to a hypothetical conflict in space is that there are many unique factors that must be taken into account. The physical environment of space, and the risk of causing space debris by use of kinetic weapons, mean that the principles of proportionality and precaution in attack must weigh particularly heavily.

The difficulty of identifying an object as a legitimate military target given the increase in dual-use space applications, and the potential for catastrophic reverberating collateral effects when destroying or disabling a dual-use satellite, also mean that the principle of distinction may not be enough on its own to determine whether there is sufficient “definite military advantage” to targeting such an object.

Thus a curious result can be said to materialise. On the one hand the choice to target a space object would already appear to fulfil principle of humanity, because the risk of casualties is extremely low. In this sense, a parallel could be drawn with cyber-warfare; some would argue that the principle of proportionality dictates that cyber should be the preferred course over targeting physical objects where possible, since the risk of human casualty is extremely low. The same could be said of targeting a space object over targeting an object on Earth. On the other hand, it is extremely difficult to distinguish a legitimate military target in space due to the high number of dual-use applications, and it may be near impossible to target only the transponders on a satellite which provide military applications. As well, the risk of space debris means that kinetic weapons should not be preferred, and yet even with non-kinetic means of interruption, disablement or capture, the difficulty of calculating collateral effects and the likelihood that these effects would be immense all mean that proportionality dictates in the opposite direction, away from targeting such space objects.

It would seem that the principle of precaution in attack has a particular role to play in space. Both the principle of distinction and the principle of proportionality point towards elevated precaution in all potential attacks in the space domain.

Thus, while it is imperative that States recognise that IHL is applicable to all their activities in space that involve conflicts on Earth and/or in space, care must be taken in weighing up the traditional

principles and their application to this new domain. As the technology that increases war-fighting capability advances, so does the imperative to understand the applicable legal framework for the use of such technology. There is much work that needs to be done and it needs to be done before, not after, any conflict in space should occur.