



Revisiting the Right to Airspace Defense in the Era of Satellite and Hypersonic Threats

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Abstract

The rapid evolution of space technologies, military and commercial satellites, surveillance and reconnaissance systems, and the emergence of hypersonic missiles and vehicles have challenged the traditional concept of "airspace defense." The classical air law regime is grounded in the principle of a state's complete and exclusive sovereignty over the airspace above its territory, whereas space law emphasizes the non-appropriation of outer space and the freedom of its exploration and use. The core issue arises because many modern systems operate at the boundary between air and space, or their effects manifest simultaneously across multiple domains. Employing a descriptive-analytical method, this article examines key international legal instruments—including the 1944 Chicago Convention, the 1967 Outer Space Treaty, the 1972 Liability Convention, and the UN Charter—alongside contemporary legal literature on military space operations. The primary finding is that while existing law provides the fundamental principles necessary to regulate a significant portion of these threats, substantial ambiguities remain regarding the precise air-space boundary, the legal status of suborbital and hypersonic flights, criteria for attributing satellite-related conduct, the consequences of anti-satellite actions, and coordination mechanisms between air defense and aviation safety. In conclusion, the article offers proposals to strengthen rules concerning threat notification, the transparency of space activities, liability and compensation, civil-military coordination mechanisms, and the formulation of supplementary rules addressing emerging threats.

Keywords: Airspace; Air Sovereignty; Space law; satellite; hypersonic threat; air defense; international responsibility; use of force; humanitarian law.

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1. Introduction

Airspace is one of the fundamental elements of the exercise of territorial sovereignty by states. Article 1 of the 1944 Chicago Convention provides that each state has complete and exclusive sovereignty over the airspace above its territory. This principle constitutes the cornerstone of international civil aviation law and authorizes states to regulate the entry, transit, and activities of aircraft within the scope of their sovereignty and, where legally permitted, to restrict or prohibit such activities [1]. However, the security architecture of the twenty-first century is no longer limited to conventional aircraft. Satellites may play a role in intelligence gathering, communications, navigation, early warning, and support for military operations. Conversely, certain attack systems may follow trajectories that, from an operational perspective, occur at very high altitudes or along suborbital paths. Under such circumstances, the question is not merely "what has entered the airspace?" Rather, it is necessary to determine which legal regime governs the conduct in question, to which state responsibility for that conduct may be attributed, and to what extent the affected state may take measures to protect its territory, population, and critical infrastructure.

In legal scholarship, air law and space law are closely related yet distinct branches of law. Air law focuses on territorial sovereignty, aviation safety, and the regulation of flight, whereas space law is founded on the freedom

of exploration and use of outer space, the prohibition of national appropriation, and responsibility for space activities [2]. Nevertheless, emerging technologies have brought the operational boundaries of these two fields increasingly closer together. International law has not established a precise and universally agreed “vertical boundary” between airspace and outer space. This legal gap has become particularly significant in relation to suborbital flights, re-entry vehicles, hypersonic systems, and certain space operations.

2. Problem Statement and Research Questions

The central issue addressed by this study is the extent to which existing rules of international law can protect the sovereignty, security, and safety of airspace against threats whose origin or trajectory does not fall exclusively within the traditional domain of air law. In the classical situation, an aircraft enters the airspace of another state, and the sovereign state may respond on the basis of the rules of air law and its domestic legal framework. However, a satellite that collects information about a country from outer space does not necessarily enter that country's airspace; consequently, such activity cannot simply be characterized as a violation of airspace sovereignty. Similarly, if a space object causes damage to an aircraft or persons during re-entry into the atmosphere, the space liability regime and aviation safety rules may become applicable simultaneously [3].

The principal research question of this article is:

“How should international law strike a balance between the airspace sovereignty of states, the freedom to use outer space, and the right of defense against satellite and hypersonic threats?”

The subsidiary research questions are as follows:

- What is the legal basis of state sovereignty over airspace, and how is its scope determined?
- Under what circumstances can satellite activities transform from lawful space activities into conduct that violates international obligations?
- What is the legal status of hypersonic vehicles and suborbital flights at the intersection of air law and space law?
- Under what conditions are a state's defensive measures against air and space threats consistent with the United Nations Charter and the law of armed conflict?
- What legal reforms and mechanisms could be established to reduce ambiguity and the risk of unintended escalation of disputes?

3. Research Methodology

This study is applied in terms of its objective and adopts a descriptive-analytical and legal methodology. The primary sources of data include international treaties, official documents of the United Nations and the International Civil Aviation Organization (ICAO), as well as specialized legal instruments and scholarly works concerning military operations in outer space. The analysis is based on legal interpretation, a comparative examination of the legal regimes governing airspace and outer space, and an assessment of their interaction with the principles of the United Nations Charter and international humanitarian law. This article distinguishes between “**lex lata**” (**existing law**) and “**proposed legal reform**” and, where international law has not yet established a clear and generally accepted rule, refrains from drawing definitive conclusions.

4. Legal Foundations of Airspace Sovereignty

4.1. The Principle of Complete and Exclusive Sovereignty

Article 1 of the Chicago Convention provides that states have complete and exclusive sovereignty over the airspace above their territory [1]. From a legal perspective, this principle is directly connected to the concept of territorial sovereignty and enables states to establish and enforce rules governing the entry and transit of foreign aircraft. The importance of this rule is also maintained in the security context. In its 2025 statement, ICAO once

again emphasized states' sovereignty over their airspace and their responsibility to continuously assess the safety and security of their airspace [4].

4.2. Distinction Between Civil and State Aircraft

The Chicago Convention distinguishes between civil and state aircraft. Aircraft used in military, customs, and police services are classified as state aircraft, and the legal principles governing their operation are not identical to those applicable to civil aircraft. Accordingly, the analysis of military threats must be distinguished from the rules governing civil aviation safety and from the rules regulating the use of force. At the same time, military operations should not be conducted without due regard to obligations relating to aviation safety and the protection of civilians.

4.3. Airspace Sovereignty and Its Limitations

Airspace sovereignty does not imply an unlimited authority to use force. State conduct remains subject to the obligations established by the United Nations Charter, particularly the prohibition of the threat or use of force under Article 2(4) and, where applicable, the inherent right of self-defense under Article 51 [5][6]. Therefore, a distinction must be drawn between the **“right to regulate and control airspace”** and the **“right to resort to force.”** The former derives from territorial sovereignty, whereas the latter is governed by the separate rules of the *jus ad bellum*.

5. The Boundary Between Air Law and Space Law

One of the most challenging legal issues in the era of emerging technologies is determining the point at which the air law regime ends and the law of outer space begins. The 1967 Outer Space Treaty provides that the exploration and use of outer space are subject to international law and the United Nations Charter and, in Article II, prohibits the national appropriation of outer space [2]. However, the Treaty does not establish a specific altitude at which the boundary between airspace and outer space is located. Consequently, certain disputes concerning suborbital flights and re-entry vehicles may fall within a legally ambiguous area between the two regimes.

From a legal perspective, the absence of a single treaty-based boundary does not necessarily imply the existence of a complete legal vacuum. State conduct may nevertheless be governed by general rules of international responsibility, the United Nations Charter, international humanitarian law applicable in armed conflict, and obligations concerning safety and cooperation. Nevertheless, the absence of a clearly defined boundary may create difficulties in determining jurisdiction, establishing rules governing transit, assessing violations of sovereignty, and anticipating the legal responses available to states.

6. Satellite Threats and Their Legal Status

6.1. Reconnaissance, Communications, and Dual-Use Satellites

Satellites perform a wide range of functions, and the mere fact that a satellite has a military purpose does not, in itself, render its activities unlawful. The Outer Space Treaty permits the use of space equipment and the conduct of space activities within the framework of international law and does not prohibit all military activities in outer space. The express prohibition contained in Article IV primarily concerns the placement of nuclear weapons and other weapons of mass destruction in orbit and certain military activities on celestial bodies [2]. Accordingly, the legality of a satellite should be assessed on the basis of the nature of its activities, their purpose and effects, and other applicable international obligations, rather than solely on the basis of whether it is classified as “military” or “civilian.”

6.2. The Principle of Due Regard and the Prevention of Harmful Interference

Article IX of the Outer Space Treaty requires states to conduct their space activities with due regard to the corresponding interests of other states and, where there is reason to believe that an activity or experiment planned by a state or its nationals would cause potentially harmful interference with the activities of other states, to undertake appropriate international consultations [2]. This rule may provide a basis for developing standards of conduct concerning dual-use satellites, close-proximity operations involving other satellites, activities posing a risk of generating space debris, and certain harmful or destructive operations.

6.3. State Responsibility for Private Activities

Article VI of the Outer Space Treaty holds states responsible for national activities in outer space, whether conducted by governmental entities or non-governmental entities, and makes the activities of non-governmental entities subject to authorization and continuing supervision by the appropriate state [2]. This rule has assumed greater significance in the era of private satellite companies, as a complete distinction between commercial infrastructure and security-related applications is not always possible.

7. Liability and Compensation for Damage Caused by Space Objects

The 1972 Liability Convention is one of the principal legal instruments for analyzing damage caused by space objects. Under Article II, the launching state bears absolute liability for damage caused by its space object on the surface of the Earth or to aircraft in flight [3]. For damage occurring elsewhere than on the surface of the Earth, including in outer space, the applicable rule is different, and liability is determined on the basis of fault under the circumstances specified by the Convention [3].

This distinction is particularly important for the protection of airspace, because an incident may originate from a space activity while the resulting damage occurs within airspace or to a civil aircraft. In such circumstances, the space liability regime may provide a legal avenue for seeking compensation, while aviation rules and the general law of international responsibility may also become relevant, depending on the circumstances. Consequently, effective legal protection is not limited to the capacity to intercept or neutralize a threat; it must also encompass mechanisms for evidence collection, attribution, notification of damage, and the pursuit of compensation.

8. Hypersonic Threats and Emerging Legal Challenges

From a legal perspective, hypersonic systems do not necessarily constitute a distinct and new category of “prohibited weapons.” Technical characteristics such as extremely high speed, maneuverability, and unconventional flight trajectories do not, in themselves, determine the legal status of a weapon; rather, they make the application of existing legal rules more complex. The central legal question is what objective the system is intended to pursue, in what context it is employed, and whether its use is consistent with the rules governing the prohibition of the use of force and, where an armed conflict exists, with international humanitarian law.

8.1. The Prohibition of the Use of Force

Article 2(4) of the United Nations Charter prohibits states from threatening or using force against the territorial integrity or political independence of any state, or in any other manner inconsistent with the purposes of the United Nations [5]. Accordingly, the transit of, or an attack by, a hypersonic system against the territory of another state, insofar as it constitutes a use of force, must be assessed within the framework of this principle and the exception of self-defense. The speed or advanced technological characteristics of such a system do not, by themselves, create an exception to the prohibition on the use of force.

8.2. Self-Defense, Necessity, and Proportionality

Article 51 of the United Nations Charter recognizes the inherent right of individual and collective self-defense in the event of an armed attack and requires a state exercising this right to immediately report the measures taken to the Security Council [6]. Under international law, the exercise of self-defense is analyzed in conjunction with the requirements of necessity and proportionality. Accordingly, defensive measures against missile or hypersonic threats must be assessed with regard to the nature and severity of the attack, the defensive objective,

available alternatives, and the necessity of the proposed action. The mere existence of a potentially threatening technology, in the absence of the legal conditions required for the exercise of self-defense, does not in itself authorize the use of force within the territory of another state.

8.3. International Humanitarian Law in Armed Conflicts

Once an armed conflict exists, international humanitarian law also applies to operations involving missile and space systems. The principles of distinction, proportionality, and precautions in attack are relevant depending on the circumstances and the nature of the target. Specialized legal guidance concerning military operations in outer space likewise emphasizes that the rules of the United Nations Charter and the law of armed conflict do not cease to apply to space-related operations, although the manner in which these rules operate in the space environment may, in certain circumstances, require further interpretation [7].

9. Defense of Aerospace: From the Traditional Concept to a Multilayered Legal Framework

With the emergence of satellite and hypersonic threats, the concept of “aerospace defense” should evolve from a purely technical-military concept into a multilayered legal framework. Under this approach, defense encompasses three legal levels: first, prevention and risk management; second, lawful response to a threat; and third, post-incident response and compensation.

9.1. First Level: Prevention, Early Warning, and Coordination

States should establish effective mechanisms for exchanging information concerning risks, issuing flight restrictions and aerospace notices, coordinating military and civilian activities, and protecting civil aircraft. The importance of these measures increases in an environment in which the speed of decision-making is exceptionally high. ICAO has also emphasized states’ responsibility for assessing the safety and security of their aerospace and providing accurate information concerning potential hazards [4].

9.2. Second Level: Response and the Use of Force

Any defensive response must pass through two stages of legal assessment. First, it must be determined whether the conduct of the opposing party constitutes a violation of sovereignty or an unlawful use of force. Second, it must be determined whether the proposed response falls within the applicable legal framework, particularly the United Nations Charter and, where an armed conflict exists, international humanitarian law. This distinction prevents every entry or movement of an unidentified object from being automatically regarded as authorization for the use of force.

9.3. Third Level: Attribution, Investigation, and Compensation

In the context of satellite and hypersonic threats, attribution of conduct may be difficult because technical trajectories, remote-sensing data, launch components, and control systems may span multiple domains and even involve multiple states. Accordingly, the legal framework for aerospace defense should be accompanied by systems for data recording, chain of custody for evidence, independent expert assessment, and diplomatic mechanisms for pursuing claims for compensation. The space liability regime provides an important framework for state responsibility in cases of damage caused on the surface of the Earth or to an aircraft in flight [3].

10. International Responsibility and Attribution of Conduct

One of the central issues in the era of space-related threats is distinguishing between the “**occurrence of an incident**” and the “**legal attribution of conduct.**” For example, the detection of a space object or an unusual flight trajectory may, in itself, be insufficient to establish which state is legally responsible. The law of state responsibility requires the establishment of both attribution of conduct and a breach of an international obligation. In the space domain, the Outer Space Treaty addresses not only the general responsibility of states but also the responsibility of states for the activities of non-governmental entities under their jurisdiction [2].

From a legal policy perspective, the development of “**confidence-building and transparency**” mechanisms can help prevent disputes arising from premature attribution. Accurate registration of space objects, notification of potentially hazardous activities, the exchange of emergency contact information, and consultation mechanisms where potentially harmful interference may occur are among the measures consistent with the cooperative logic embodied in space law [2][7].

11. Legal Gaps and the Need for Review

11.1. First Gap: The Absence of a Treaty-Based Boundary Between Airspace and Outer Space

The most significant legal gap is the absence of a comprehensive, numerically defined boundary between airspace and outer space. Although various theories have been advanced in legal scholarship, none has, by itself, developed into a universally accepted treaty rule. This ambiguity may affect the determination of sovereignty, freedom of transit, and liability in relation to systems operating at very high altitudes.

11.2. Second Gap: Rapid Technological Development Relative to Treaty Rules

A substantial part of the principal space law treaties was developed during the 1960s and 1970s, whereas small satellites, satellite constellations, commercial remote-sensing services, proximity operations, and highly high-speed flight systems did not exist at that time in their present forms. This does not mean that the foundational rules have become obsolete; rather, it demonstrates the need for supplementary interpretation, rules of conduct, and, where necessary, the development of new legal instruments.

11.3. Third Gap: The Overlap Between Air Defense and Space Defense

Traditional legal structures have maintained a distinction between aviation and space activities. However, emerging threats may originate in one domain and culminate in another. Therefore, maintaining separate rules for airspace and outer space alone is insufficient; connecting rules should also be developed to address cross-domain incidents.

12. Legal and Policy Recommendations

- **Development of a supplementary international instrument on the safety and security of suborbital flights and re-entry vehicles**, with an emphasis on advance notification of trajectories and hazardous areas.
- **Establishment of an international early-warning mechanism** among defense authorities, civil aviation authorities, and space authorities to prevent misidentification and reduce risks to civil aircraft.
- **Strengthening the implementation of Article IX of the Outer Space Treaty** through practical procedures for consultations concerning activities that may cause potentially harmful interference.
- **Development of rules of conduct concerning close-proximity activities, destructive operations, and activities capable of generating large amounts of space debris**. Such rules could initially take the form of non-binding standards and subsequently be developed into a legally binding instrument.
- **Establishment of a standardized mechanism for recording and preserving technical data** in order to ensure accurate attribution of incidents and prevent claims that lack sufficient evidentiary support.
- **Strengthening procedures for pursuing compensation under the 1972 Liability Convention**, particularly in cases involving damage to aircraft and critical infrastructure.
- **Development of clear national guidelines concerning the relationship between airspace sovereignty, self-defense, aviation safety obligations, and rules of engagement**, so that emergency decisions remain consistent with international obligations.

- **Establishment of multilateral emergency communication channels** to prevent the unintended escalation of crises in which the origin or nature of a flying object is uncertain.
- **Promotion of scientific cooperation among legal scholars, aviation specialists, space experts, and safety professionals** to develop common technical-legal definitions.

13. Final Discussion and Analysis

An analysis of the existing legal instruments indicates that the challenge posed by the hypersonic and satellite era arises less from a complete absence of law than from the fragmentation of applicable rules and the rapid pace of technological development. The Chicago Convention establishes the principle of airspace sovereignty; the Outer Space Treaty provides the fundamental principles governing space activities, state responsibility, and cooperation; the Liability Convention regulates certain aspects of compensation for damage; and the United Nations Charter establishes the principal framework governing the prohibition of the use of force and the right of self-defense [1][2][3][5][6].

Accordingly, the appropriate legal solution is not to replace all existing rules with a single unified regime. A more effective approach would be to establish a **“coordinated legal framework”** linking air law, space law, the law of state responsibility, the law governing the use of force, and international humanitarian law. Within such a framework, each legal domain would retain its distinct role, while connecting rules and coordination mechanisms would be established for cross-domain incidents.

A distinction must also be maintained between a **“potential threat”** and an **“armed attack.”** A military satellite, a suborbital flight, or a hypersonic system does not, merely by virtue of its technical characteristics, trigger a single predetermined legal response. The nature of the conduct, its objective, effects, location, attribution, and the relevant political and military context must be assessed. This approach both prevents an excessively broad interpretation of the right of self-defense and preserves the possibility of a lawful response to an actual armed attack.

14. Conclusion

Reconsidering the legal framework for the defense of airspace in the era of satellite and hypersonic threats requires moving beyond a purely territorial perspective and developing a multidomain legal framework. The principle of complete and exclusive state sovereignty over airspace remains the fundamental basis of air law; however, space activities and highly high-speed flight systems have demonstrated that the operational boundary between airspace and outer space does not always correspond to their conceptual boundaries under international law [1][2].

With respect to satellite activities, the mere military nature of a satellite does not render it unlawful. Nevertheless, states bear specific responsibilities for national space activities and for the activities of non-governmental entities under their jurisdiction and are required to act with due regard to the corresponding interests of other states [2]. Likewise, in the hypersonic domain, high speed and maneuverability do not, in themselves, place a system outside the framework of the United Nations Charter. Where force is used, the rules of the Charter and, where an armed conflict exists, the rules of international humanitarian law remain the principal standards governing the legality of the conduct [5][6][7].

The principal finding of this study is that the current legal gap is not an **“absence of law”** in an absolute sense, but rather the **“absence of clear and coordinated rules governing cross-domain incidents.”** From this perspective, legal priorities should include clarifying the boundary between airspace and outer space, regulating hazardous space activities, strengthening warning and coordination mechanisms, standardizing attribution and evidentiary procedures, and improving compensation mechanisms. Such an approach would preserve state sovereignty, reduce the risks of misunderstanding, unintended conflict, and harm to civil aviation, and remain more consistent with the existing structure of international law.

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