

Environmental Protection as a Limitation to the Use of Force in Outer Space

Peter Stubbe*

Abstract

Despite the absolute ban of the use of force in international law, military confrontations in international relations cannot be completely ruled out. This could potentially also apply to outer space. Satellites are widely used for military purposes and could, therefore, be regarded by the belligerent parties as legitimate military targets. Warfare in outer space would have a devastating impact on the outer space environment due to the creation of a massive amount of space debris. The paper argues that the environmental protection provisions of international humanitarian law, which applies to military warfare in outer space, have a limiting effect on the conduct of military operations in space. Outer space forms part of the human environment and space debris pollution constitutes a global environmental concern. The provisions to be examined are the environmental protection norms of the *ius in bello*, namely those enshrined in the First Additional Protocol to the Geneva Convention and the Environmental Modification Convention, as well as the fundamental principles of international humanitarian law. Particular account is given to the current work of the International Law Commission in the field of environmental protection in times of armed conflict. This includes the proposal to designate areas of major ecological importance as protected zones in which no warfare is permissible. In applying this approach to (certain parts of) outer space, the outer space environment could be spared from the devastating consequences of space warfare.

I. Introduction

While the use of force is banned under international law, the use of force cannot be totally excluded from international relations. In the space context, a military confrontation could make satellites the object of the use of force. Their physical destruction, damaging or impairment in any other manner causes the generation of space debris, thus resulting in the degradation of the outer space environment and threatening the long-term usability of outer

* German Aerospace Center (DLR), Germany, peter.stubbe@dlr.de.

space. The destruction of the Fengyun-1C satellite¹ and other ASAT tests² bear witness of this potential for environmental damage in outer space.

This paper asks whether environmental protection law can have a limiting effect on the conduct of an armed conflict in outer space. In a first step, the current state of affairs in terms of space security shall be briefly mapped, including references to ongoing discussions in international fora, and the two bodies of law, *ius contra bellum* and *ius in bello*, will be briefly presented. In a second step, the norms having a protective effect for the outer space environment will be scrutinized with regard to their potential for constraining the use of military force in outer space. This does not only include the examination of the relevant *ius in bello*, but also cover the 'ordinary' rules of international environmental law. The scrutiny, finally, opens up the perspective to an approach that is currently being discussed in the International Law Commission (ILC), namely the designation of certain areas as protected zones. Since 2013, the ILC works on the topic of 'Protection of the Environment in Relation to Armed Conflict'.³

II. Outer Space and Military Force

II.1. Outer Space as a Potential Area of Conflict and the Consequences for the Space Environment

As a basic principle, it cannot be excluded that a military confrontation extends to outer space. Space applications have become an essential element for the conduct of military operations and the corresponding space and ground infrastructure could become a military target. During the times of the East-West confrontation, the two superpowers, by and large, exercised some degree of restraint when it comes to the development of anti-satellite weapons, which even the Strategic Defence Initiative (SDI) programme did not challenge. This reluctance reflected their interest in safeguarding outer space as a strategic room for their respective militaries.⁴ Since the beginning of the new millennium, however, the weaponization of space seems to have become a realistic policy option. Corresponding technology developments and anti-satellite

1 See *National Aeronautics and Space Administration*, Fengyun-1C Debris Cloud Remains Hazardous, in: *Orbital Debris Quarterly* (18, 1) 2014, p. 2.

2 See *Klinkrad, H.*, *Space Debris: Models and Risk Analysis*, Springer Berlin/Heidelberg/New York 2006, p. 21.

3 See UN Doc. A/68/10, Report of the International Law Commission, sixty-fifth session (6 May-7 June and 8 July-9 August 2013), paras. 130-144.

4 See *Moltz, J.C.*, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 2nd edition, Stanford University Press, Stanford 2011, p. 50; *Mutschler, M.*, *Keeping Space Safety: Towards a long-term strategy to arms control in outer space*, Peace Research Institute Frankfurt, Report No. 98, Frankfurt/Main 2010, pp. 6-7. Nevertheless, there were, of course, a number of space weapons development programs.

weapons testing bear witness of this policy change.⁵ In the context of the thus heightened tensions, there is a risk of misperceptions and ambiguities in view of the increasing pollution of space with space debris and the equally growing probability of in-orbit collisions.⁶ The object population in low-Earth orbits has reached a level that can be characterized as unstable. The Inter-Agency Space Debris Coordination Committee (IADC) found:

“Even with a 90% implementation of the commonly-adopted mitigation measures, based on the ESA provided initial population of 2009, the LEO debris population is expected to increase by an average of 30% in the next 200 years.”⁷

Accidental collisions together with uncertainties over the cause of the sudden loss of a satellite occurring in times of serious political tensions may be perceived as an armed attack, thus triggering a military response. It is increasingly recognized that there is a need to enhance transparency and mutual trust in order to avoid and mitigate tensions among States in the utilization of outer space.

There are a couple of different types of space weapons. Of particular interest are those targeting satellites. Anti-satellite weapons are nuclear explosions in outer space, kinetic-energy and directed-energy weapons, jamming as well as anti-ballistic weapons systems; they can be either ground or space based.⁸ The damaging or complete destruction of satellites results in the creation of massive amounts of space debris.⁹ The resulting fragmentation of a spacecraft can add massively to the already existing debris population. The Fengyun-1C destruction created as many as 3,400 additional debris objects.¹⁰ Even measures that disrupt the ordinary functioning of a satellite in absence of its complete destruction or its physical damaging increase the risk of a further debris proliferation. A (temporarily) disabled satellite is incapable of performing collision

5 See *Ibid.*, pp. 7-9; *Liemer, R./Chyba, C.F.*, A Verifiable Limited Test Ban for Anti-satellite Weapons, *The Washington Quarterly* (33, 3) 2010, pp. 149-151; and *Mao-goto, J.N./Freeland, S.*, Space Weaponization and the United Nations Charter Regime on Force: A Thick Legal Fog or a Receding Mist?, *The International Lawyer* (41, 4) 2007, pp. 1096-1097.

6 See *Adushkin, V. et al.*, Orbital missions safety – A survey of kinetic hazards, *Acta Astronautica*, In Press, Corrected Proof, Available online 8 January 2016, pp. 5-6.

7 IADC Doc. 12-08, Rev.1, Stability of the Future LEO Environment, January 2013, p. 17.

8 See *Hart B.L.*, Anti-Satellite Weapons: Threats, Laws and the Uncertain Future of Space, *Annals of Air and Space Law* (XXXIII) 2008, p. 346. See also *Neuneck, G./Rothkirch, A.*, The Possible Weaponization of Space and Options for Preventive Arms Control, *Zeitschrift für Luft- und Weltraumrecht* (55, 4) 2006, pp. 504-507.

9 See *Hart B.L.*, Anti-Satellite Weapons: Threats, Laws and the Uncertain Future of Space, *Annals of Air and Space Law* (XXXIII) 2008, pp. 374-375.

10 See *National Aeronautics and Space Administration*, Fengyun-1C Debris Cloud Remains Hazardous, in: *Orbital Debris Quarterly* (18, 1) 2014, p. 2.

avoidance maneuvers in case of close conjunctions. It is expected that collision debris in low-Earth orbits will take over as the most important source of debris and there is a growing collision risk in orbit.¹¹

The Outer Space Treaty (OST)¹² only prohibits the placement of weapons of mass destruction in outer space and on celestial bodies. Conventional weapons do not fall under this ban so that their stationing and deployment is not prohibited by the disarmament norms of the Outer Space Treaty.¹³ Particular restrictions exist for the Moon and other celestial bodies, which must be used for ‘exclusively purposes’ only.¹⁴ This excludes not only aggressive, but also every military use¹⁵ so that conventional weapons too, must not be placed or deployed on the Moon and other celestial bodies.

In light of the incomplete disarmament provisions of international space law and the heightening tensions, there are several initiatives aimed at curbing space weaponization and at building mutual trust and confidence. The debate over the ‘prevention of an arms race in outer space’ (PAROS) in the scope of the Conference on Disarmament in Geneva started in the 1980s, but has not matured substantive results. Discussions have remained in a deadlock for many years. Russia and China have proposed a legally binding disarmament treaty,¹⁶ but no consensus could yet be reached on a meaningful step towards disarmament in outer space. In order to overcome the Geneva stalemate, the idea of a voluntary Code of Conduct for Outer Space Activities has been put

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- 11 See IADC Doc. 12-08, Rev.1, Stability of the Future LEO Environment, January 2013, p. 13; and *Liou, J.-C.*, An active debris removal parametric study of LEO environment remediation, in: *Advances in Space Research* (47, 11) 2011, p. 1866. The 2009 Iridium-Cosmos collision can be regarded as a case in point in this respect.
 - 12 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (done 27 January 1967, entered into force 10 October 1967) 610 UNTS 205.
 - 13 See *Neuneck, G./Rothkirch, A.*, The Possible Weaponization of Space and Options for Preventive Arms Control, *Zeitschrift für Luft- und Weltraumrecht* (55, 4) 2006, p. 513.
 - 14 See Art. IV para. 2 of the Outer Space Treaty and Art. 3 of the Moon Agreement (MOON). Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (done 18 December 1979, entered into force 11 July 1984) 1363 UNTS 3.
 - 15 See *Jakhu, R./Stubbe, P.*, Art. 3 MOON, in: *Hobe, S./Schmidt-Tedd, B./Schrogl, K.-U. (eds.)*, Cologne Commentary on Space Law, Volume II, Carl Heymanns, Köln 2013, margin number 66.
 - 16 It was first proposed in 2008 and recently updated. The 2014 version is: CD Doc. CD/1985, Letter Dated 10 June 2014 from the Permanent Representative of the Russian Federation and the Permanent Representative of China to the Conference of Disarmament Addressed to the Acting Secretary-General of the Conference transmitting the updated Russian and Chinese texts of the draft treaty on prevention of the placement of weapons in outer space and of the threat or use of force against outer space objects (PPWT), introduced by the Russian Federation and China, 12 June 2014.

forward and is being promoted by the European Union.¹⁷ Persisting dissent over the substance and the way in which the instrument has been consulted and negotiated seem to make the success of this initiative rather unlikely. In the scope of the United Nations, a Group of Governmental Experts (GGE) on Transparency and Confidence-Building Measures has adopted a consensus report highlighting possible means for furthering mutual trust in the conduct of outer space activities.¹⁸ The Committee on the Peaceful Uses of Outer Space (COPUOS), since 2009, works on the topic of long-term sustainability in the scope of its Scientific and Technical Subcommittee.¹⁹ What becomes apparent from the discussions is that the issues of sustainability (encompassing to a number of sub-topics, among them the key question of the long-term preservation of the usability of outer space) and transparency and confidence-building (aimed at restoring mutual trust) overlap to a significant extent. Both are concerned with the question of how to ensure interference-free utilization of outer space, i.e. with the safety of space operations.²⁰ Against this background, it should be made sure that the ongoing tensions related to space security do not become an obstacle to the successful and important work on the civil issues of space safety and space sustainability.

II.2. *Ius contra bellum* and *ius in bello*

When it comes to the possible extension of a military confrontation to outer space, the question of the applicability of the *ius contra bellum* and the *ius in bello* arises. As a general principle, these rules apply to outer space activities; there is no general limitation *ratione loci*. Art. III OST provides that all activities in outer space must be carried out “in accordance with international law, including the Charter of the United Nations”. The prohibition of the use of force as manifested in Art. 2 no. 4 of the UN Charter is a peremptory

17 See *European External Action Service*, Disarmament and Non-proliferation: Outer space activities: Code of Conduct for Outer Space Activities, <http://eeas.europa.eu/non-proliferation-and-disarmament/outer-space-activities/index_en.htm> (accessed 30 January 2016).

18 See UN Doc. A/68/189, Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, 29 July 2013.

19 A recent draft version of a set of guidelines elaborated in the scope of a corresponding working group is enshrined in: UN Doc. A/AC.105/C.1/L.348, Updated set of draft guidelines for the long-term sustainability of outer space activities, 26 November 2015.

20 This, in turn, brings to the table the question of a space traffic management system, which is defined as “[comprising] technical and regulatory provisions for guaranteeing safe and interference-free access into outer space, operations in outer space, and return from outer space to Earth.” *Contant-Jorgensen, C./Lála, P./Schrogl, K.-U. (ed.)*, Cosmic Study on Space Traffic Management, International Academy of Astronautics, 2006, p. 21.

norm of international law from which no derogation is permissible.²¹ Its establishment constitutes a major advancement of the international legal order after the Second World War and there are only two narrow exceptions to the rule: lawful measures of self-defense²² and military actions based on an authorization of the UN Security Council.^{23, 24}

The condition that triggers the right to self-defense is the 'armed attack' according to Art. 51 UN Charter.²⁵ In the outer space context, the unauthorized physical interference with a space object could be regarded as such an attack, even if it is not undertaken with the intention to damage or destroy in order to obtain a military advantage, but, for instance, for the purpose of active debris removal. The Russian-Chinese draft PPWT treaty tabled in the Conference on Disarmament seems to follow this understanding as the definition of 'use of force' contained therein covers any damage inflicted on third States' space objects, unless there are special agreements authorizing actions to stop the uncontrolled flight of space objects.²⁶

Ius in bello, as part of international law, applies to space activities, as well.²⁷ The norms of international humanitarian law serve the purpose of limiting the negative consequences resulting from the application of military force.²⁸ It protects persons and bans certain means and methods of warfare. Based on the recognition that armed conflicts cannot be completely excluded from international relations, its ultimate aim is to at least reduce human suffering. The body of international humanitarian law includes provisions on environmental protection. These provisions could limit the conduct of armed operations in outer space in view of the space environmental degradation that is associated with the generation of space debris.

21 See *Crawford, J.*, *Brownlie's Principles of Public International Law*, 8th edition, Oxford University Press, Oxford 2012, pp. 595-596.

22 See Art. 51 UN Charter.

23 See Chapter VII of the UN Charter.

24 See *Shaw, M.*, *International Law*, 7th edition, Cambridge University Press, Cambridge 2014, p. 815.

25 The notion of the expression 'armed attack' is close to notion of an 'act of aggression' whose meaning has been clarified in the context of international criminal law. See Art. 8 bis of the Rome Statute of the International Criminal Court (done 17 July 1998, entered into force 1 July 2002) 2187 UNTS 90 together with Resolution RC/Res.6 of the Review Conference of the Rome Statute, Amendments on the crime of aggression to the Rome Statute of the International Criminal Court (depository notification number C.N.651.2010), 11 June 2011.

26 See Art. I lit. (d) Draft PPWT.

27 See *Goh, G.M.*, *Keeping the peace in space: a legal framework for the prohibition of the use of force*, *Space Policy* (20, 4) 2004, p. 267.

28 See *Gasser, H.-P./Thürer, D.*, *International Humanitarian Law* (Status: March 2011), in: *Wolfrum, R. (ed.)*, *The Max Planck Encyclopedia of Public International Law: Online Edition*, <opil.ouplaw.com/home/EPIL> (accessed 30 January 2016), Oxford University Press, margin number 1.

III. Space Environmental Protection in Armed Conflict

Environmental protection in times of armed conflict is an issue that has long been debated. It is widely recognized that the environment, the livelihood of mankind, must be granted a certain level of protection, in peacetime and in times of war. A wide body of environmental law has emerged in order to preserve man's natural environment and environmental protection norms have found their way into body of the *ius in bello*. The norms that shall be particularly scrutinized in the following are Art. 35 and 55 of the First Additional Protocol to the Geneva Conventions²⁹ as well as the relevant provisions of the Environmental Modification Convention.³⁰

But it is not only these specific provisions that may have a protective effect. There are, in addition, general principles in international humanitarian law, such as the principles of distinction, proportionality and precaution that are potentially relevant to the preservation of the space environment;³¹ their application to the warfare in outer space will also be included in the examination.

The condition for a protective effect of environmental protection law is that outer space can be regarded as belonging to man's natural environment and that the generation of space debris, accordingly, represents a form of environmental damage. This question will be addressed before turning to the application of the norms and principles to the debris-generating use of space weapons.

III.1. Space Debris as Space Environmental Pollution

The notion of the natural environment is generally construed in a broad manner. Over the years, a great variety of different environmental protection law – be it conventional or customary – has developed. There are multiple instruments protecting various types of flora and fauna, biodiversity and the climate. The treaties regulating State's activities in certain areas contain their own environmental protection provisions, such as the Outer Space Treaty³² and the United Nations Convention on the Law of the Seas.³³ The customary 'no harm' rule, i.e. the prohibition of serious transboundary environmental

29 Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I) (done 8 June 1977, entered into force 7 December 1978) 1125 UNTS 3 (hereafter 'First Additional Protocol').

30 Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques (done 10 December 1976, entered into force 5 May 1976) 1108 UNTS 151 (hereafter 'ENMOD Convention').

31 See *Droege, C./Tougas, M.-L.*, The Protection of the Natural Environment in Armed Conflict – Existing Rules and Need for Further Legal Protection, *Nordic Journal of International Law* (82, 1) 2013, p. 24.

32 See Art. IX sentence 2 OST prohibiting the harmful contamination of outer space.

33 See Part XII of the United Nations Convention on the Law of the Sea (done 10 December 1982, entered into force 16 November 1994) 1183 UNTS 396.

damage, protects the environment as a whole and also the later discussed provisions of the *ius in bello* use the generic term ‘environment’. This diversity is generally believed to result in a wide understanding of the term which is to be interpreted as encompassing everything that surrounds and environs, i.e. human beings, all living and non-living nature, social and economic circumstances.³⁴ The ILC, in its current work on environmental protection in armed conflicts, undertakes to elaborate a set of principles which is intended to include a definition of the environment. The working definition as set forth in 2015 report of the special rapporteur reads as follows:

“[E]nvironment includes the natural resources, both abiotic and biotic, such as air, water, soil, fauna and flora and the interaction between the same factors, and the characteristics of the landscape.”³⁵

This definition and other definitions are not legally binding. In addition, definitions contained in specific treaties are only valid in the particular context of these instruments. As a result, there is no generally accepted legally binding definition of the term ‘environment’ in international law.

The absence of such legal clarity in this respect complicates the discussion of the inclusion of outer space into the notion of the environment. Space is also not referred to in the aforementioned definition which, in essence, merely mentions a number of natural resources and their interaction as well as the characteristics of the landscape as parts of the environment. There is, however, good reason for assuming that space belongs to the natural environment. As a basic principle, the generally wide understanding of the term speaks for such an inclusion. There is also a corresponding strong indication in international space law itself. The Moon Agreement recognizes that there is an environment of the Moon and other celestial bodies in Art. 7 MOON.³⁶ In addition, the ENMOD Convention defines an ‘environmental modification techniques’ as “[...] any technique for changing [...] the dynamics, composition or structure of the earth [...] or outer space.” As environmental modification is deemed possible in outer space, space cannot but be considered part of the environment. The United

34 See *Birnie, P./Boyle, A.*, International Law and the Environment, 2nd edition, Oxford University Press, Oxford 2002, p. 3.

35 UN Doc. A/CN.4/685, Second report on the protection of the environment in relation to armed conflict: Submitted by Marie G. Jacobsson, Special Rapporteur, 28 May 2015, Annex I: Protection of the environment in relation to armed conflicts: proposed draft principles, Preamble: Use of terms lit. (b). The definition corresponds to the definition contained in the ILC’s 2006 Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities, namely in Principle 2 lit. (b). See UN Doc. A/61/10, Report of the International Law Commission, fifty-eighth session (1 May-9 June and 3 July-11 August 2006), para. 66.

36 Art. 7 MOON requires that States “shall take measures to prevent the disruption of the existing balance of the environment [...]”

Nations Educational, Scientific and Cultural Organization (UNESCO) established a working group on ethics and space policy which stated: “As to the protection of the environment, space technology was found to represent a factor of damage to the circumterrestrial, terrestrial and planetary environments”³⁷ while specifically referring to space debris in this context.³⁸

Given that space belongs to the environment, space debris can, in fact, be regarded as an environmental damage. Space debris are defined as “all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional”.³⁹ Their introduction into the pristine (space) environment constitutes a form of environmental pollution. Pollution is namely defined as the human-induced insertion of substances or objects into an environment or the generation of such substances/objects in an environment to which they usually do not belong.⁴⁰ It can therefore be concluded that the generation of space debris (as induced by the deployment of space weapons) represents a form of environmental pollution and thus environmental damage.

III.2. *Ius in bello*

III.2.1. First Additional Protocol to the Geneva Conventions

Art. 35 para. 3 of the First Additional Protocol reads as follows: “It is prohibited to employ methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment.” Art. 55 of the First Additional Protocol reads as follows:

“Care shall be taken in warfare to protect the natural environment against widespread, long-term and severe damage. This protection includes the prohibition of the use of methods or means of warfare which are intended or may be expected to cause such damage to the natural environment and thereby to prejudice the health or survival of the population.”

Both norms have a similar scope of application as they prohibit “widespread, long-term and severe damage” to the environment and the difference between them appears to be rather marginal. A look at the systematic context of the two articles suggests that Art. 35 aims to protect the environment *per se* because the provision belongs to the part of the Protocol addressing methods and means of warfare. Art. 55, on the other hand, is concerned with the

37 *Pompidou, A.*, The Ethics of Space Policy, <<http://unesdoc.unesco.org/images/0012/001206/120681e.pdf>> (accessed 30 January 2016), UNESCO 2000, p. 7.

38 See *Ibid.*

39 IADC Doc. 13-02, Key Definitions of the Inter-Agency Space Debris Coordination Committee, April 2013.

40 See *Springer, A.L.*, Towards a Meaningful Concept of Pollution in International Law, in: *International and Comparative Law Quarterly* (26, 3) 1977, pp. 532-533.

reduction of the suffering of the civilian population, thus implying that the environment is only protected indirectly it is quality as a basis for human life.⁴¹ This should, however, not be construed as a reduction of the protective effect of either of the two provisions. In substance, the causation of widespread, long-term and severe environmental damage is prohibited.

When it comes to the application to space warfare, it needs to be considered whether the generation of debris as a result of the deployment of space weapons can, in fact, cause such environmental damage. It needs to be kept in mind that all of these conditions (widespread, long-term, and severe) need to be fulfilled cumulatively. The physical destruction of a space object by an anti-satellite weapon can indeed generate a massive amount of debris, which must be assessed as being unlawful under the First Additional Protocol. As a general principle, the presence of space debris can be regarded as a form of environmental damage/pollution. The pollution caused by a cloud of debris objects can also be characterized as widespread because the destruction of a satellite causes its fragments to spread out in different directions. An in-orbit fragmentation, in particular if caused by a high-velocity impact,⁴² is always associated with the dispersion of debris objects over many different orbits.⁴³

These objects may also remain for a long time in orbit before they (if at all) re-enter Earth's atmosphere. Depending on the altitude of the objects, the resulting debris objects could remain in outer space for decades or even centuries. There are only very limited natural forces that lead to a reduction of the debris pollution. The more significant factors reducing the orbital lifetime

41 See *de Preux, J.*, in: *Sandoz, Y./Swinarski, C./Zimmermann, B. (eds.)*, Commentary on the Additional Protocols of 8 June 1977 to the Geneva Conventions of 12 August 1949, Martinus Nijhoff Publishers, Geneva 1987, para. 1449, p. 414.

42 It has already been mentioned that there are weapons that do not directly result into the creation of debris (as kinetic energy weapons do). But also weapons that aim to temporarily disable satellites without destroying them increase the risk of collisions and thus of fragmentation events. There would thus be a causal connection between the deployment of the space weapon and the later fragmentation.

43 The shoot-down of Fengyun-1C as well as the Iridium-Cosmos collision in 2009 (while it did not involve a space weapon, the environmental consequences are nevertheless comparable) can be regarded as cases in point. See *National Aeronautics and Space Administration*, Chinese Anti-Satellite Test Creates Most Severe Orbital Debris Cloud, in: *Orbital Debris Quarterly* (11, 2) 2007, p. 2; and *National Aeronautics and Space Administration*, Satellite Collision Leaves Significant Debris Cloud, in: *Orbital Debris Quarterly* (13, 2) 2009, p. 2.

of debris are air drag, which emanates from residual Earth atmosphere,⁴⁴ as well as solar radiation pressure.⁴⁵

The third criterion, the severity of the damage, appears to be much more open to interpretation. One may ask whether environmental harm that already qualifies as widespread and long-term does not in any event constitute a severe damage to the environment. It is clear that a single debris object cannot be regarded as a serious space environmental damage.⁴⁶ The events discussed in the present context, however, are of a different scale so that the damage can be held to be of a severe nature. Even more so, the question of seriousness cannot be discussed without considering the long-term sustainability of outer space activities. The already high level of debris pollution implies an uncontrolled growth of the LEO object population in the future. Any additional pollution events must therefore be assessed more strictly as compared to a situation of a pristine environment. It is the preservation of the usability of outer space for the benefit of future generations⁴⁷ that is the decisive criterion for assessing the severity of environmental damage in space.⁴⁸

As a result, Art. 35 and 55 of the First Additional Protocol protect the space environment from massive pollution with space debris in times of armed conflict.

III.2.2. Environmental Modification Convention

The ENMOD Convention bans the severe and long-lasting modification of the environment, including the space environment. Art. I para. 1 of the ENMOD Convention reads as follows:

“Each State Party to this Convention undertakes not to engage in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State Party.”

44 See *Alwes, D./Benkö, M./Schrogl, K.-U.*, Space Debris: An Item for the Future, in: *Benkö, M./Schrogl, K.-U. (eds.)*, International Space Law in the Making: Current Issues in the UN Committee on the Peaceful Uses of Outer Space, Edition Frontières, Gif-sur-Yvette 1993, p. 235.

45 See *Klinkrad, H.*, Space Debris: Models and Risk Analysis, Springer, Berlin et al. 2006, pp. 322-323.

46 Space activities would otherwise be effectively outlawed because any such activity sooner or later results in the creation of debris. A decommissioned satellite that has lost its function after the end of its operational lifetime turns into a debris object.

47 The principle of inter-generational equity infuses the problem of justice as well as an intertemporal dimension into international law. See *Weiss, E.B.*, Intergenerational Equity in International Law, in: American Society of International Law Proceedings (81) 1987, pp. 126-127.

48 See *Stubbe, P.*, Background of the COPUOS SDM Guidelines, in: *Hobe, S./Schmidt-Tedd, B./Schrogl, K.-U. (eds.)*, Cologne Commentary on Space Law, Volume III, Carl Heymanns, Köln 2015, margin numbers 23-24.

According to the treaty, States must not use the environment itself as a weapon by means of its modification. Such a scenario is not totally unthinkable; the use of deliberately created debris fragments for the purpose of destroying satellites represents a possible way of space warfare.⁴⁹

The criteria of the prohibited environmental damage are the same as under the pertinent provisions of the First Additional Protocol. The above reasoning therefore also applies in the context of the ENMOD Convention. The protective effect of the can be held to be even higher because the criteria do not need to be fulfilled in a cumulative manner, but only alternatively ('or').

Generating debris for the purpose of using the resulting space environmental pollution as a weapon is, therefore, prohibited under the ENMOD Convention.

III.2.3. Principles of International Humanitarian Law

Apart from the above environmental protection provisions, the principles of international humanitarian law may also have a protective effect. The relevant principles are distinction, proportionality and precaution.⁵⁰

Distinction is certainly one of the most fundamental principles of the *ius in bello*. It means that "[...] 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."⁵¹ Civilian objects must not be attacked.⁵²

This raises the question as to whether the environment – here: outer space environment – can be qualified as a civilian object. Civilian objects are objects that do not fall into the scope of military objectives. The latter is defined as "[...] 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

49 See Neuneck, G./Rothkirch, A., The Possible Weaponization of Space and Options for Preventive Arms Control, *Zeitschrift für Luft- und Weltraumrecht* (55, 4) 2006, p. 508.

50 Neutrality is also a principle relevant to space warfare given that third States that are not a party to the conflict could be affected by space warfare. The present discussion, however, focusses only on those provisions that directly protect the space environment. The principle of neutrality is particularly important with regard to the hazard that debris resulting from the destruction of satellites poses to the satellites of neutral States. See Bourbonnière, M., The Ambit of the Law of Neutrality and Space Security, *Israel Yearbook on Human Rights* (36) 2006, pp. 224-225. In discussing the principle, it also needs to be kept in mind that outer space is a *res communis* area in whose preservation the international community as a whole can be held to have an interest. See Gaja, G., States Having an Interest in Compliance with the Obligation Breached, in: Crawford, J./Pellet, A./Olleson, S. (eds.), *The Law of International Responsibility*, Oxford University Press, New York 2010, p. 961.

51 Art. 48 First Additional Protocol.

52 See Art. 52 para. 1 First Additional Protocol.

a definite military advantage.”⁵³ While it may be that a certain part of the environment turns into a legitimate military objective in certain specific situations,⁵⁴ the environment is, as a basic rule, a civilian object. It may be objected that the environment consists of many different elements and can thus not easily – in parts or in its entirety – be regarded as an ‘object’. On the other hand, it was brought forward that State practice shows the opposite: The environment is, in fact, included in the notion of a civilian object. In addition, the dichotomy of the two object categories – civilian and military – equally suggests that everything that is not a military target falls into the other, civilian category, including the natural environment.⁵⁵ This seems to be supported by the ILC which formulated in Draft Principle 1 on environmental protection in relation to armed conflict: “The natural environment is civilian in nature and may not be the object of an attack [...]”⁵⁶ According to the principle of distinction, the outer space environment must be protected as a civilian object and must not become the target of an attack; indiscriminate attacks are also prohibited. Applying this norm to warfare in outer space means that the outer space environment itself must not be attacked, for example through the deliberate creation of debris for the purpose of using the debris as a weapon against satellites.

A further principle is that of proportionality. In attacking a military object, civilian objects must be protected against excessive incidental (or ‘collateral’) damage.⁵⁷ The perceived military advantage must be put into relation with the resulting human suffering or loss of or damage to civilian objects. In particular in the environmental context, the foreseeability of the damage is one of the key discussion points. Military conduct may also have reverberating effects: The damage may extend in time and space as compared to the point in time of the immediate military advantage. All these facts need to be taken into consideration in the proportionality assessment.⁵⁸ In the case of space weapons destroying orbiting satellites, the immediate environmental damage is beyond doubt. The generation of debris clouds can, in addition, be regarded as a typical example for an environmental pollution that has long-term,

53 Art. 52 para. 2 First Additional Protocol.

54 See *Droege, C./Tougas, M.-L.*, The Protection of the Natural Environment in Armed Conflict – Existing Rules and Need for Further Legal Protection, *Nordic Journal of International Law* (82, 1) 2013, p. 28.

55 See *Ibid.*, pp. 26-27.

56 UN Doc. A/CN.4/685, Second report on the protection of the environment in relation to armed conflict: Submitted by Marie G. Jacobsson, Special Rapporteur, 28 May 2015, paras. 149-151.

57 See *Shaw, M.*, *International Law*, 7th edition, Cambridge University Press, Cambridge 2014, pp. 859-860.

58 See *Droege, C./Tougas, M.-L.*, The Protection of the Natural Environment in Armed Conflict – Existing Rules and Need for Further Legal Protection, *Nordic Journal of International Law* (82, 1) 2013, pp. 29-31.

secondary effects. Additional debris objects increase the collision probability and spur the collision-cascading process. It should, therefore, not come as a surprise that the physical interception of a satellite results in a severe damage that – as has been discussed above – can be characterized as widespread, long-term and severe. The magnitude of the initial, direct damage is, therefore, well foreseeable and the attacking party should also be aware of the related long-term consequences. It may be argued that there is less certainty in cases where the space weapon does not lead to the total destruction of the satellite. But also in this case, the increased pollution risk resulting from (temporarily) uncontrolled objects should play a role in the assessment of proportionality.

The third principle relevant in this context is that of precaution. It says that the attacking side must constantly apply a high level of care in order to exclude or reduce damage to civilian objects. All feasible means must be applied to this end, including the gathering and assessment of all relevant information. In deciding upon the means and methods to be deployed in an armed confrontation, the belligerent party is required to revert to the option that causes the least suffering and damage. Environmental impact assessments need to be carried out for this purpose. Interestingly, it has been submitted that the precaution principle exerts its primary effect on the development or procurement of weapons systems.⁵⁹ In applying the principle to warfare in outer space, it is clear that effective precaution is not feasible without sufficient information about the consequences of deploying space weapons against satellites. This would also presuppose relevant knowledge about the space object population in the first place. Given that the principle applies early and shall determine decisions of weapons development and procurement, it may be argued that the development and procurement of space weapons capable of attacking satellite is incompatible with the requirements by international humanitarian law for the protection of the space environment.

III.2.4. Interim Conclusion

What could be shown by the above discussion is that international humanitarian law, in fact, sets certain conditions for military conduct in outer space. Space is an integral part of the human environment and enjoys protection equal to the protection of other parts of the environment, also in times of armed conflict. The magnitude of damage caused by attacks on satellites orbiting the Earth suggests that the effect of the *ius in bello* is significant. It appears that, as a general rule, the environmental damage resulting from an attack is of a widespread, long-term and serious character and that such damage is out of proportion as compared to the presumed military advantage (which would

59 See Droege, C./Tougas, M.-L., The Protection of the Natural Environment in Armed Conflict – Existing Rules and Need for Further Legal Protection, *Nordic Journal of International Law* (82, 1) 2013, pp. 33-34.

consist, in the present context, in taking out an adversary's Earth observation, communication etc. capabilities). This implies that it will be difficult to argue that the deployment of space weapons aimed at or leading to the destruction of satellites is a legitimate form of using force in outer space. The actual assessment, of course, needs to be made on the basis of the circumstances of the individual case as a number of different factors play a role. The altitude in which the attack occurs, for example, has a significant bearing on the scale of the pollution. It has been suggested in respect to the protection of the environment in times of armed conflict that the application of the *ius in bello* should be scrutinized by discussing individual, typical subcases of different forms of military conduct in order to assess the corresponding environmental impact and to clarify the notion of proportionality.⁶⁰ It would be a reasonable undertaking to do the same for space warfare.

The question of whether international humanitarian law can prevent the deployment of weapons having devastating consequences for humanity has been scrutinized by the International Court of Justice in its advisory opinion on the legality of the threat or use of nuclear weapons. The Court argued that:

“[T]he principles and rules of law applicable in armed conflict – at the heart of which is the overriding consideration of humanity – make the conduct of armed hostilities subject to a number of strict requirements. Thus, methods and means of warfare, which would preclude any distinction between civilian and military targets, or which would result in unnecessary suffering to combatants, are prohibited. In view of the unique characteristics of nuclear weapons, to which the Court has referred above, the use of such weapons in fact seems scarcely reconcilable with respect for such requirements.”⁶¹

While the Court, at the same time, did eventually not conclude that the use of nuclear weapons is definitively illegal (also in view of the right of self-defense when the survival of a State is at stake),⁶² the advisory opinion shows that in particular international humanitarian law can effect a limitation that comes close to a quasi-ban on certain weapon types.⁶³

In considering whether this reasoning can also be applied to space weapons it has to be taken into account that their use leads to a further degradation of the already polluted space environment. It is in particular against the back-

60 See *Bothe, M. et al.*, International law protecting the environment during armed conflicts: gaps and opportunities, *International Review of the Red Cross* Vol. 92, No. 879, 2010, p. 578.

61 *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion of 8 July 1996, ICJ Reports 1996, ICJ Reports 1996, para. 95.

62 See *Ibid.*, paras. 95-97.

63 See *Epping, V.*, in: *Ipsen, K. (ed.)*, *Völkerrecht*, 6th edition, C.H. Beck, München 2014, §54, margin number 13.

ground of the generally dire prospects for the further evolution of the debris population in low-Earth orbits and the related threat to the future usability of outer space, that the environmental protection provisions of the *ius in bello* can be held to impose a significant limitation on the use of space weapons. This suggests that their deployment may be acceptable only under exceptional circumstances, but that such weapons are not an ordinary means of warfare in outer space.

III.3. Other Environmental Law: 'No Harm' Rule and Art. IX Outer Space Treaty

Given that outer space forms part of the natural environment, other environmental law outside international humanitarian law could also be potentially relevant for the protection of the space environment in times of armed conflict. Art. IX sentence 2 OST prohibits the 'harmful contamination' of outer space. While the provision is often construed within the context of the *travaux préparatoires* of the Outer Space Treaty, suggesting that outer space is only protected against nuclear, biological and chemical pollution,⁶⁴ the provision should instead be interpreted more broadly. Any type of pollution/contamination of outer space is prohibited under the Outer Space Treaty given that contamination and pollution have essentially the same meaning, namely the introduction of certain things, elements or substances into an environment where they do usually not belong.⁶⁵ In addition, Art. IX sentence 2 Outer Space Treaty should be regarded in the broader context of international environmental law. The customary 'no harm' rule prohibits trans-border, serious environmental damage, including to areas outside the jurisdiction of a State.⁶⁶ As this includes outer space, Art. IX sentence 2 OST represents the space-specific expression of the broader 'no harm' rule of international environmental law.⁶⁷

The presence of space debris in outer space constitutes a form of space pollution because man-made debris objects are not part of the natural space environment. This presence is thus an environmental damage that is prohibited

64 See *Hackett, G.T.*, *Space Debris and the Corpus Iuris Spatialis*, Editions Frontières, Gif-sur-Yvette 1994, pp. 104-107.

65 See UN Doc. ST/ESA/STAT/SER.F/67, *Glossary of Environmental Statistics*, United Nations, New York 1997, p. 58; and *Frantzen, B.*, *Umweltbelastungen durch Weltraumaktivitäten*, in: *Böckstiegel, K.-H.*, (ed.), *Handbuch des Weltraumrechts*, Carl Heymanns Verlag, Köln et al. 1991, p. 612.

66 See *Beyerlin, U.*, *Umweltvölkerrecht*, C.H. Beck, München 2000, §8, margin number 116, p. 55; *Brunnée, J.*, *Common Areas, Common Heritage, and Common Concern*, in: *Bodansky, D./Brunnée, J./Hey, E.* (eds.), *The Oxford Handbook of International Environmental Law*, Oxford University Press, New York 2007, p. 557. The 'no harm' rule being a norm of customary international law found expression in Principle 21 of the Stockholm Declaration.

67 See *Durner, W.*, *Global Commons: Statusprinzipien von Umweltgütern im Völkerrecht*, Nomos, Baden-Baden, 2001, p. 166.

under Art. IX sentence 2 OST and the customary ‘no harm’ rule. It is clear, though, that the generation of a single piece of or a minor amount of debris does not constitute a violation of international law. Only ‘harmful’ (Art. IX sentence 2 OST) or ‘serious’ damage (‘no harm’ rule) is prohibited. While it is difficult to assess when the threshold to a significant pollution event is crossed, the impacts of space warfare on the space environment that are discussed in this paper must be regarded as such significant damage. Again, the currently high degree of pollution, especially in low-Earth orbits, and the associated loss of parts of outer space for the use of generations to come must be taken into account.

Beyond the consideration of the substance of the provisions and their protective effect for the space environment, it is necessary to clarify the interrelationship between international humanitarian law and the ‘ordinary’ norms of international law. As a general principle, international law remains applicable in times of armed conflicts. The ILC, in 2011, adopted as set of draft principles relating to the effect of armed conflicts on treaties,⁶⁸ whose Art. 3 stipulates: “The existence of an armed conflict does not ipso facto terminate or suspend the operation of treaties: (a) As between States parties to the conflict; (b) As between a State party to the conflict and a State that is not.” There is no reason why this should not also be the case for other sources of international law, namely customary international law (such as the ‘no harm’ rule) and general principles of international law (such as the principles of sustainable development). While not specifically speaking of the applicability of environmental law in times of armed conflict, the ICJ, in its advisory opinion on the legality of the use of nuclear weapons found that environmental law “[...] indicates important environmental factors that are properly to be taken into account in the context of the implementation of the principles and rules of the law applicable in armed conflict.”⁶⁹ This led observers to speak of a complementary function of the non-international humanitarian environmental protection law *vis-à-vis* international humanitarian environmental protection law, while also hinting to the necessity of further research on their interrelationship as regards, for example, the substantial differences between the corresponding norms.⁷⁰

In its recent work on environmental protection in times of armed conflict, the ILC also considered this question of interrelation. In addressing some norms of environmental law (referred to as ‘principles’), it found: “Although general

68 See UNGA Res. 66/99, Effects of armed conflicts on treaties, 27 February 2012, Annex.

69 *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion of 8 July 1996, ICJ Reports 1996, ICJ Reports 1996, para. 33.

70 See *Droege, C./Tougas, M.-L.*, The Protection of the Natural Environment in Armed Conflict – Existing Rules and Need for Further Legal Protection, *Nordic Journal of International Law* (82, 1) 2013, pp. 46-48.

applicability of the principles cannot be excluded, there is little indication that they would be applicable during the conduct of hostilities as such, at least as they are understood in a peacetime environmental context.”⁷¹ In its recent work, the ILC therefore seems to follow a more reluctant approach to this question. Some support for this approach may be derived from the secondary rules of international law. One of the circumstances precluding wrongfulness of a certain conduct is that the act in question “[...] constitutes a lawful measure of self-defence taken in conformity with the Charter of the United Nations.”⁷² There appears to be little room for arguing that the provision would not also apply *mutatis mutandis* to the use of force that is authorized by the UN Security Council. Any use of force would, therefore, constitute a circumstance that precludes the wrongfulness and thus the responsibility of the respective State if such conduct is taken within the limits established by international law.⁷³ The legitimacy of the use of force presupposes compliance with the *ius in bello*. In other words, space environmental damage resulting from the damaging/destruction of a satellite would not result into the responsibility of the State to which the damaging or destroying act can be attributed unless such responsibility can be based on the violation of the environmental protection norms of international humanitarian law. The applicability of general environmental law remains untouched in this logic, only wrongfulness would be excluded.⁷⁴ This reasoning applies, of course, only as long as the norms of general environmental law do not belong to the body of *ius cogens*.⁷⁵

IV. Protected Zones – A Case for Outer Space?

Brief account shall be given to another means for protecting the environment in times of armed conflict. Outer space, or a particular part of it, could be declared an ‘area of major ecological importance’ that is spared from the conduct of military operations. The possibility for establishing demilitarized

71 UN Doc. A/CN.4/685, Second report on the protection of the environment in relation to armed conflict: Submitted by Marie G. Jacobsson, Special Rapporteur, 28 May 2015, para. 153.

72 Art. 26 of the ILC Articles on State Responsibility. The text of the articles is annexed to a UN General Assembly resolution: UNGA Res. 56/83, Responsibility of States for internationally wrongful acts, 28 January 2002, Annex.

73 There is a duty to comply with the law, if the circumstance no longer exists. The invocation of a circumstance precluding wrongfulness is also without prejudice to the obligation to provide compensation for material damage resulting from the conduct in question. See Art. 27 of the ILC Articles on State Responsibility.

74 See also the reasoning applied by the ICJ: *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion of 8 July 1996, ICJ Reports 1996, ICJ Reports 1996, para. 30.

75 The wrongfulness of a violation of a peremptory norm of international law cannot be excluded according to Art. 26 of the ILC Articles on State Responsibility.

zones already exists under international humanitarian law. According to Art. 60 First Additional Protocol, the parties to an armed conflict can agree on such demilitarized zones, to which they are not allowed to extend their military operations. In view of the importance of environmental protection in times of armed conflict, the ILC, in its current work on the topic, proposes that “States should designate areas of major ecological importance as demilitarized zones before the commencement of an armed conflict, or at least at its outset.”⁷⁶ The absence of military operations in a thus protected area obviously spares this area from war-induced (environmental) devastations.

As a general principle, outer space must be used for peaceful purposes only. This is, however, construed as prohibiting only aggressive acts,⁷⁷ thus not going beyond the prohibition of the use of force in international relations. Only the Moon and other celestial bodies are to be used for exclusively peaceful purposes only, suggesting that any military use is prohibited.⁷⁸ The designation of space as a demilitarized zone, thus acknowledging its special ecological importance, would be a desirable step towards protecting the outer space environment from the consequences of warfare. While it appears unrealistic to expect that any military use will be suspended as a result of such a designation given that space applications are used for a variety of military purposes (reconnaissance, navigation and telecommunication), the use of weapons of any kind against space infrastructure could be banned on the basis of creating protected zones.

To a certain extent, such zones already exist today, namely in the context of the space debris mitigation regime. Low-Earth orbits and the geostationary Earth orbit are particularly protected under this regime. Particularly strict end-of-life disposal requirements apply in these regions. The presence of objects in low-Earth orbits is confined to 25 years after end-of-life and objects in the geostationary Earth-orbit must be directly removed from this orbital region and transferred into a graveyard orbit.⁷⁹ The protected region in low-Earth orbit is defined as is the spherical shell that extends from the surface of

76 UN Doc. A/CN.4/685, Second report on the protection of the environment in relation to armed conflict: Submitted by Marie G. Jacobsson, Special Rapporteur, 28 May 2015, Annex I: Protection of the environment in relation to armed conflicts: proposed draft principles, Principle 5.

77 See von Kries, W., Die militärische Nutzung des Weltraums, in: Böckstiegel, K.-H. (ed.), *Handbuch des Weltraumrechts*, Carl Heymanns, Köln et al. 1991, pp. 338-339.

78 See Schrogl, K.-U./Neumann, J., Article IV OST, in: Hobe, S./Schmidt-Tedd, B./Schrogl, K.-U. (eds.), *Cologne Commentary on Space Law*, Volume I, Carl Heymanns, Köln 2009, margin number 45.

79 See No. 5.3.2 and No. 5.3.1 IADC Mitigation Guidelines. The space debris mitigation document of the Inter-Agency Space Debris Coordination Committee (IADC) was the first mitigation document of its kind (2002) and has been updated since its first publication. See IADC Doc. IADC-02-01, Rev. 1, IADC Space Debris Mitigation Guidelines, September 2007.

the Earth to an altitude of 2,000 kilometers and the protected region in geostationary Earth-orbit as a segment of the spherical shell which is characterized by a lower boundary at 200 kilometers below and an upper boundary of 200 kilometers above the geostationary Earth orbit altitude and which is located in the latitude sector defined by 15 degrees South latitude and 15 degrees North latitude.⁸⁰ Given that the definition of the protected regions is driven by their currently high degree of pollution and their prospective further use for various space applications, the thus defined regions can also be characterized as areas of major ecological importance. They deserve special protection, also in times of armed conflict.

As there currently seems to be little progress with the traditional approach towards more transparency and mutual confidence or towards the prevention of an arms race in outer space, the infusion of the environmental perspective into the demilitarization debate may facilitate efforts for achieving mutual security in space. An increased discussion of the environmental consequences of space weapons and space debris in general constitutes a contribution to this end.

V. Conclusion

As the above discussion shows, international humanitarian law can, in fact, limit the use of military force in outer space. Space debris is a consequence of deploying space weapons and can be characterized as a form of environment damage in outer space. This basic premise opens up the field of application for a number of norms relevant to environmental protection. Apart from the specific environmental protection provisions of the First Additional Protocol and the ENMOD Convention, there are a couple of *ius in bello* principles (distinction, proportionality, precaution) that have a limiting effect in this context. Space weapons causing major environmental harm in outer space can, thus, not be regarded as legitimate means of warfare in outer space.

Further studies should be carried out in order to clarify in more detail the way in which the relevant provisions apply to space warfare. The ongoing discussions in the International Law Commission on the topic of environmental protection in armed conflicts are a contribution to this end. A particular issue worth being considered is to designate outer space as a protected, demilitarized zone, in which no combat action would be allowed in order to preserve the outer space environment also in times of military conflict for the benefit of future generations.

80 See No. 3.3.2 IADC Mitigation Guidelines. The instrument also includes an illustration of the regions.

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