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RECONNAISSANCE SATELLITES IN
MODERN WARFARE: ESPIONAGE OR
LEGITIMATE SURVEILLANCE?

Addressing Their Legal Status
and Regulatory Gaps

*“The first Sputnik contained infra-red
devices to map the United States
for targeting purposes.”¹*

INTRODUCTION

The development of modern warfare, coupled with the rapid growth of reconnaissance satellites, has given intelligence gathering a highly developed and indispensable instrument for military operations. This paper refers to intelligence gathering as the collection of sensitive or military-related data by spy satellites. These space assets enable real-time battlefield monitoring, precise strategic planning and informed decision-making at both the operational and political levels. The increasing reliance on satellite reconnaissance raises complex legal uncertainties at the intersection of space law and telecommunications regulation.²

Historically, during periods of increased international tensions, states have used espionage to gather sensitive information, stop potential threats and monitor foreign political or military activity. Such actions have long been recognised as strengthening a nation's strategic and defensive position.³ Surprisingly, although it remains hidden through often-imposing methods,

¹ GARTHOFF 1958: 134.

² Columbia Law Review 1961: 1075.

³ Columbia Law Review 1961: 1075.

we cannot deny that espionage has traditionally had an ambiguous status in international law and still does, as this paper will demonstrate. Furthermore, technology has vastly expanded the tools available to intelligence gathering. Beyond classic human and electronic surveillance, states have employed aircraft and high-altitude balloons⁴ extensively for surveillance and reconnaissance missions.⁵ In the space arena, it would stand to reason that satellite-based reconnaissance and intelligence-gathering activities could sensibly be addressed under the same principles of law. That is, one would view such reconnaissance as a breach of international law only if the methods employed therein already represent a separate violation of accepted legal norms, such as unwarranted intrusion on territorial sovereignty or prohibited disruption of communications systems; in other words, the method by which it is carried out could make it either legal or illegal. This position suggests a continuity between traditional espionage activity and contemporary space-based intelligence, indicating both the legal ambiguity and the operational necessity of reconnaissance in modern strategic relations.⁶

Before jumping into what this article addresses explicitly regarding reconnaissance satellites, a general definition of the term is required. Depending on Professor Frans von der Dunk: “A ‘satellite’, the obvious *prima facie* target of ‘international space law’, whatever precisely it is, is best characterised as ‘a manufactured object or vehicle intended to orbit the earth, the moon, or another celestial body’”.⁷ Describing that as, since mention of “orbits” around various celestial bodies, including Earth, means that satellites are operating in outer space, the three main sectors making up such satellite operations, and therefore subject to something which can be called ‘international satellite law’, that could be divided in three categories: satellite communications, satellite remote sensing (satellite Earth observation), and satellite navigation, which are all orbit-related to the Earth. In a legal context, all three are subject alternatively to general

⁴ GALLIFORD 2024.

⁵ Columbia Law Review 1961: 1075.

⁶ Columbia Law Review 1961: 1075.

⁷ Merriam-Webster s. a. cited by VON DER DUNK 2019.

international space law and, in addition, each sector is subject to its own international regime.⁸

The term 'spy satellites' is not a legal term, but it is commonly recognised as such. It is more frequently used, as it is charged with powerful historical and political reasons. It emerged during the Cold War, capturing the public imagination and being perceived as a means for confidentiality, espionage and power projection. It is still widely used in the media and public discourse today as a controversy over sovereignty and security. In contrast, 'reconnaissance satellite' is the legal term that highlights their strategic intelligence-gathering.

Another reason is that "[w]hile discussion of reconnaissance satellites has continued for some time, no significant attempts to define precisely the term 'reconnaissance' or other important terms have apparently been made",⁹ especially from a legal perspective. Despite this ambiguity, we can say that reconnaissance is defined as a "mission to obtain information through visual observation or detection methods about the activities and resources of a target, aimed at gathering comprehensive data without direct contact".¹⁰

To make it simpler, we can say that spy satellites, or, more officially, reconnaissance satellites, are observation spacecraft in space used by governments to monitor activities on the ground for national defence purposes secretly.¹¹ They are high-tech 'eyes in the sky', peering down from space to assess foreign military forces, weapons programs, missile test launches and other strategic targets. The primary task of a reconnaissance satellite is to provide essential surveillance intelligence that may otherwise be unattainable or difficult to obtain, all without violating sovereign airspace. In essence, these satellites allow countries to spy on each other at the impersonal distance of space, offering a continuous stream of imagery and information to inform military planning, treaty monitoring and threat estimation.¹² By capturing precise photos, radar charts, or tapping into electronic signals,

⁸ VON DER DUNK 2019.

⁹ SORAGHAN 1967.

¹⁰ Elsevier s. a.

¹¹ FRĄCKIEWICZ 2025.

¹² FRĄCKIEWICZ 2025.

reconnaissance satellites put policymakers in the lead, uncovering hidden missile bases, tracking troops moving into place, and alerting leaders to impending danger.¹³

The history of reconnaissance satellites has spanned from the Cold War period, as mentioned above, to the contemporary world, revealing how they have evolved from testing tools to critical instruments of global security.¹⁴ It began in the late 1950s, when the Soviet Union launched Sputnik 1, prompting the United States to recognise the strategic advantages of space monitoring.¹⁵ The U.S. responded by initiating the top-secret CORONA program in 1958, officially camouflaged as the 'Discoverer' scientific flights, which successfully recovered photographic and video footage of Soviet terrestrial targets and, by 1961, revealed missile sites that exposed the 'missile gap' myth and directly affected U.S. defence policy.¹⁶ At the same time, the Soviet Union initiated its own Zenit program, a Vostok capsule-based design that carried cameras instead of a cosmonaut.¹⁷ Both superpowers expanded their capabilities with the U.S. Gambit system for high-resolution imagery and the KH-9 Hexagon for broad-area mapping, which by the early 1970s had become essential not only for intelligence but also for verification of arms control treaties.¹⁸

The next great leap was the digital revolution in 1976, with the KH-11 Kennen, which provided real-time electronic imaging equal to the telescope design of the Hubble, enabling nearly instant transmission of intelligence, something the Soviets attempted but never came close to.¹⁹ Further, by the late 1980s, the U.S. also diversified its surveillance with the Lacrosse radar satellites capable of imaging through clouds and darkness, along with Sigint intercepts of messages and Vela tracking nuclear tests, thus

¹³ FRĄCKIEWICZ 2025.

¹⁴ FRĄCKIEWICZ 2025.

¹⁵ TABOR s. a.

¹⁶ FRĄCKIEWICZ 2025.

¹⁷ FRĄCKIEWICZ 2025; Bean 2025.

¹⁸ FRĄCKIEWICZ 2025.

¹⁹ FRĄCKIEWICZ 2025.

having a complete array of Imint, Elint and nuclear surveillance assets.²⁰ After the Cold War, these capabilities only grew but did not diminish: the U.S. National Reconnaissance Office developed follow-ons to KH-11 with global instant access through commercial relays, while Russia, long delayed by economic crises, finally brought the Persona and Liana systems to the field, and new entrants such as France with Helios, and later China, India and Japan joined the growing multipolar space-based intelligence market.²¹

However, one of the main challenges facing their legal framework is that current space and telecommunications treaties do not distinguish between routine monitoring and 'spying', nor do they fully address the use of satellites to intercept or jam signals. The principal space law treaty, the Outer Space Treaty (OST), requires the use of outer space to be for 'peaceful purposes' in Article I, bans weapons of mass destruction in orbit, and, by omission, permits conventional military uses specifically in Article IV.²² In the same manner, the International Telecommunication Union (ITU), even if it allocates radio frequencies and prevents harmful interference, does not explicitly address military intelligence gathering or signal intercepts.²³

In that case, states have, in practice, developed their own understandings; satellites used for reconnaissance are universally accepted as 'peaceful', nonhostile applications of outer space,²⁴ but interrupting communications sent by another party is generally considered classical espionage. These juridical gaps raise significant issues of sovereignty, privacy and international security: Does a satellite in operation signal intelligence over the territory of a foreign nation against sovereignty, and if an intelligence or spy satellite is deliberately destroyed, does such an act amount to aggression or legitimate targeting of a military target? The ambiguity on such issues underscores the need for more specific legal parameters to regulate the increasingly widespread strategic use of spy and reconnaissance satellites in modern military affairs.

²⁰ TABOR S. a.

²¹ FRĄCKIEWICZ 2025.

²² United Nations Office for Outer Space Affairs 1967.

²³ KEIR 2021.

²⁴ SORAGHAN 1967.

Using a qualitative approach, this paper examines whether reconnaissance satellites are tools of espionage or legitimate surveillance, analyses their legal status to expose their typically unclear position in international law, and puts the question in concrete terms by examining instances of their use in current military and intelligence operations. This paper will use the terms ‘spy’ and ‘reconnaissance’ satellites interchangeably.

TERMINOLOGY CLARIFICATION

Satellites have become a central tool for states that desire to strengthen their national security capacity and maintain a strategic advantage over potential competitors. In the introduction of this paper, we sought to clarify what is meant by ‘spy satellites’, presenting their legal status as reconnaissance satellites; however, a deeper terminology is still needed, especially when we try to answer the following question: What is espionage? And how is it different from legitimate surveillance?

In international customary law²⁵ and the law of international humanitarian law (IHL), espionage in the context of an international armed conflict is well defined. However, the actual measures for collecting information are neither specified nor prohibited.²⁶ As the International Committee of the Red Cross describes it, ‘espionage’ is the “gathering or attempting to gather information in territory controlled by an adverse party through an act undertaken on false pretences or deliberately in a clandestine manner”.²⁷

To make the separation from legitimate surveillance easier, we can refer to the ‘Liberty to Spy’ book,²⁸ in which the author made a definition of ‘espionage’ depending on specific characteristics, as follows:

²⁵ International Committee of the Red Cross s. a.

²⁶ FANG et al. 2023.

²⁷ FANG et al. 2023.

²⁸ LUBIN 2020: 190.

- The operation occurs in Peacetime.
- The operation involves passive gathering, analysis, verification, and dissemination of information of relevance to a State or States' "decision-making process" and in the service of some State interests.
- The operation involves some degree of secrecy and confidentiality as to both the needs behind the operation and the specific methods of collection and analysis employed so to ensure its effectiveness. These [...] operations would often be coupled with some degree of deceitful intent on the part of the Surveilling State(s), though such is not always mandated.²⁹

From what has been presented, we note that the legal distinction between satellite espionage and legitimate satellite surveillance depends on the activity's aim (simple observation vs. interception or interference), the other state's consent, and whether the means themselves violate other international law norms.³⁰ As a result, we can say that legitimate surveillance satellites are launched openly and legally to enhance situational awareness, support national security, and facilitate international cooperation in a respectful attitude towards other states' sovereignty. On the contrary, reconnaissance satellites operate secretly, aggressively penetrating another nation's military, strategic, or communications systems to gather intelligence at will.³¹ As legal systems collect data for defensive or cooperative purposes, spy satellites deliberately infringe on the informational and territorial sovereignty of targets, raising complex legal and ethical issues under international law.

²⁹ LUBIN 2020: 190.

³⁰ SORAGHAN 1967.

³¹ Space Mesmerise 2023.

THE LEGAL CHARACTERISATION OF
RECONNAISSANCE SATELLITES

*The application of the Outer Space Treaty
on reconnaissance satellites*

As a start, we need to make it clear that international law does not explicitly prohibit the use of satellites to gather intelligence, as they are primarily and directly regulated under space law.³² The OST is the foundational space law instrument; most notably, it bans the placement of nuclear or other weapons of mass destruction in Earth orbit or on the Moon, and requires that the Moon and other celestial bodies be used for peaceful purposes. In light of this, the OST, in its Article 1, explicitly declares that “outer space is free for exploration and use by all nations” and forbids any state from claiming sovereignty over outer space or celestial bodies. This means that using space technology, such as satellites, is also open to all nations without discrimination. As a result, we can understand that no state shall use it in a way that produces any form of discrimination, including spying on another country using high-quality intelligence to obtain non-public/secret information. Notably, the OST requires ‘peaceful’ uses of outer space; however, the first challenge is that it did not clearly define this notion, which is one of its key gaps and has led to it being interpreted differently over the years, mainly by space-faring nations.³³

Due to this ambiguity, the United States has generally interpreted ‘peaceful purposes’ as ‘non-aggressive’. In contrast, the Soviet Union traditionally favoured a ‘non-military’ interpretation, reflecting differing approaches to the permissibility of military activities in outer space.³⁴ Accordingly, the Soviet Union adopted a firm stance at the outset, arguing that any surveillance of its territory (even from space) constituted illegal espionage. Therefore, at first, satellite reconnaissance was considered military in nature

³² GALLIFORD 2024.

³³ SORAGHAN 1967.

³⁴ SORAGHAN 1967.

and therefore ‘non-peaceful’, in violation of international law.³⁵ By contrast, U.S. and other Western officials argued that overflight by unarmed satellites was lawful and did not violate international law.³⁶ By the mid-1960s, the Soviets quietly stopped protesting reconnaissance satellites (perhaps realising they needed them too), and no government has ever applied the OST to forbid another’s satellite imagery.³⁷

Other than that, Article IV of the OST prohibits only the deployment of nuclear weapons (and other weapons of mass destruction) into orbit or on celestial bodies,³⁸ but not cameras or sensors; this is understood because it does not ban conventional military satellites or reconnaissance systems.

Still, the legal interpretation is not without controversy. The OST does not explicitly extend its ‘peaceful purposes’ clause to Earth orbit, and some scholars argue that, if read strictly as ‘non-military’, even satellite reconnaissance would be unlawful. From this perspective, all military uses of space undermine global security and should be deemed non-peaceful.³⁹ Others counter that such a definition is overly restrictive and destabilising, noting that intelligence-gathering through surveillance satellites can actually foster stability by reducing uncertainty and the risk of miscalculation.⁴⁰ On balance, prevailing state practice and the UN record support the narrower interpretation: non-violent military activities, including reconnaissance, are tolerated under the OST. Importantly, no treaty expressly legalises reconnaissance satellites; their legitimacy instead rests on states’ silence, tied to the aim behind their use, as this paper will later demonstrate with respect to states’ consent and sovereignty. This legal silence on surveillance does not signal approval of spying; it means that states never negotiated a specific, binding norm prohibiting space-based espionage, and the law on this point remains ambiguous. We can say that although the OST does not ban spy satellites, their use raises distinct legal ambiguities because

³⁵ SORAGHAN 1967.

³⁶ SORAGHAN 1967.

³⁷ SORAGHAN 1967.

³⁸ GRUNERT 2021.

³⁹ SORAGHAN 1967.

⁴⁰ SORAGHAN 1967.

the treaty was drafted at a time when such capabilities were emerging and was not designed to regulate the intelligence functions of advanced space technology. The result is a regime in which space-based espionage is technically lawful because it is not expressly forbidden, but remains normatively and politically contested, and commentators highlight the tension between this silence and broader principles of public international law that emphasise sovereign equality, non-intervention and the need for responsible conduct. These general principles, while capable of informing a normative critique of aggressive surveillance activities, are not enforceable and are themselves too broad to serve as effective alternatives to a clear and binding rule on space espionage.

THE AMBIGUITY OF REGISTERING
RECONNAISSANCE SATELLITES UNDER
THE REGISTRATION CONVENTION

The Convention on Registration of Objects Launched into Outer Space serves an extremely important role within the legal framework surrounding the use of reconnaissance satellites. It is not about directly regulating spying but rather creating a process that establishes some level of transparency in the operation of space objects. In this sense, one may ask: Does the convention regulate the registration of reconnaissance satellites, or does it merely make them legally visible without revealing their operational function? The answer lies in the structure of the Registration Convention itself, which governs the existence and legal identification of satellites far more effectively than it regulates their strategic or intelligence purposes.⁴¹ In this regard, it should be recalled that the Registration Convention was developed as an elaboration of the Outer Space Treaty, particularly Article VIII, which establishes that the State of registry retains jurisdiction and control over its space objects. Although the Outer Space Treaty introduced this principle, it did not provide a specific procedural framework for registration. As a result,

⁴¹ JAKHU et al. 2018: 406–420.

the above-mentioned legal gap was closed by the Registration Convention, which requires the launching States to provide certain details, such as the launching State, launch date and place, orbit, and the function of the space object.⁴² At least in theory, this system was intended to strengthen transparency, reduce uncertainty in international relations, and support the peaceful use of outer space. But does this transparency extend to military reconnaissance activities in practice? With regard to reconnaissance satellites, the importance of registration in terms of law centres around attribution. In other words, while a spy satellite has a classified purpose, from a legal standpoint it cannot escape the launching State, which, under Article VI of the OST, is internationally responsible for the activity. Therefore, if a State like the U.S., Russia, or China launches a reconnaissance satellite used for intelligence purposes or in military strategies, international responsibility falls on the launching state.⁴³ However, it is vital to raise another question here: Does such a process regulate espionage? The answer is no. It ensures legal identification, not substantive control over intelligence operations. However, the transparency aims of the Treaty suffer from the vagueness associated with the notion of 'general function' prescribed by Article IV.⁴⁴ Why is this element a problem? Because it allows States to adhere to the requirement to register satellites, but at the same time, hide the actual nature of operations conducted by the satellites. In fact, States mainly do not mention satellites as being used for reconnaissance or surveillance. They prefer to describe them in broad terms as 'Earth observation', 'communication', 'scientific' satellites, or those with 'practical application'. The major disadvantage, however, is the vagueness of the notion of 'general function'.⁴⁵ The United States has registered its military satellites as 'practical application', including weather and communication satellites; the Soviet Union used scientific nomenclature for its satellites; China uses the term 'remote sensing' for its Yaogan satellites; and Russia uses generic

⁴² JAKHU et al. 2018: 406–420.

⁴³ JAKHU et al. 2018: 406–420.

⁴⁴ JAKHU et al. 2018: 406–420.

⁴⁵ JAKHU et al. 2018: 406–420.

information about tasks by the Ministry of Defence.⁴⁶ In turn, there have been instances in which France openly disclosed reconnaissance satellite Elisa as an electronic intelligence satellite (Microsatellite d'écoute).⁴⁷ All of these actions undermine the very purpose of this Convention as a means of promoting transparency, underscoring the drawbacks of the voluntary nature of the information exchange process. As a matter of fact, the role played by the Secretary-General of the UN is mostly secretarial, where the organisation simply registers the information presented but cannot check its validity or confront incorrect data.⁴⁸ This leads to a key issue: registration creates visibility without transparency. Spy satellites are acknowledged as existing objects, but their intelligence function remains obscured. In essence, the Registration Convention regulates the issue of attribution and not functionality. The Convention guarantees that reconnaissance satellites do not have anonymity; however, it does not limit their operational purposes.

*The non-relevance of the Moon Agreement in
the context of reconnaissance satellites*

Article 3 of the Moon Agreement⁴⁹ articulates its core normative stance: “The Moon shall be used by all States Parties exclusively for peaceful purposes.” It then prohibits “any threat or use of force or any other hostile act or threat of hostile act on the moon” and forbids the placing of weapons of mass destruction in orbit around or on the Moon, as well as the establishment of military bases, installations, or fortifications there.⁵⁰ These prohibitions clearly reflect the desire to prevent the militarisation and hostile exploitation of the Moon itself, a body that is increasingly attracting scientific and exploratory interest. However, the language of Article 3 is focused on activities on and in orbit of the Moon; it does not purport to govern activities occurring entirely

⁴⁶ JAKHU et al. 2018: 406–420.

⁴⁷ JAKHU et al. 2018: 406–420.

⁴⁸ JAKHU et al. 2018: 406–420.

⁴⁹ United Nations Office for Outer Space Affairs 1979.

⁵⁰ United Nations Office for Outer Space Affairs 1979.

in Earth orbit, such as the deployment of satellites for Earth observation or reconnaissance. A careful reading of this text reveals two fundamental limitations when applying the Moon Agreement to spy satellites. First, the geographical restriction is stated in the treaty: the obligations apply to “the Moon and other celestial bodies [...] except insofar as specific legal norms enter into force with respect to any of these celestial bodies”.⁵¹ By excluding Earth and focusing on orbits or trajectories related to the Moon itself, the treaty establishes a geographical limitation that clearly excludes the domain of terrestrial remote sensing. Second, the limitation in terms of the subject matter is also clearly stated in the treaty; the prohibited acts are those of conventional military character on the Moon, such as the hostile use of force, the stationing of weapons of mass destruction, and military manoeuvres on or around the lunar terrain, but not remote sensing on Earth by satellites in low or medium Earth orbits.

This understanding may be explained in the context of the conditions surrounding the treaty’s negotiation and its application in practice. Negotiation of the Moon Agreement is based on the need to achieve the treaty’s objectives: to avoid conflict in the exploitation of resources on the Moon, to promote international cooperation in their exploitation, and to maintain the Moon as a zone of peaceful scientific activities. The prohibition of military bases and the use of military weapons on the Moon, as set out in the Moon Agreement, reflects concerns about the presence of human beings and potential territorial entanglements on the Moon. There is no such discussion or provision for the collection of intelligence through the gathering of intelligence via Earth’s orbit. This makes the line drawn on surveillance and espionage more ambiguous. The Moon Agreement’s low ratification rate suggests it has lesser significance. This is unlike the OST, which has received almost universal ratification and serves as the foundation of international space law. Only a handful of countries have ratified the Moon Agreement, none of which are major players in the use of space for espionage.

⁵¹ United Nations Office for Outer Space Affairs 1979.

International Telecommunication Union

Moving to the specific regulation of satellites, a parallel body of law governs satellite communications (ITU and related rules), but it does not ban surveillance. The International Telecommunication Union allocates spectrum and orbital slots to prevent interference. Under the ITU Radio Regulations, states must avoid causing 'harmful interference' to others' radio signals. Article 48 of the ITU Constitution also recognises a limited 'military exception', affirming that member states 'retain their entire freedom about military radio installations'. However, this freedom is expressly conditioned by a duty to observe, as far as possible, the ITU measures designed to prevent harmful interference. Intentional jamming or cyberattack on another's satellite signal would clearly violate these ITU interference rules.⁵² Indeed, analysts emphasise that, while no meaningful international remedy exists against such interference (other than possible self-defence), treaty law prohibits jamming.⁵³ By contrast, the interception of satellite signals (espionage and spying on non-public data) is not addressed by any international treaty. In practice, states assume that sensitive military communications will be interpreted. Thus, while intercepting a foreign military uplink may be seen as unfriendly, it is not regulated by the ITU and is not, *per se*, illegal under space law.

Another issue we can raise is that if a commercial company's satellite is gathering information over Country X and selling it to Country Y's military, could Country X request this information under the UN Remote Sensing Principles?⁵⁴ Theoretically, yes, but there is no way to implement it.⁵⁵ During the 1970s, proposals to register satellites and exchange images to avoid misinterpretation were made, but no such practice was ever implemented. Presently, nations store their high-resolution pictures confidentially as part of military intelligence. The 1975 Registration Convention requests states to register satellites they launch, but only in general terms. A satellite, for

⁵² KEIR 2021.

⁵³ KEIR 2021.

⁵⁴ United Nations General Assembly 1986.

⁵⁵ FRĄCKIEWICZ 2025.

example, can be registered as 'Earth observation' without mentioning that it is utilised for spying. Certain military satellites are even registered late or with minimal information.⁵⁶

SOVEREIGNTY AND SELF-DEFENCE WHEN USING RECONNAISSANCE SATELLITES

The use of reconnaissance satellites raises questions about sovereignty and privacy, since no state 'owns' space and is not subject to any nation's sovereignty, as stated in the 'non-appropriation' principle of the OST. For this reason, satellites routinely pass over other countries. Under international law, this overflight is not considered a violation of sovereignty, unlike an aircraft that enters another country's airspace without permission. The doctrine of 'province of mankind' (Article I of the OST) and related resolutions affirm that space is free and open.⁵⁷ This does not always imply that states do not seek to exercise some degree of control over foreign spy operations conducted at orbital altitudes over their borders. Satellite spying is regularly conducted from outer space over the territories of other states. Although such activity does not constitute a physical invasion of territorial sovereignty, it can nevertheless pose a tremendous threat to national security and confidentiality.⁵⁸

In other words, satellites gather data about people and militaries on Earth, raising privacy and security concerns, especially during wartime. High-resolution imagery can reveal crowd movements and even individual faces. Real-time surveillance (through motion-capture or signal interception) can intrude deeply into a state's information sphere. Some states view such intrusions as 'acts of espionage' or interference with sovereign rights. For example, when a Chinese balloon drifted over the U.S. in 2023, U.S. officials denounced it as a violation of sovereignty and international

⁵⁶ FRĄCKIEWICZ 2025.

⁵⁷ FANG et al. 2023.

⁵⁸ SORAGHAN 1967.

law.⁵⁹ The same logic could apply to satellites: if a satellite eavesdrops on military communications without consent, that is certainly uneasy for the target state's sovereignty.

On the other hand, the counterargument is that satellite surveillance is necessary for stability: no country should have complete secrecy over its military posture. Indeed, one rationale for OST reconnaissance exceptions was that an open society has the right to gather information that a closed society would hide.⁶⁰

Finally, states often justify space-based surveillance on security grounds. Under Article 51 of the UN Charter, states have an inherent right to self-defence, including the right to gather information for that purpose. Western nations have long argued that reconnaissance satellites are an essential non-violent component of defence (and arms control verification). The U.S. at the UN asserted that covertly collecting intelligence by 'purely passive' means is entirely consistent with the right of self-defence.⁶¹ From this perspective, reconnaissance satellites are similar to unfettered freedom of navigation; they enable early warning of threats, preventing war rather than provoking it. In sum, the duality in international law, with no express ban on espionage but strong sovereign rights, means that states invoking security needs can generally claim legitimacy for space spying as a sort of legitimate surveillance. Marking it as another grey zone in the legal context of space in general and satellites in particular.

RECONNAISSANCE SATELLITES AS A TARGET DURING WARFARE

Reconnaissance satellites are military assets, which raises the question of whether they can legally be targeted during war. According to international law, specifically the law of armed conflict (LOAC) or international humanitarian law, attacks may be directed only against military targets.

⁵⁹ FANG et al. 2023.

⁶⁰ SORAGHAN 1967.

⁶¹ SORAGHAN 1967.

Article 52(2) of the Additional Protocol I to the Geneva Conventions also 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 [...] offers a definite military advantage”.⁶² Reconnaissance satellites are within this definition. They collect intelligence in support of military action and, for instance, positively assist it. On that account, they can lawfully be considered military targets and thus legitimate targets in war.⁶³

Although reconnaissance satellites can be made the target of military action, there are severe legal and ethical constraints on doing so. According to Article 35 of Additional Protocol I and customary IHL, attacks should not inflict excessive collateral harm or long-term, widespread, severe environmental effects. Destruction of the satellite typically generates orbital debris that damages civilian satellites and space infrastructure utilised by many states. It leaves one wondering if such attacks could ever be proportionate.⁶⁴

No treaty, however, exists that expressly prohibits anti-satellite (ASAT) attacks, yet new practice signals growing concern. In 2022, the United States issued a moratorium on ASAT testing that creates space debris, and some other states signed up to it to set a new global norm in this matter.⁶⁵

Finally, if commercial satellites provide intelligence or targeting data during a war, they might lose their civilian immunity and become military targets themselves. The International Committee of the Red Cross (ICRC) notes that civilian objects used for a military purpose may be attacked, yet only when they are being used for such ends.⁶⁶ This issue was evident in the Ukrainian war, where satellite imagery from private sources was reported to contribute to military action.⁶⁷

⁶² Protocol I 1977: Articles 35, 52.

⁶³ FRĄCKIEWICZ 2025.

⁶⁴ FRĄCKIEWICZ 2025.

⁶⁵ FRĄCKIEWICZ 2025.

⁶⁶ International Committee of the Red Cross 2005: Rules 1–10, 43–45.

⁶⁷ FRĄCKIEWICZ 2025.

CASE STUDIES IN USING RECONNAISSANCE
SATELLITES FOR INTELLIGENCE GATHERING

This section is mandatory to demonstrate how reconnaissance satellites were incorporated into modern warfare and to provide actual instances of their use in spying and intelligence gathering. In the face of the present shifting geopolitical landscape, it is also required to recognise that the deployment of force has extended beyond traditional wars. Terrorist activities, in my view, should be regarded as a form of warfare, in which we find non-governmental actors rather than states. Spy satellites have been used in counterterrorism operations, for which the case of Osama bin Laden will be discussed.

Reconnaissance satellites in conventional armed conflicts

The use of reconnaissance satellites in military wars is not a theory but a well-documented reality that has made up the bulk of contemporary warfare. From the Cold War to the latest conflicts, military spy satellites have played vital roles in intelligence gathering, guiding operations and informing political decision-making. One of the first and most dramatic was the Cuban Missile Crisis of 1962. At this time, U.S. reconnaissance satellites in the CORONA program⁶⁸ supplied photographic proof of Soviet nuclear missile bases in Cuba. The photographs, available only recently due to the success of America's first satellite spy system, provided unparalleled insight into Soviet behaviour.⁶⁹ The photos had a crucial role insofar as they offered irrefutable proof that the Soviet Union was deploying strategic weapons off the coast of the United States.⁷⁰ They had significant political and legal value, allowing the United States to present its case to the United Nations and defend the naval quarantine of Cuba in international law.⁷¹ Here, we can see that satellite intelligence did not just inform military decisions

⁶⁸ Central Intelligence Agency 1995.

⁶⁹ Central Intelligence Agency 1995.

⁷⁰ CADDELL 2016.

⁷¹ CADDELL 2016.

but also shaped the legal and diplomatic lexicon that ultimately averted a nuclear confrontation.⁷²

Two decades on, the 1990–1991 Gulf War was the first to see spy satellites fully deployed in combat.⁷³ The U.S. satellites delivered near-real-time intelligence on Iraqi military deployments, pinpoint missile targets, and the effectiveness of coalition bombing raids.⁷⁴ Space-based systems, such as GPS, enabled the precise targeting of Iraqi military assets.⁷⁵

The 2003 invasion of Iraq by the U.S. further demonstrated this trend. We cannot deny that satellites for reconnaissance provided high-resolution images of Iraqi infrastructure, military installations and possible weapons facilities.⁷⁶ This imagery, together with signals intelligence, was intended to disable Iraq's military command and control quickly. But the Iraq War also exhibited the controversial nature of satellite intelligence. The U.S. justification for the invasion included claims of weapons of mass destruction, supported in part by satellite imagery, which were later proven to be unconfirmed.⁷⁷ The most notable event was the presentation by the United States Secretary of State Colin Powell to the UN Security Council, where satellite images were used to argue that Iraq was concealing prohibited weapons.⁷⁸ Legally, this challenged the legitimacy of satellite evidence as a cause for the use of force, highlighting the clash between intelligence, political perception and international law.⁷⁹ Other conflicts, such as the recent Russian–Ukrainian War, further underscore the ongoing use of spy satellites for strategic reconnaissance and instant targeting, underscoring the need to clarify their legal status and states' responsibility.

⁷² CADDELL 2016.

⁷³ Central Intelligence Agency 2002.

⁷⁴ BALL 1991.

⁷⁵ CITINO 2012.

⁷⁶ Central Intelligence Agency 2002.

⁷⁷ Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction 2005.

⁷⁸ Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction 2005.

⁷⁹ Central Intelligence Agency 2002.

*Reconnaissance satellites in counterterrorism
operations: The Osama bin Laden case*

Following the 11 September 2001 attacks, the U.S. relied heavily on a combination of human efforts, signals intelligence and satellite imagery to track Osama bin Laden, the al-Qaeda leader, on 2 May 2011.⁸⁰ Spy satellites proved invaluable, especially after attention shifted to a suspicious compound in Abbottabad, Pakistan. High-definition photographs revealed peculiar security features, such as high walls, a lack of telephone or internet access, and controlled patterns of movement, leading the analysts to conclude that the compound must have been constructed to hide a high-value target.⁸¹ But satellite imaging could not guarantee bin Laden's presence inside; intelligence estimates given to President Obama before the raid varied at best between a 40–60% chance that he was there. Deciding to proceed with Operation Neptune Spear⁸² thus came with a compromise: to operate on high confidence instead of complete certainty, knowing that national security concerns overrode evidentiary shortcomings.

Legally, the operation was a violation of sovereignty, as Pakistan did not approve the invasion and loudly complained about it as an infringement of international law.⁸³ The proponents of the action, however, invoked the theory of self-defence under Article 51 of the UN Charter, as well as the 'unwilling or unable' test, to argue that the U.S. was justified in acting within another state's territory if the latter was unable to cope with threats emanating from its own territory.⁸⁴ The ethical and legal dimensions also encompassed proportionality, necessity, and whether it was permissible to kill rather than capture bin Laden.⁸⁵ Lastly, several factors compelled the choice since bin Laden's ongoing threat as al-Qaeda

⁸⁰ CLARK 2011.

⁸¹ WALSH 2011.

⁸² National September 11 Memorial & Museum s. a.

⁸³ DUNLAP 2019.

⁸⁴ DUNLAP 2019.

⁸⁵ DUNLAP 2019.

leader, years of accumulated intelligence on his couriers and compound structure, doubts about the validity of diplomatic or cooperative solutions with Pakistan, the operational practicability made possible by satellite and aerial surveillance, and political and moral obligations to deliver justice for 9/11.⁸⁶ Therefore, while the attack was an exemplary act of sovereignty breach, it also illustrated how reconnaissance satellites and covert espionage influenced sensitive decisions, in which legal justification and national security are intertwined.



Figure 1. Image showing U.S. satellites spying on the Osama bin Laden compound for several months before they attacked him

Source: DigitalGlobe 2011.

⁸⁶ CLARK 2011.

ESPIONAGE AND THE DUAL-USE DILEMMA

*Distinguishing reconnaissance satellites from
civilian earth observation systems*

Compared with a civilian satellite, a spy satellite is different in both technology and law. They can use similar technologies, but they differ in purpose, operation and legal classification. As clearly mentioned in this paper, a spy or reconnaissance satellite is specifically designed to carry out military or intelligence-related goals. The spy or reconnaissance satellite may carry sophisticated equipment such as high-resolution optical sensors, multi-spectral or synthetic aperture radar (SAR) and signals intelligence (Sigint) equipment. The equipment may be capable of gathering accurate spatial, spectral and signal information. This information may include enemy military facilities, troop movements and signals. These capabilities distinguish them operationally from satellites designed for other purposes.⁸⁷

In contrast, civilian satellites are designed primarily to fulfil non-military missions, such as weather monitoring, environmental observation, communications, scientific research and public services. Earth observation satellites in this category collect imaging or sensor data targeted at environmental conditions (such as climate variables, forest cover, sea surface temperature) or cartographic and resource management purposes. Communications satellites relay radio signals to support television, internet and telephone services across broad geographic areas, and even military communications may rely on these civilian infrastructure satellites. However, there is a degree of technological convergence here, as many of these civilian satellites are equipped with high-powered sensors capable of generating intelligence-value imagery or data. Commercial Earth observation satellites can produce images of ground features with a level of detail approaching military-grade quality. This is referred to as dual-use technology, where the hardware can be used for both civilian and military purposes.⁸⁸

⁸⁷ Central Intelligence Agency s. a.

⁸⁸ MORIC 2022.

If we mentioned in the previous pages that reconnaissance satellites were legitimate targets in wars, since they are military objects, what about civilian satellites? The principle of distinction, as provided for in the IHL, requires the parties to distinguish between military objectives and civilian objects. In this respect, a civilian object shall be protected from attack if it does not meet the cumulative requirements provided for in the Additional Protocol I to the Geneva Conventions, which make an object a military objective.⁸⁹ These requirements include the object's contribution to the military action and its destruction, providing a definite military advantage in the conflict. However, it is also noteworthy that an object shall not be considered a military objective solely because it serves dual functions, both military and civilian. Instead, the focus should be on the mode in which the object has been used in the conflict.⁹⁰ For instance, the satellite should be available for civilian communications and broadcasting services and should be protected accordingly. However, if the satellite has been used in providing real-time imagery and command and control services to the military, it shall be qualified to become a target in the conflict.⁹¹

This assessment of use is particularly relevant whenever civilian satellites are used, directly or indirectly, for espionage or intelligence-gathering purposes. Espionage, as such, is not expressly regulated or prohibited under international space law, and space-based intelligence collection has long been tolerated under the legal logic of the freedom of use of outer space established by the OST, as stated in the previous section of this article. However, when intelligence activities conducted through civilian satellite systems become operationally integrated into military decision-making, the legal character of the satellite under IHL may be affected. A civilian satellite that provides data later analysed for strategic intelligence purposes does not automatically lose its civilian protection. By contrast, where a civilian Earth observation or communications satellite is used to supply real-time intelligence that directly supports military operations, such as targeting, operational planning, or command and control, it may be considered as

⁸⁹ Protocol I 1977: Articles 35, 52.

⁹⁰ FRĄCKIEWICZ 2025.

⁹¹ BERRANG 2023.

making an effective contribution to military action within the meaning of Article 52(2) of Additional Protocol I.⁹² In such circumstances, the intelligence function performed by the satellite moves beyond passive observation and enters the realm of operational military support, thereby engaging the legal framework applicable to military objectives.

The espionage dimension, therefore, sharpens, rather than replaces, the dual-use analysis. While international law does not prohibit intelligence-gathering from outer space *per se*, the decisive issue under IHL is whether the satellite's intelligence output is used to produce a concrete military advantage in an ongoing conflict.⁹³ As the International Committee of the Red Cross has noted, the determination of military objective status depends on the object's actual use at the relevant time, not on its civilian ownership or commercial character. This approach preserves the differentiation between general intelligence collection, which may be viewed as acceptable as a part of peacetime state practice, and operationally decisive forms of intelligence during war. In such circumstances, a presumption of civilian status remains, reinforcing the logic of IHL in modern data-driven warfare.

In addition, gathering information through civilian satellites creates difficulties in applying the principles of proportionality and precaution.⁹⁴ The espionage activities civilian satellites engage in rarely remain contained within the conflict between warring states, and disabling such satellites poses a threat to civilian services and even the risk of space debris. These foreseeable consequences must be taken into account when assessing the lawfulness of any attack. The espionage function of a satellite, therefore, does not automatically negate its civilian character. Still, it can, in specific circumstances, shift the legal balance toward targetability, subject constantly to the strict limits imposed by the IHL.

⁹² Protocol I 1977: Articles 35, 52.

⁹³ BERRANG 2023.

⁹⁴ BERRANG 2023.

The remote sensing principles and dual-use data

The Principles concerning Remote Sensing of the Earth from Outer Space, which were adopted by the United Nations General Assembly through Resolution 41/65 on 3 December 1986, were meant to address remote sensing of Earth for civilian purposes, including natural resource management, environmental protection and land use planning;⁹⁵ however, as mentioned previously, the same satellites used in such remote sensing can provide valuable military information, thus resulting in an overly broad normative regime that addresses civilian uses of remote sensing while completely ignoring the security implications. The issue becomes particularly apparent when considering dual-use technology.⁹⁶ The reconnaissance satellites used by the military and civilian remote sensing satellites are no longer similar technologies but rather the same technologies, collecting images with the same sensors at similar resolutions from similar altitudes in space, save for differences in the application of the collected information. It is this blurring of the line between civilian and military technology that the drafters of the Principles in 1986 never considered, and, thus, it is this blurring that makes the Principles relevant to espionage. The ambiguity in question originates with Principle I, which defines the remote sensing concept strictly in terms of civil development.⁹⁷ In essence, the Cold War era definition was chosen by the leading powers in space as a political concession, allowing them to exclude the reconnaissance programs of each other from international control. The resulting lack of a formal definition leaves no provision to distinguish civilian from military remote sensing, and the dual-use nature of such information makes the situation legally complicated. Indeed, it is collected within the procedures of a civil mission, but then can be analysed and used by intelligence agencies in reconnaissance roles. Principle XII adds an additional layer of complexity, in that it recognises a right of access by the sensed State to both primary and processed data

⁹⁵ United Nations General Assembly 1986.

⁹⁶ MORIC 2022.

⁹⁷ United Nations General Assembly 1986: Principle I.

related to its territory,⁹⁸ but does not grant it any veto over acquisition, any constraints on the third-party distribution of data, or, most importantly, any controls over the translation of the acquired imagery data into actionable intelligence, which is precisely where commercially obtained data would hold the most strategic value. The responsibility norm in Principle XIV, mirroring Article VI of the 1967 Outer Space Treaty, establishes that States bear international responsibility for all national remote sensing activities, whether governmental or private in character,⁹⁹ yet this provision lacks any enforcement architecture and any prohibition on militarisation of collected data, rendering it accountability without remedy. In the end, it is important to note that the principles of Remote Sensing from 1986 do not ban espionage but rather show how international law often governs the technological means of observation, neglecting its strategic uses. In reality, this helps create a situation in which dual-use remote sensing technologies can conduct espionage while still complying with international regulations, since their activities can be attributed to peaceful purposes. In terms of reconnaissance satellite research, it shows how espionage in outer space is no longer conducted via military satellites alone.

Private entity and the ownership of reconnaissance satellites

Historically, reconnaissance satellites were a top-secret tool owned mainly by the state; now, with the proliferation of space actors, they are also owned by private space companies, making this topic even more fragile. Companies like SpaceX now provide imagery, communication and navigation services to states. This has created legal issues regarding responsibility and control.¹⁰⁰ The OST addresses this under Article VI, which states that each state retains international responsibility for all national activities in outer space, both governmental and non-governmental. That means that

⁹⁸ United Nations General Assembly 1986: Principle XII.

⁹⁹ United Nations General Assembly 1986: Principle XIV.

¹⁰⁰ SHARMA 2025.

if a private satellite within U.S. jurisdiction misbehaves or injures someone, the U.S. is responsible.¹⁰¹

If Starlink is used for spying or espionage, or if its launch violates a treaty requirement, the U.S. could be held responsible by aggrieved states. In fact, SpaceX is even making spy satellites for U.S. national reconnaissance, indicating how blurred the boundaries between private and public space intelligence have become.¹⁰² The Ukraine conflict example is very concrete: the Ukrainian forces rely heavily on Starlink for communications, while Western firms provide high-resolution imagery and signals intelligence.¹⁰³ The U.S. Government effectively facilitates Ukraine's intelligence by controlling these private constellations.¹⁰⁴ Some have warned that this could create a form of collective responsibility. If any of these satellites were to break the rules, the U.S. could be implicated under OST Article VI. It also shows how civilian tech can be rapidly militarised.¹⁰⁵ The Atlantic Council notes that Western satellite coverage has given Ukraine a 'comparative advantage' on the battlefield, and that Russia considers those satellites a legitimate target under the laws of war.¹⁰⁶

CONCLUSION

Depending on the information provided, the following question can be addressed: In the context of modern warfare, what role do reconnaissance satellites play? We cannot provide a single specific response due to the nature of the act of spying itself. All the same, espionage practices remain controversial. Some have argued that space observation is inherently military, and that stricter restrictions are needed to uphold the peaceful-use principle. At the legal level, however, state practice has resolved the uncertainty in

¹⁰¹ SHARMA 2025.

¹⁰² ROULETTE-TAYLOR 2024.

¹⁰³ BURBACH 2022.

¹⁰⁴ BURBACH 2022.

¹⁰⁵ BURBACH 2022.

¹⁰⁶ BURBACH 2022.

favour of permissive interpretation. States regularly maintain that the 'peaceful purposes' article of the OST does not preclude non-violent military reconnaissance. All in all, there is no prohibition in a treaty against spy satellites; they are legal under international law if they do not carry banned weapons and do not engage in aggression themselves. It is dualism, no express prohibition but fear of sovereignty, that is the line most quoted by states in justification of space espionage. What makes it more complicated is when a civilian satellite is used in an espionage mission to gather intelligence for the military, highlighting the complex and challenging legal framework governing the dual use of these satellites. Finally, prevailing legal and normative trends strongly support the conclusion that satellite intelligence collection is legally acceptable under current space law, particularly when justified as defensive surveillance. Nevertheless, the normative dispute persists, with the question pending whether permissibility constitutes legitimacy.

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