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Security and Defence Implications of Earth Observation*

INTRODUCTION

In 1958 Lyndon B. Johnson, a future President of the United States, proclaimed that "control of space means control of the world".[1]

This contention represented a futuristic projection based on the experience gained by armies throughout the history of military strategy. Indeed, since ancient times, every army has sought to view the ground from above. What has changed over time are the developments in technology that enable this aerial surveillance.

While the ancient Greek and Roman armies could only rely on hilltops and watchtowers for this purpose, a significant step forward was made in 1794 when, during the battle of Fleurus, the French army used hot air balloons for the first time to scout enemy movements.[2] Subsequently, in the First and Second World Wars, airplanes equipped with cameras were employed.[3] The

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1 Wasser 2005; Hersch–Steer 2021: 5.

2 *Military Use of Balloons During the Napoleonic Era* s. a.

3 The Normandy landings in 1944 were planned relying on observation techniques from above. See in this respect *History of Earth Observation*: "As part of preparations for the Normandy Invasion (D-day), aerial photographs were used to map coastal conditions to identify the most suitable sites on which to land. By measuring waves close to the coast it

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most recent advancement occurred in the 1960s during the "race to space" when mankind invented satellites. In our modern world, satellites are employed for various activities, both civilian and military.

In this article I intend to delve into security and military issues. In particular, following a preliminary examination of Article IV of the Outer Space Treaty, the first part of the article will focus on the use of satellites to acquire intelligence information. This activity, indeed, raises certain issues of compliance with the "space legal framework", specifically when carried out during peacetime. Continuing my analysis, I will examine the applicability of Article 51 of the United Nations Charter in the context of satellite espionage, that is, whether the State whose territory is being "spied on" by another State may lawfully act in self-defence.

In the second part, the focus will shift to the use of satellites to guide armed attacks against objectives on Earth. I will delve into the principles of International Humanitarian Law, outlining the conduct that must be strictly adhered to in a warfare scenario. The utilisation of precise, advanced technology, such as satellites, in carrying out attacks should enhance the application of the principles of distinction, proportionality and precaution in such military operations. To conclude this part, considering the support that satellites can give in military operations, I will examine how the aforementioned principles of International Humanitarian Law would apply when satellites are targeted.

HOW DOES ARTICLE IV OF THE OUTER SPACE TREATY APPLY TO SATELLITES?

Preliminarily, it is crucial to establish the scope of what is permitted under Article IV of the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies" (the so-called "Outer Space Treaty", adopted in 1967). Article

was possible to determine wavelength and thereby calculate water depth. Furthermore, infrared film was used to identify green vegetation and distinguish it from camouflage nets."

IV definitively sets the boundaries beyond which the military use of space is prohibited. It has been argued that Article IV aims to prevent the so-called "weaponisation"[4] of Outer Space.

The guiding principle is stated in paragraph 2 of the article, where it stipulates that "the Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes". Article IV includes, as ancillary to that principle – but also by way of implementing it – a series of obligations, i.e.

> 1. "States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner";
> 2. "The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden".

Article IV then concludes by clarifying that neither "the use of military personnel for scientific research or for any other peaceful purposes" nor "the use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies" is forbidden.

The key to understanding Article IV lies in the interpretation of the wording "peaceful purposes". The article defines in detail the aims that States can legitimately pursue in carrying out space activities. According to one

[4] A distinction has been drawn between the so-called "militarisation" and "weaponisation" of outer space. Regarding this matter, see Ferreira-Snyman 2022: 75–76. The Author explains that non-militarisation (or demilitarisation) means "the prohibition of using space-based facilities for any military purpose". The majority of States consider such utilisation of Outer Space "non-aggressive" and, therefore, not in violation of Article 2, paragraph 4 of the United Nations Charter. In summary, "militarisation" is considered legal. On the other hand, "weaponisation" means "the deployment of weapons of an offensive nature in outer space or on the ground with their intended target located in space". The majority of States view this kind of space utilisation as illegal. As a result, Article IV of the Outer Space Treaty aims at preventing the "weaponisation" of outer space, while "militarisation" has been accepted as legal.

interpretation, supported by the United States, "peaceful" is not the opposite of military, but means non-aggressive only. A second interpretation, supported by the Soviet Union, held that "peaceful" means non-military, i.e. any military activity, aggressive or not, is prohibited.

The first interpretation has prevailed and consequently, "peaceful" must be interpreted as "non-aggressive". This means that States may use and place weapons and other military equipment in space, on condition that they do not use them for aggressive purposes. So, by way of rephrasing the principles set forth in Article IV, it can be concluded that the Moon and other celestial bodies shall be used exclusively for what could be called "non-aggressive" purposes; the use of military personnel and the use of any equipment (including military one) is allowed, provided that the use is non-aggressive.

The language adopted in Article IV raises another implication. Paragraph 2 of the article, when setting forth the principle of "peaceful purposes", only refers to the "Moon" and "other celestial bodies", but it does not mention "Outer Space" at all. This may imply that "peaceful purposes" should only apply to "the Moon and other celestial bodies", but not to Outer Space.[5]

Apart from posing the above interpretative puzzles, Article IV sets forth a specific obligation, i.e. the obligation "not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner". Certain States have, over time, developed the capability to fire intercontinental ballistic missiles (even carrying nuclear warheads) or other weapons of mass destruction. Would firing such kinds of weapon perhaps trigger a violation of Article IV?

Scholars have rejected the possibility that firing intercontinental ballistic missiles (including those carrying out nuclear warheads) or other weapons of mass destruction through space may violate Article IV, since such weapons, actually, only temporarily cross the orbit, but they are neither placed in orbit

[5] See Salatino 2022: 423.

around the Earth, nor installed on celestial bodies, nor they station in outer space in any other manner.[6]

Having examined the principles and obligations set forth in Article IV of the Outer Space Treaty, it can now be assessed how they relate to satellites.

Satellites are, indeed, "space objects"[7] that are typically stationed in orbit around the Earth or in space. However, they do not carry nuclear weapon or other weapons of mass destruction.

Under certain circumstances (which will be examined later), a satellite may also be considered to have "military" objectives.[8] However, only "the Moon and other celestial bodies" shall be used for "peaceful purposes", while satellites, as already pointed out, are usually stationed in orbit around the Earth or float in space. In any case, since "peaceful" must be interpreted as non-aggressive, the use of satellites does not preclude peaceful purposes, as these satellites are not inherently aggressive.

In addition, the last sentence of Article IV confirms that it is permitted to use any equipment or facility necessary for "peaceful" exploration (which should be interpreted as non-aggressive exploration) of the Moon and other celestial bodies.

Article IV also prohibits "the testing of any type of weapon and the conduct of military manoeuvres on celestial bodies". A satellite can, of course, contribute to performing those actions, but the prohibition clearly focuses on the "weapon" and the "military manoeuvres", while it does not relate to satellites as such. The other obligations contained in Article IV are even less applicable

[6] Schmitt 2006: 104; Dinstein–Dahl 2020: 4. See the commentary to Rule 2: "In order to be considered to be 'placed in orbit' an Outer Space object must complete at least one orbit. WMD or nuclear weapons that simply transit through Outer Space without completing an orbit, such as an Intercontinental Ballistic Missile (ICBM), do not fall within the scope of the prohibition."

[7] See the definition included in Article I of the Convention on International Liability for Damage Caused by Space Objects.

[8] According to the definition of Article 52 Additional Protocol I to the Geneva Convention, military objectives are "those objects which by their nature, location, purpose or use make an effective contribution to military action".

to satellites: a satellite is obviously neither a military base, nor an installation, nor a fortification. In light of the above, it can be concluded that the use of satellites does not trigger any violation of Article IV of the Outer Space Treaty.

THE USE OF SATELLITES FOR ACQUIRING INTELLIGENCE INFORMATION

Although the use of satellites does not *per se* trigger any violation of Article IV of the Outer Space Treaty, certain activities conducted by means of satellites may raise concerns regarding other principles outlined in the Outer Space Treaty. One such questionable activity is the acquisition of intelligence information through satellites, specifically when performed during peacetime. Such an activity, even during peacetime, is rather common for States, as all States with the technological capabilities "spy" via satellites for security reasons. Consequently, few would raise doubts regarding its lawfulness.

However, it must be noted that the Outer Space Treaty was inspired by the principles of collaboration and benefit-sharing between States. In contrast, the acquisition of intelligence information through satellites, like any act of espionage, is carried out not only without the collaboration of the surveilled State, but even against its will.

Some authors have suggested that "peacetime espionage" benefits from a permissive customary international law exception.[9] This view, however, has been strongly contested by others.[10]

In the 1960s there were two opposing theories.[11] According to the first theory, supported by the Soviet Union, the acquisition of intelligence information through satellites had to be considered illegal under international law. Such activity is military in nature and, consequently, non-peaceful. Furthermore, it violates the sovereignty of the sensed State, regardless of where the observer is

[9] Scott 1999: 226.
[10] Navarrete–Buchan 2019: 897.
[11] Soraghan 1967: 463.

located. According to the second theory, supported by the United States, the acquisition of intelligence information through satellites should be considered legal under international law. The activity is non-aggressive and, consequently, "peaceful". Additionally, there is no violation of the sovereignty of the sensed State, since the observer is located high above the admitted boundaries of sovereignty. Third, such activity is necessary for security and proper self-defence. In particular, the United States intended to use satellites to close the information gap with the Soviet Union, as the latter was a closed society that made the acquisition of information more difficult compared to the open society of the United States.[12]

I believe that the second theory has now prevailed. It has been admitted that "peaceful" must be interpreted as "non-aggressive". The acquisition of intelligence information through satellites is not inherently aggressive. Moreover, the Outer Space Treaty has established the principle of free exploration and use of Outer Space, which means that space activities can be conducted freely and States are not required to seek permission from other States or to inform them in advance about the activity being carried out.[13] Consequently, the use of satellites for the acquisition of intelligence information cannot in itself constitute a violation of the sovereignty of the sensed State. The issue, however,

[12] The Soviet Union contested in formal documents the use of satellites for the acquisition of intelligence information twice. The first time was in 1962, when the Soviet Union argued that: "8. The use of artificial satellites for the collection of intelligence information in the territory of foreign States is incompatible with the objectives of mankind in its conquest of outer space" [see the "Draft declaration of the basic principles governing the activities of States pertaining to the exploration and use of outer space" (A/AC.105/L.02)]. The second such protest occurred in 1963, when the Soviet Union argued that: "Space vehicles aboard which devices have been discovered for the collection of intelligence information in the territory of another State shall not be returned" [see the "USSR: Draft International Agreement on the Rescue of Astronauts and Spaceships Making Emergency Landings" (A/AC.105/12/Annex I (B)]. It should be noted, however, that while the Soviet Union championed the idea of the illegality of the acquisition of intelligence information through satellites, it actually extensively used its own satellites for spying purposes. For this reason, Navarrete–Buchan 2019: 933, characterised the Soviet Union's opposition as "only lip service".

[13] Li 2020: 344.

is not the lawfulness of the activity in itself. In my opinion, the real question is: does the legal framework include an obligation to share data and information acquired by satellites?

There are indeed certain legal instruments from which such an obligation may be construed.

According to the Outer Space Treaty, the exploration and use of Outer Space shall be carried out "for the benefit and in the interests of all countries" (Article I); additionally, "States Parties [...] shall be guided by the principle of cooperation and mutual assistance" (Article IX); and, in a more detailed way, "States Parties [...] agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities" (Article XI).

Moreover, according to the "Principles Relating to Remote Sensing of the Earth from Outer Space", adopted by the United Nations Organization in 1986, "the sensed State" shall have access to "primary data and processed" data as well as "to the available analysed information concerning the territory under its jurisdiction", "on a non-discriminatory basis and on reasonable cost terms" (Principle XII).

Obviously, States intend to keep the intelligence information they acquire from satellites confidential. However, if there is an obligation to share this information, the strategic advantage of States that engage in intelligence activity would be compromised, and, consequently, the activity itself would lose effectiveness and utility.[14]

[14] According to Lee–Steele 2014: 102, on the assumption that Principle XII of the Principles Relating to Remote Sensing of the Earth from Outer Space has attained the status of customary law, they argue that the obligation for the sensing State to share intelligence information also applies in a warfare scenario. They contend that this obligation must be complied with "unless there is a resolution of the Security Council authorizing the denial of the remote sensing data to the sensed target state". However, I find this conclusion to be far-reaching. Firstly, as I will further elaborate in this article, the Principles Relating to Remote Sensing of the Earth from Outer Space have the limited scope defined in Principle I (i.e. "improving natural resources management, land use and the protection

If it were to be confirmed that the "space legal framework" includes an obligation to share information acquired through satellites, States carrying out the activity without complying with such an obligation would commit a violation of international law.

In such an event, States may exempt themselves from the obligation to share the acquired information by invoking "necessity" under Article 25 of the International Law Commission's Articles on State Responsibility. More precisely, "necessity" can be invoked "as a ground for precluding the wrongfulness of an act not in conformity with an international obligation", provided that: 1. the wrongful act "is the only way for the State to safeguard an essential interest against a grave and imminent peril"; 2. it "does not seriously impair an essential interest of the State or States towards which the obligation exists, or of the international community as a whole".[15]

In light of these conditions, a State may engage in the activity of acquiring intelligence information from another State only if there is a "grave and imminent peril" that the "observed State" is planning an attack against the "observing State".

If such interpretation prevails, however, the room for manoeuvre of States in carrying out intelligence gathering activities by means of satellites would be significantly reduced.

Several arguments can be developed to challenge the reconstruction of the obligation to share intelligence information acquired through satellites.

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of the environment"). Secondly, in a warfare scenario, even the Outer Space Treaty is likely to be suspended and, consequently, if one were to entertain the assumption (which is not endorsed) that there is an obligation to share intelligence information during times of peace, such an obligation would not endure in times of war.

[15] For the sake of completeness, it must also be added that according to paragraph 2 of Article 25 of the International Law Commission's Articles on State Responsibility: "In any case, necessity may not be invoked by a State as a ground for precluding wrongfulness if: (a) the international obligation in question excludes the possibility of invoking necessity; or (b) the State has contributed to the situation of necessity."

As for Article I and Article IX of the Outer Space Treaty, the principles of cooperation, mutual assistance, benefit and interest of all countries are more guiding principles than obligations from a technical standpoint.[16]

To "defuse" Article XI of the Outer Space Treaty (i.e. the sensing State would be obliged to share "the nature, conduct, locations and results of such activities") reference can be made to the specific wording used in the clause. The clause states that "State parties [...] agree to inform" rather than using the term "shall". Therefore, it could be argued that not even Article XI can be interpreted as imposing an obligation.

In relation to the "Principles Relating to Remote Sensing of the Earth from Outer Space", it is important to mention that their binding nature is debated, given that they are considered to be a soft law instrument. Moreover, their scope is limited in the wording of Principle I: they govern remote sensing activities only "for the purposes of improving natural resources management, land use and the protection of the environment". Consequently, any remote sensing activity with different objectives would not fall within the purview of said principles.

To conclude, after examining the opposing theories, I can affirm that the acquisition of intelligence information during peacetime is not as straightforward as the common practice of States would suggest; on the contrary, it gives raise to certain doubts.

I am aware that States typically gather a substantial amount of information through satellites, ranging from non-sensitive to sensitive information. It is likely that those States which aim to adhere to the greatest extent possible to the legal framework described above will share non-sensitive information, while keeping sensitive information confidential.

In relation to the acquisition of intelligence information, one final issue is worth examining. Can a State invoke Article 51 of the United Nations Charter in relation to the acquisition of intelligence information on its territory by another State? According to Article 51 of the United Nations Charter:

[16] Marchisio 2022: 278.

> "Nothing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations, until the Security Council has taken measures necessary to maintain international peace and security."

The interpretation of Article 51 of the United Nations Charter is currently a matter of contention.[17] Strictly adhering to the text of the clause, the right of self-defence is triggered only by an armed attack that is currently happening. Therefore, since the mere acquisition of intelligence information cannot be equated with an ongoing armed attack, any claim of a right to self-defence under Article 51 of the United Nations Charter can be ruled out. In other words, the State that is being observed by satellites would not have the right to attack either the satellites or any other assets (or the territory) of the observing State.

On the other hand, according to a broader interpretation of Article 51 of the United Nations Charter, a State may invoke the right of self-defence even before being attacked and "strike first" to prevent an attack. As a precondition, however, it is necessary that the attack by the other State be at least imminent. Under this interpretation, the acquisition of intelligence information may be considered a preparatory activity for an armed attack, which could be used as a pretext by the observed State to launch an attack against the observing State.

My view on these two interpretations of Article 51 of the United Nations Charter is rather straightforward: in general terms, I believe that the first interpretation should be followed, and no right of self-defence can be triggered unless an armed attack is actually occurring.

However, even if one were to apply the second interpretation and accept the concept of "preventive strikes", I firmly believe that the mere acquisition of intelligence information by means of satellites would not be sufficient to justify acting in self-defence under Article 51 of the United Nations Charter. This type of activity does not imply that an attack is imminent. Furthermore, it is inherently non-aggressive and, consequently, it must be considered to be

[17] Ferreira-Snyman 2022: 78; Picone 2016: 11.

permitted under the Outer Space Treaty and international law. Since there is no violation of international law, the observed State cannot take any form of countermeasure.

On the contrary, if someone were to argue that even non-aggressive military activities are prohibited in space (which is, however, a rather outdated theory), the principle of proportionality inherent in Article 51 of the United Nations Charter would imply that only non-aggressive countermeasures can be taken. Consequently, even under the interpretation that allows for preventive attacks, the mere activity of acquiring intelligence information would not be sufficient to justify a claim of self-defence. The observed State would need to provide additional evidence to substantiate that the State acquiring intelligence information is actually planning an attack.

GUIDANCE FOR WEAPON ATTACKS AGAINST TARGETS ON EARTH

Satellites also play a significant role in warfare scenarios. As in peacetime, satellites are used to gather intelligence information on other States that are regarded as enemies in this context. In my opinion, in a warfare scenario, there is no doubt that there are no prohibitions on employing satellites for this purpose, nor is there an obligation to share the acquired information with the enemy. In a wartime context, however, an additional use of satellites may play a fundamental role. This is the application of satellites as "gun sights" to guide missile attacks against objectives located on Earth. In the following paragraphs, I will delve into the legal implications associated with this usage of satellites.

I believe that the use of satellites to guide weapon attacks should actually be welcomed, as the greater the accuracy of the technology, the more tailored the attacks can be, thereby aligning with the legal framework known as "International Humanitarian Law".

International Humanitarian Law tries to strike a delicate balance between the principle of military necessity and the principle of humanity.[18] Through this legal framework, the interpretation of the principle of military necessity has evolved over time.[19] Prior to the First World War, it was commonly believed that the principle of military necessity granted a State that is engaged in warfare with another State the authority to employ any means it deemed necessary to subjugate the enemy, even if it involved committing atrocities and disregarding humanitarian laws.

However, this perspective is now considered outdated. The International Court of Justice has recognised that "certain general and well-recognized principles, namely: elementary consideration of humanity"[20] must always be taken into account, as a "minimum yardstick".[21] Therefore, the use of force is now subject to limitations: it should be employed only to the extent that is strictly necessary to subdue the enemy, with the aim of minimising unnecessary suffering. In other words, when States engage in armed conflict, they are now obligated to comply with the rules of humanitarian law.

In this new perspective, the use of precise technologies such as satellites to target objectives on Earth represents a double-edged sword. On the one hand, as mentioned earlier, satellites can assist states in complying with the International Humanitarian Law. On the other hand, belligerent States have no justifications for non-compliance, and they must be held accountable for any violations.

[18] Schmitt 2010: 798.

[19] Ronzitti 2020: 215.

[20] *The Corfu Channel Case* 1949: 22. *Case Concerning Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)* 1986: para. 215. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion 1996: para. 79.

[21] *Case Concerning Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)* 1986: para. 218.

The fundamental principles of International Humanitarian Law

With this in mind, it is worth reviewing the fundamental principles of International Humanitarian Law, which implement the balance between the principle of military necessity and the principle of humanity, namely the principle of distinction, the principle of proportionality and the principle of precaution in attacks.[22] This examination will refer to the codification of these principles contained in the Additional Protocol I to the Geneva Convention. It is important to note, however, that these principles have been recognised as principles of international customary law.[23] As a result, these principles bind all States, including those that are not party to Additional Protocol I to the Geneva Convention.

The principle of distinction

At the core of the system lies the principle of distinction. According to Article 48 of the Additional Protocol I to the Geneva Convention, the parties involved in 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". Consequently, only combatants and military objectives are lawful targets.

In this respect, Article 52 defines "military objectives" 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 a definite military advantage".

An explanation of the definition of "military objective" is contained in the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 106–108. According to the commentary, in order for an object to qualify as a military

[22] Stephens–Steer 2015: 13.

[23] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion 1996: para. 78; *Prosecutor v. Stanislav Galić* 2006: para. 87.

objective, it must fulfill not only the requirement of "making an effective contribution to military action" through its nature, location, purpose, or use but also the condition that its "total or partial destruction, capture, or neutralization, in the circumstances ruling at the time, offers a definite military advantage". The commentary further elaborates that qualifying an object as a military objective by "nature" requires the object to possess inherent characteristics or attributes that contribute to military action. Examples include military equipment and facilities, tanks, military aircraft, military airfields, or military barracks, among others. Consequently, even when not in use, these objects are legitimate targets during armed conflict. The criterion of "location" refers to specific areas that hold strategic significance in military operations, such as a particular mountain pass that could serve as an escape route for enemy forces during a planned attack. Considering the location of the pass, it is permissible to target it through aerial attacks regardless of its current use. The distinction between "purpose" and "use" is more intricate. "Use" refers to the present function of an object, whereas "purpose" focuses on its intended future use. By applying the "purpose" criterion, if an attacker has reasonable grounds to believe that the enemy intends to use an object for military purposes in the future, the attacker can lawfully target it even before the commencement of its military use. The commentary provides an example: the attacker, based on reliable intelligence and other information, discovers that an apartment building is being renovated to serve as a military barracks. In this case, the apartment building becomes a military objective by dint of its purpose, regardless of its actual use. The "use" criterion, on the other hand, requires the object to be actively used for military purposes, even if it initially appears civilian in nature. In other words, the object is not inherently a military objective but becomes a legitimate target as a result of its conversion for military use. It is important to clarify that once the object ceases to serve a military purpose, it no longer qualifies as a lawful target and may not be attacked.

Furthermore, if there is any doubt regarding whether an object that is typically dedicated to civilian purposes is being used to contribute effectively to military action, it shall be presumed that it is not being so used.[24]

[24] According to Article 52, para. 3 of the Additional Protocol I to the Geneva Convention: "In case of doubt whether an object which is normally dedicated to civilian purposes, such

As a consequence of the principle of distinction, "indiscriminate attacks" are always prohibited.[25] In particular, given their indiscriminate nature, "carpet bombing", which treats clearly separated and distinct military objectives located in a populated area as a single military target, are prohibited.[26]

The principle of proportionality

It is possible, however, that despite an attack being directed at and hitting a military objective, it may also result in what is known as "collateral damage", i.e. damage to civilians or civil objects.[27] In order to avoid or at least minimise

as a place of worship, a house or other dwelling or a school, is being used to make an effective contribution to military action, it shall be presumed not to be so used."

[25] According to Article 51, para. 4 of the Additional Protocol I to the Geneva Convention: "Indiscriminate attacks are: a) those which are not directed at a specific military objective; b) those which employ a method or means of combat which cannot be directed at a specific military objective; or c) those which employ a method or means of combat the effects of which cannot be limited as required by this Protocol; and consequently, in each such case, are of a nature to strike military objectives and civilians or civilian objects without distinction."

[26] Ronzitti 2020: 320. According to Article 51, para. 5 of the Additional Protocol I to the Geneva Convention: "Among others, the following types of attacks are to be considered as indiscriminate: a) an attack by bombardment by any methods or means which treats as a single military objective a number of clearly separated and distinct military objectives located in a city, town, village or other area containing a similar concentration of civilians or civilian objects; and b) an attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated." According to the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 89, Rule 13 (b), various factors can contribute to an attack being regarded as indiscriminate. These factors include the nature of the target, the choice of weapons, the malfunctioning of weapon systems, human error and other circumstances. Even when target identification and weapons guidance systems are employed, there may still be instances where attacks become indiscriminate due to factors such as adverse weather conditions or other unforeseen circumstances.

[27] According to the definition contained in Bruderlein 2009: 3, "collateral damage" means "incidental loss of civilian life, injury to civilians and damage to civilian objects or other protected objects or a combination thereof, caused by an attack on a lawful target".

collateral damage, the principle of proportionality comes into play. According to this principle, attacks that "may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated" are prohibited.[28]

The principle of proportionality must be taken into consideration at all stages of an attack, from planning to implementation. If it becomes apparent during the planning phase that the attack may result in the incidental loss of civilian life, injury to civilians, or damage to civilian objects, commanders must refrain from launching it. Similarly, if it becomes apparent after the attack has been launched that it may cause the aforementioned collateral damage, those responsible for its implementation must suspend it.

In order to fully understand the scope of the principle of proportionality, it is worthwhile examining the language used in the rules contained in Additional Protocol I to the Geneva Convention. Firstly, it should be emphasised that collateral damage is relevant only if it is "excessive". Furthermore, the concept of excessiveness is not absolute, but must be weighed against "the concrete and direct military advantage anticipated". Consequently, even if the collateral damage caused is extensive, it does not necessarily imply that it is "excessive".[29]

The terms "expected" and "anticipated" indicate that the assessment of the attack and military advantage must be made in advance *(ex ante),* and not after the fact *(ex post).* The evaluation is based on all available up-to-date and reliable information accessible to the attacking party at that time, considering the reasonable precautions that could have been taken in the given circumstances. The consequences of any actions taken must be assessed in terms of probability, i.e. whether an outcome is more likely than not.[30]

[28] See Articles 51, para. 5, point b), 57 para. 2, point a), iii) and 57 para. 2, point b) of the Additional Protocol I to the Geneva Convention.

[29] *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 92.

[30] *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 92.

The term "concrete and direct", in reference to military advantage, implies that only measurable, "substantial and relatively close"[31] advantages are relevant. Speculative advantages,[32] long-term effects, or psychological consequences[33] are to be disregarded.[34]

Another aspect to be considered pertains to the specific segment of the military operation on which the proportionality assessment must be conducted. Specifically, there is a debate regarding whether proportionality should apply to each individual attack on a specific target, a series of attacks within the same military operation, or the entire armed conflict. According to the majority view,[35] the proportionality assessment should be applied to the military operation as a whole, rather than to each individual attack on a specific target or the entirety of the armed conflict.

[31] Sandoz et al 1987: para. 2209.

[32] *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 92.

[33] Ronzitti 2020: 279. According to the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 91, the definition of "collateral damage" does not include inconvenience, irritation, stress, fear or other intangible conditions caused to the civilian population. It is limited to death/injury to civilians, or to damage/destruction of objects.

[34] According to the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 110, there is a contentious debate regarding the qualification of "war-sustaining" economic objects as military objectives. "A war-sustaining economic object is one which indirectly but effectively supports the enemy's overall war effort." Those who argue in favour of considering war-sustaining economic objects as military objectives assert that it is permissible to target export production generating revenue for financing the war. For example, Stephens–Steer 2015: 21 report that during the American Civil War, Confederate cotton fields were destroyed because the sale of cotton funded the importation of weapons and ammunition. The U.S. Courts that afterwards adjudicated on the matter deemed such targets as lawful. However, as the commentary reports: "The majority of the Group of Experts took the position that the connection between revenues from such exports and military action is too remote. Consequently, it rejected the war-sustaining argument."

[35] Ronzitti 2020: 279. *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 93.

As a final comment on the principle of proportionality, it is worth considering a passage from the judgement rendered by the International Criminal Tribunal for the former Yugoslavia in the *Kupreskic* case.[36] The Court highlighted that the language used in Additional Protocol I to the Geneva Convention suggests a broad margin of discretion for the attacking party when assessing proportionality.

> "In the case of attacks on military objectives causing damage to civilians, international law contains a general principle prescribing that reasonable care must be taken in attacking military objectives so that civilians are not needlessly injured through carelessness. This principle, already referred to by the United Kingdom in 1938 with regard to the Spanish Civil War, has always been applied in conjunction with the principle of proportionality, whereby any incidental (and unintentional) damage to civilians must not be out of proportion to the direct military advantage gained by the military attack. In addition, attacks, even when they are directed against legitimate military targets, are unlawful if conducted using indiscriminate means or methods of warfare, or in such a way as to cause indiscriminate damage to civilians. These principles have to some extent been spelled out in Articles 57 and 58 of the First Additional Protocol of 1977. Such provisions, it would seem, are now part of customary international law, not only because they specify and flesh out general pre-existing norms, but also because they do not appear to be contested by any State, including those which have not ratified the Protocol. Admittedly, even these two provisions leave a wide margin of discretion to belligerents by using language that might be regarded as leaving the last word to the attacking party." (*Prosecutor v. Kupreskic and others* 2000: para. 524)

However, the Court also underscored that this is an area "where the 'elementary considerations of humanity' [...] should be fully used".

[36] *Prosecutor v. Kupreskic and others* 2000.

> "Nevertheless this is an area where the 'elementary considerations of humanity' rightly emphasised by the International Court of Justice in the Corfu Channel, Nicaragua and Legality of the Threat or Use of Nuclear Weapons cases should be fully used when interpreting and applying loose International rules, on the basis that they are illustrative of a general principle of international law" (*Prosecutor v. Kupreskic and others* 2000: para. 524)

Consequently, the prescriptions of the Additional Protocol I (and the corresponding rules of customary law) "must be interpreted so as to construe as narrowly as possible the discretionary power to attack belligerents and, by the same token, so as to expand the protection accorded to civilians".

> "More specifically, recourse might be had to the celebrated Martens Clause which, in the authoritative view of the International Court of Justice, has by now become part of customary international law. True, this Clause may not be taken to mean that the 'principles of humanity' and the 'dictates of public conscience' have been elevated to the rank of independent sources of international law, for this conclusion is belied by international practice. However, this Clause enjoins, as a minimum, reference to those principles and dictates any time a rule of international humanitarian law is not sufficiently rigorous or precise: in those instances, the scope and purport of the rule must be defined with reference to those principles and dictates. In the case under discussion, this would entail that the prescriptions of Articles 57 and 58 (and of the corresponding customary rules) must be interpreted so as to construe as narrowly as possible the discretionary power to attack belligerents and, by the same token, so as to expand the protection accorded to civilians." (*Prosecutor v. Kupreskic and others* 2000: para. 525)

In essence, notwithstanding the loose language used in framing the rules, the ultimate aim remains the protection of civilians.

The principle of precaution in attacks

The third principle to be examined is the principle of precaution in attacks. As a preliminary and basic form of precaution, Article 57, paragraph 1, of

the Additional Protocol I to the Geneva Convention recalls the principle of distinction: "In the conduct of military operations, constant care must be taken to spare the civilian population, civilians and civilian objects." To further strengthen this form of precaution, the last paragraph of Article 57 states: "No provision of this Article may be construed as authorizing any attacks against the civilian population, civilians or civilian objects." Such clarification is not redundant, considering that according to Article 57, paragraph 2, point c) when the attack may affect the civilian population, the attacking party is requested to give "effective advance warning", unless "circumstances do not permit". The wording of the clause may open the door to interpretations that legitimise attacks against the civilian population. Therefore, in order to eliminate the risk of such an interpretation, it is crucial to emphasise that any interpretation authorising attacks against civilians or civilian objects must be rejected.

Article 57 also mentions, as a form of precaution, the principle of proportionality. As previously pointed out, the assessment of proportionality shall be carried during the planning phase of the attack and may require adjustments during the implementation stage.

Other precautions are related to the selection of "military objectives" and "means and methods of attack". Regarding military objectives, "when a choice is possible between several military objectives for obtaining a similar military advantage" the objective that is "expected to cause the least danger to civilian lives and to civilian objects" shall be selected.[37] For instance, if the military advantage is similar and less danger is expected to civilians and civilian objects, attacking facilities providing power to the military objective instead of directly targeting the objective itself may be preferable.[38]

Regarding "means and methods of attack",[39] all feasible precautions must be taken "with a view to avoiding, and in any event to minimising incidental

[37] Article 57, para. 3, of the Additional Protocol I to the Geneva Convention.

[38] This example was given in the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 128.

[39] According to Bruderlein 2009: 4–5: "'Means of warfare' mean weapons, weapon systems or platforms employed for the purposes of attack" [Article 1, point (t)]; "'Methods of

loss of civilian life, injury to civilians and damage to civilian objects".[40] Consequently, the aim of avoiding, or at least minimising "collateral damage" must be the driver in the selection of all "weapons, weapon systems and munitions, as well as tactics (such as timing, angle and altitude of attack)".[41]

With specific reference to precision guided missiles, the Harvard Manual states that there is no specific obligation for belligerent parties to use such weapons. However, the Manual recognises that there may be situations where the use of precision guided missiles is the only way to avoid indiscriminate attacks or to reduce the risk of collateral damages.[42]

The Commentary on the Harvard Manual provides further insight into this issue, clarifying that when "appropriate target identification or weapon guidance technologies" are available and their use is "militarily feasible", conducting air missile attacks against military objectives without employing such technology is prohibited. Similarly, the attack must be cancelled if "such assets are not available, and the attacker for this reason is not able to comply with the prohibition against indiscriminate attacks".[43]

Lastly, precautions should not only be taken by the attacking party but also by the defending party. The defending party, "to the maximum extent feasible"

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warfare' mean attacks and other activities designed to adversely affect the enemy's military operations or military capacity, as distinct from the means of warfare used during military operations, such as weapons. In military terms, methods of warfare consist of the various general categories of operations, such as bombing, as well as the specific tactics used for attack, such as high-altitude bombing" [Article 1, point (v)].

40 Article 57, para. 2, ii), Additional Protocol I to the Geneva Convention.

41 Bruderlein 2009: 126. According to the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 127: "For instance, an attacker ought to choose a weapon with greater precision or lesser explosive force if doing so would minimize the likelihood of collateral damage, assuming the selection is militarily feasible. [...] Similarly, angle of attack is one of the factors that determine where a bomb may land if it falls short of, or beyond, the target. Thus, to spare a building located, e.g., to the west of a target, it may be advisable to attack from the north or the south."

42 Bruderlein 2009: 9, Rule 8.

43 *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 127. The commentary also specifies: "This general rule is particularly relevant if the military objectives are located in a densely populated area."

must ensure that military objectives are not located in close proximity to the civilian population.[44]

In conclusion, the application of the aforementioned principles of International Humanitarian Law implies a certain degree of discretion, and, consequently, it requires a careful consideration and weighting of various circumstances to strike an appropriate balance. The use of satellites can undeniably offer invaluable support in this respect.

IN WHICH CIRCUMSTANCES CAN A SATELLITE BECOME A MILITARY TARGET?

Satellites serve as a means to acquire intelligence information, and satellites can guide attacks against targets on Earth. It is evident that satellites play a crucial role in modern warfare, which makes them potential primary targets for belligerent parties. Therefore, it is essential to provide a brief overview of the circumstances and extent under which satellites can be lawfully targeted during armed conflicts.

The question of whether the rules of International Humanitarian Law also apply to Outer Space is a subject of debate. The legal framework governing warfare has traditionally been compartmentalised into different theatres such as land, sea and air, but there is currently no dedicated stand-alone regulation specifically addressing warfare in space.[45]

Such lack of specific regulation, in my opinion, does not mean that the principles of International Humanitarian Law do not apply to the domain

[44] According to Article 58 of the Additional Protocol I to the Geneva Convention: "The Parties to the conflict shall, to the maximum extent feasible: a) without prejudice to Article 49 of the Fourth Convention, endeavour to remove the civilian population, individual civilians and civilian objects under their control from the vicinity of military objectives; b) avoid locating military objectives within or near densely populated areas; c) take the other necessary precautions to protect the civilian population, individual civilians and civilian objects under their control against the dangers resulting from military operations."

[45] Stephens–Steer 2015: 8.

of space. As highlighted by the International Court of Justice in the Nuclear Weapons Advisory Opinion, the "intrinsically humanitarian character" of the legal principles in question permeates the entire law of armed conflicts and "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".[46]

Consequently, the reference to "all forms of warfare" and "all kind of weapons" (including those of the present and of the future) makes the "humanitarian legal framework" applicable also to wars which include Outer Space as a theatre, and to space weapons. Moreover, the applicability of the law of armed conflict in space has been recognised by the Oslo Manual[47] and prominent experts of space law.[48]

Given the applicability of the principles of International Humanitarian Law to warfare in space, it is important to examine how the principles of distinction, proportionality and precautions when making an attack are applied in relation to space assets such as satellites.

According to the principle of distinction, only military satellites can be targeted, while civilian satellites cannot be subjected to attacks.[49] As previously

[46] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion 1996: para. 86, 259.

[47] Dinstein–Dahl 2020: 3, Rule 2: "Outer Space operations are governed by international law, including the Charter of the United Nations and the applicable principles and rules of the Law of Armed Conflict (LOAC)."

[48] Stephens–Steer 2015: 11. In particular, the authors justify the applicability of the law of armed conflicts to space, referring to: 1. articles 35, para. 3 and 55 of Additional Protocol I to the Geneva Convention, posing obligations in relation to the environment; 2. the 1976 Convention on the Prohibition of Military or Any Other Hostile Use of the Environmental Modification Techniques; 3. the *Nuclear Weapons Advisory Opinion* of the International Court of Justice; 4. the Nicaragua and Corfù Channel cases; 5. Article 3 of the Outer Space Treaty; and 6. Article 38, para. 1 (c), of the Statute of the International Court of Justice, in relation to the applicability of the general principles of law, in absence of treaty and/or customary international law.

[49] According to Schmitt 2006: 121, a possible means of distinguishing between military and civilian satellites is by referring to the registration of the space object under the Registration Convention. However, it is crucial to emphasise that the registration must not be deceptive. Article 37 of the Additional Protocol I to the Geneva Convention prohibits acts of "perfidy", namely "Acts inviting the confidence of an adversary [...] with intent to betray

mentioned, the definition of "military objective" outlined in Article 52 of the Additional Protocol I to the Geneva Convention, is based on an asset's ability to make an effective contribution to military action through its nature, location, purpose, or use, while considering the advantage derived from its destruction.[50]

By applying this definition, satellites belonging to armed forces are considered military objectives by nature.[51] Consequently, they are "in principle"[52] considered lawful targets "at all times and in all circumstances during an armed conflict".[53] Satellites used for military operations are considered military objectives by use[54] and can be targeted as long as they are actively employed for military purposes.[55] Satellites located in strategically significant areas[56]

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that confidence". Specifically, under point c), the clause explicitly mentions "the feigning of civilian, non-combatant status". Therefore, if a military satellite is falsely registered as a civilian satellite, such registration could be considered an act of perfidy, constituting a violation of International Humanitarian Law.

50 Dinstein–Dahl 2020: 9, Rule 10: "Civilian Outer Space systems and assets must not be the object of attack unless they qualify as military objectives – if not by nature – by location, purpose or use."

51 Dinstein–Dahl 2020: 9, Rule 9: "In principle, Outer Space systems and assets belonging to the armed forces constitute military objectives because, by nature, they make an effective contribution to the enemy's military action."

52 Dinstein–Dahl 2020: 9 emphasised: "The words 'in principle' were included to clarify that this was a general rule subject to exceptions. For example, medical aid stations in Outer Space belonging to the military would be excluded."

53 Dinstein–Dahl 2020: 9.

54 According to the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 109: "Any military use of a civilian object renders it a military objective."

55 *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 108.

56 According to the *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 107: "Similarly, an attacker may wish to blind the enemy by depriving it of high ground from which it could observe the attacker's operation. [...] The governing criterion is the need to attack a location so as to enhance or safeguard the attacker's operations or to diminish the enemy's options." For instance, the cislunar space is considered to hold strategic significance (see in this respect Berger 2022) and therefore an attacker may target a satellite located in that area.

may qualify as military objectives by location,[57] and they may be targeted even regardless of their use.[58] Additionally, certain satellites that are not currently used for military reasons but may be used for such reasons in the future can be qualified as military objectives by purpose, meaning their "intended future use".[59] These satellites can be targeted if there are reasonable grounds to believe that the enemy intends to use them for military purposes in the future.

The distinction between civilian objects and military objectives can become more difficult to draw when considering the existence of dual-use satellites, which provide both civilian and military services.[60]

Despite their role in providing civilian services, dual-use satellites can be qualified as military objective by use, if, and as long as, they are also used for military purposes. Furthermore, they may also be qualified as military objectives by purpose, if there are reasonable grounds to believe that they will be employed for military reasons in the future.

As in any other case where a military objective is targeted, collateral damage can occur when attacking a satellite that is deemed a "military objective". Therefore, the principle of proportionality must also be applied when targeting satellites, balancing the incidental damage to civilians and civilian objects (which is relevant only if it is "excessive") against "the concrete and direct military advantage anticipated".

In particular, the proportionality assessment must be conducted with utmost care when targeting dual-use satellites. Dual-use satellites, by definition, provide both civilian and military services. As a result, the likelihood of collateral

[57] *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 107.

[58] According to Stephens–Steer 2015: 17: "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 legitimate target."

[59] *Commentary on the HPCR Manual on International Law Applicable to Air and Missile Warfare* 2010: 107.

[60] Certainly, also for satellites, Article 52, para. 3, Additional Protocol I to the Geneva Convention applies whereby, in case of doubt, it is presumed that an object is not used for military purposes.

damage significantly increases when such satellites are targeted. A strike on a dual-use satellite will inevitably disrupt services provided to civilians.

In cases like these, Article 54, paragraph 2, of the Additional Protocol I to the Geneva Convention plays a crucial role in establishing the boundaries beyond which collateral damage is deemed unacceptable. This provision explicitly makes it prohibited "to attack, destroy, remove, or render useless objects indispensable to the survival of the civilian population".[61]

Consequently, attacks on satellites that are essential for delivering critical civilian services on Earth should be prohibited. There is ongoing debate regarding satellites that provide positioning systems, such as GPS. These types of satellites provide both military and civilian services, which, among other things, have a significant economic impact, considering that 6–7% of European GDP relies on satellite navigation.[62] In our opinion, when a global positioning system is integrated into applications that provide services that are crucial for human safety, targeting such satellites should be ruled out.[63]

As for the principle of precaution in attacks, it is essential to exercise careful judgment in selecting the means and methods of attack. Specifically, belligerent parties should avoid conducting kinetic attacks against satellites.[64] Kinetic attacks refer to actions that have the potential to completely destroy satellites, resulting in the generation of a significant amount of debris that poses a risk of collision with other space objects. Therefore, when targeting satellites, it is preferable to use weapons that can disable the functionality of the device without causing its complete destruction.

[61] Article 54, para. 2, of the Additional Protocol I to the Geneva Convention also provides a list of "objects indispensable to the survival of the civilian population", such as "foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works".

[62] Such data are provided by the European Space Agency in ESA s. a.

[63] Reference can be made, for instance, to "disaster management applications, or remote monitoring of dams and drinking water installations". See in this respect Stephens–Steer 2015: 20.

[64] See in this respect Dinstein–Dahl 2020: 10, Rule 11: "In Outer Space operations constituting attacks, assessments of collateral damage should take into consideration the effects of space debris expected to result from the attack."

CONCLUSIONS

The "space legal framework" often faces criticism, with many arguing that it is outdated, excessively vague and inadequate for regulating modern space activities. As explained earlier, even certain "ordinary activities", such as acquiring intelligence information during peacetime, can come under scrutiny due to specific clauses outlined in legal instruments.

During times of war, the "inherently humanitarian character" that permeates the entire law of armed conflicts enables the establishment of rules of conduct that should always be adhered to (although, unfortunately, violations of International Humanitarian Law continue to be witnessed in contemporary conflicts).

All the principles discussed in this article – the principle of cooperation, benefit-sharing and the principles of International Humanitarian Law – are undoubtedly of great value. These principles are common among all States and are fully recognised by the international community.

It is to be hoped that these principles will not remain mere declarations but will inspire individuals to conduct themselves accordingly, both in space and on Earth, especially in these uncertain times.

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