

Artificial Intelligence and the Challenge of States' Responsibility in Space Law

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Abstract

The development of Artificial Intelligence (AI) in space technologies has reduced human intervention in space technologies in outer space. Although it has benefits, technological and legal issues are emerging in the space industry; e.g., does international space law cover the responsibility of states arising from AI behavior? Releasing data and information by AI has undermined privacy law when it is not rule-governed. State responsibility in international space law has been complicated by data and information obtained through AI. The private sector activities have extended beyond the control of their respective states, which is challenging to attribute actions of private companies that use AI to their respective state. This article suggests that the concept of a common-sense robot instead of due care of reasonable man be adopted to establish responsibility in the performance of AI in national and international space laws.

Keywords: Responsibility, Liability, Artificial Intelligence, Outer space, Due care.

1. Introduction

Artificial Intelligence (AI) developments are headed towards a future where machines make decisions without human analysis. AI systems in advanced technologies, including space technologies, are limiting human intervention in certain decisions where AI independently makes decisions. AI or machine intelligence are goal-oriented programs that use deep learning and neural networks to imitate human cognitive features. AI is not merely used for automating computing, nor is it restricted to cognitive functions. It is claimed that its goal is to create a multifunctional artificial brain capable of

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simultaneously performing cognitive functions and demonstrating human-like reasoning, judgment, and emotion.¹

Advancements in AI systems and diminishing human interference in decisions have led to better technologies, higher performance, and safety. However, new challenges are emerging despite these benefits of using AI; two are mentioned below. Although AI might produce more data and information, sharing them without the consent of the stakeholders and making them available to third parties could violate privacy and security. Moreover, AI could cause damage to people and property due to inefficiencies in AI performance levels. Therefore, regulating the behavior of AI systems and their applications within legal frameworks is necessary. Hence, the legislatures have to modify and amend traditional principles of responsibility and liability in social relations between individuals and third parties according to the conditions of the industrial society of the AI age.²

In the past, following the development of technologies and the gradual limitation of human intervention in production and services such as rail and air transportation, legislatures were obliged to amend principles of responsibility and liability in social relations between stakeholders of an industrial society. Humans became responsible for controlling and monitoring the use of machines and therefore became responsible for damages caused by the devices to the third parties. The human factor gained an essential role in establishing responsibility and liability and compensating damages, even though the human intervention caused the damages indirectly. The introduction of AI systems could make significant changes in legislation to regulate social relations involving these systems. As mentioned above, the human factor traditionally has had a vital role in establishing responsibility and liability. For instance, damages might occur in air accidents or environmental pollution, and indirect human intervention could cause such damages. However, in AI-related damages, the case is different since the human factor is no longer directly or indirectly involved in the damage caused by the AI; i.e., AI may independently cause the damage by its wrongdoing act. Thus, the principles, rules, and regulations governing responsibility and liability should be reviewed, modified, or even codified. Because to establish responsibility in the current rules based on necessary due care, diligence, negligence, and supervision, humans should be proved as wrongdoers. In the case of a decision-making AI, there exists no human factor.³

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- 1 L. Soroka, K. Kurkova, *Artificial Intelligence and Space Technologies: Legal, Ethical and Technological Issues*, *Advanced Space Law*, Volume 3, 2019.
 - 2 K. Muzyka, *The basic rules for coexistence: The possible applicability of metalaw for human- AGI relations*, DeGruyter, 2020.
 - 3 M. Chatzipanagiotis, *Whose fault is it? Artificial Intelligence and Liability in International Space Law*, IAC, 2020.

The question arises as to who should control or supervise the behavior of a decision-making AI or who is responsible for the decisions made by AI if damage occurs. Whereas this paper focuses on space law, the question is narrowed down: who is responsible for controlling or supervising AI if it causes damage to technologies used in space-based activities?

Most of the current premises in the national AI regulatory frameworks still emphasize the responsibility and liability of the owner or manufacturer of AI. However, they might go beyond the owner and manufacturer's responsibility shortly, when AI would make decisions without human intervention. In space law, the responsibility for controlling space-based activities using AI systems is more complicated. The states have a central role in managing, monitoring, and supervising the necessary due care; therefore, they only have an international responsibility against other states. However, factors such as the growth of private actors in outer space activities, AI in their space-based technologies, and emerging decision-making AI are restraining the oversight role of the states.

After elaborating on the current space law regime and defining challenging points, this paper introduces legal solutions within a comprehensive interpretation of space law to answer the abovementioned question. Furthermore, it might be advisable to adopt new regulations on the responsibility of AI in space activities; therefore, this paper explains the issues with the principles governing responsibility in existing international space law and provides suggestions for the responsibility of the states about the development and application of AI in space industries.

2. Responsibility and Artificial Intelligence

So far, AI has not been adequately addressed in international space law. The outer space activities are governed by the legal framework of outer space activities consisting of five international treaties: the 1967 Outer Space Treaty (OST), the 1968 Rescue Agreement, the 1972 Liability Convention, the 1975 Registration Convention, the 1979 Moon Agreement. To date, the treaties that might be related to AI are as follows: 1) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967 (OST); 2) Convention on International Liability for Damage Caused by Space Objects, 1972 (The Liability Convention), and 3) Convention on Registration of Objects Launched into Outer Space, 1976 (The Registration Convention).

According to Article VI of the outer space treaty," states party to this treaty shall bear international responsibility for national activities in outer space." One of the primary responsibilities of states could be on damage caused by objects or their parts that they launch or have launched into space. Space law treaties have not directly addressed the issues raised by the presence of AI in space activities. Nevertheless, this issue deserves due attention.

Although AI is proved to be helpful, it can also do damages. These damages can be material (e.g., endangering and increasing safety and health risk of persons; including loss of life and injury, or damage to the property) or immaterial (e.g., violation of privacy, freedom of expression, human dignity, and other rights). It can also involve a wide range of risks. Prevalence of futuristic perspectives, using AI technologies to access and explore outer space, and growth of the space-based business activities probably would lead to a wide range of intended and unintended consequences of using and abusing the new space technologies and systems⁴ such as:

1. Privacy issues of using AI-based space technologies, e.g., tracking and monitoring citizens, fake images, biased automatic decisions, unfair discrimination based on nationality, gender, race, geographical location, and lack of transparency.
2. Liability issues of damage caused by decision-making AI in collision to space objects or collision of a space object to space debris. Or damage caused by hacking and sabotage of AI systems aimed at manipulating them and their consequences on space data, which could endanger the security of sensitive data.⁵

The provisions of the current space law are not sufficient for using decision-making AI in space technologies because the international responsibility for monitoring and controlling space activities and the responsibility for compensation rests solely on the states. Expansion of space activities and the emergence of new actors other than states, i.e., the private sector, has opened up a new era for space law, where decision-making AI in space-based activities and space technologies, i.e., machines deciding without human intervention, has made the issue more severe and complex.

It is challenging to attribute the approximate cause of the responsibility of private space actors to a state due to the diversity of space-based activities. But it would be more problematic to attribute causality to decision-making AI and then to a private actor and finally to a specific state, such as a launching state. If an accident occurs due to decision-making AI, determining responsibility and liability and then compensating based on international space treaties would be difficult. Because it is not clear which state has international responsibility and in the event of damage, which states (launching state, registrar state, or the appropriate state) would be responsible and liable.

4 F. von der Dunk, "Legal aspects of navigation - The cases for privacy and liability: An introduction for non-lawyers", *Coordinates Magazine*, May 2015, <http://mycoordinates.org/legal-aspects-of-navigation/>

5 B. Cheng, Article VI of the 1967 Space Treaty Revisited: "International Responsibility," "National Activities," And the Appropriate State." 26 *Journal of Space Law* 7 (1998).

Article 6 of the 1967 Space Treaty affirms that contracting states will assume international responsibility, in response to national activities in outer space, including the Moon and other celestial bodies, be carried out by governmental or non-governmental organizations, and to ensure that national activities comply with the provisions of the space treaties. Article 6 is designed to recognize the international state responsibility for outer space activities, whether the space activities apply by public or private entities.

The activities of private entities in outer space, including the Moon and other celestial bodies, require the permission and continuous supervision of the contracting state of the 1967 Space Treaty. Therefore, according to Article 6 of this treaty, the states have an obligation to monitor and authorize the activities of their public and private institutions in outer space. Article 6 makes the states responsible for the actions of their national private sector in outer space and celestial bodies. Article 6 is significant because it makes states the main international actors in outer space activities, regardless of whether the space activities are scientific or commercial, and whether public or private entities carry them out. Therefore, by national law, the states can authorize the space activity of their national private companies and continuously control their performance. On the other hand, the international responsibility for the actions of the private sector in outer space lies with its national state.⁶

One of the main issues of article 6 is related to the role of private entities in outer space activities. This principle is contrary to the concept applicable under general international law. Because the direct responsibility of the states includes only actions that are directly attributable to the state(s), but in article 6, the state is generally also responsible for the conduct of the private sector in space activities, regardless of whether the private sector operates non-independently or independently.

Violation of international law by the launching state can be caused by space activities of a private entity when the state fails to maintain control of the space activities of private entities under its jurisdiction. According to the contrary concept, if the party-state has correctly and effectively issued licenses and has sustained control on these entities, it is not considered responsible according to Article 6 of the 1967 Space Treaty. This non-responsibility of the state party occurs when; despite the necessary due care and caution on space activities, the state actions that have led to damage have been carried out illegally by the private sector in its territory or by a private sector from a state has acted under the authority by issuing licenses of a third state. Article 6, therefore, implies that the doctrine of misconduct allows for a claim to be filed against a state that has not fulfilled obligation in issuing

6 J.A. Dennerley, *State Liability for Space Object Collisions: The Proper Interpretation of "Fault" for the Purposes of International Space Law*, 29 *EUROPEAN JOURNAL OF INTERNATIONAL LAW* 281 (2018).

licenses and continued monitoring of space activities under its jurisdiction, even if no damage has been caused. A state that permits space activities under its jurisdiction without proper and rational supervision shall provide sufficient evidence for fulfilling its international responsibility under Article 6.

Article 6 of the 1967 Space Treaty requires that the state ensure that the space activities of its public and private entities comply with the treaty. Article 6 not only makes the state internationally responsible for the control and supervision of its national activities in outer space but also obligates to issue “continuously license and certificate.” It should be noted that Article 6 does not explicitly oblige the “launching state” to issue an operating license and undertake to monitor the performance of the private sector. Instead, it mandates an “appropriate state.”

Neither Article 6 of the 1967 Space Treaty nor any other articles of the current space law regime define “appropriate state.” Nor does it provide any criteria for determining the appropriate state. There are no legal standards or consensus on an “appropriate State.” However, it is accepted that a launching state is generally deemed an appropriate state for Article 6. It can be a logical and accurate inference because the liability is based on the status of the launching state. Whereas the liability based on fault generally results from a breach of due care and negligence standard, the dual responsibility for issuing “continuous authorization and supervision by the appropriate contracting state” reasonably sets a standard of due care the launching state must follow by an intelligence space object.

This argument means that the launching state has due care to ensure issuing the necessary authorization and proper oversight on an intelligent space object launched by a non-governmental entity, regardless of its ownership or operator or whether it was owned by one of its citizens. Thus, investigating the specific due care standard that had caused the damage would change whether the launching state has issued the necessary adequate permits for the intelligent space object.

By comparing the issue of licensing and monitoring private sector performance in outer space with the “due diligence” standard under international law, determining whether the launching state has issued and implemented adequate licensing and monitoring would be a more flexible standard.⁷ Reasonably due care is not an obligation to achieve a specific result. Instead, as a behavioral obligation, it requires the launching state to

7 J.E. Messerschmidt, Hackback: Permitting Retaliatory Hacking by NonState Actors as Proportionate Countermeasures to Transboundary Cyberharm, *Shearman & Sterling Student Writing Prize in Comparative and International Law, Outstanding Note Award*, 52 *Colum. J. Transnat'l L.* 275, 302 - 305 (2013). See *United States Diplomatic and Consular Staff in Tehran (U.S. v. Iran)*, 1980 *I.C.J.* 3, 61 - 67 (May 24).

make sufficient and necessary efforts to prevent harm or injury to a third state, its nationals, or global businesses.⁸

Violation of this duty is not limited to the state action and includes the behavior of its citizens. When there is a minimum level of vigilance and general caution with the reasonably due care, a higher degree of care may be more realistic and expected from the states with the capacity and resources to provide it.⁹

The standard of due care for the launching state requires the state to authorize and monitor space activities used in AI in space objects. However, based on flexible standards of due care, it appears to be the function of the intelligent space object to determine whether human intervention or surveillance is needed and, if so, how much the appropriate degree and degree of oversight should be.

Article 6 of the 1967 Space Treaty stipulates states have international responsibility for national activities in space and explicitly allows private entities' space activity to be regulated with the permission and supervision of its national state(s). International responsibility under Article 6 can be used to claim for the damages resulting from improper control of space activities in their territory. Decision-making AI in space technologies can be subject to a general theory based on the concept of an internationally wrongful act. If a party state can prove the responsibility of another state by its AI failure, negligence, and fault that causes the damages, it can exempt itself from responsibility and liability.

3. Challenges and Solutions

The current space law regime does not conform to space activities' economic realities and conditions. Globalization of risks, rational planning of missions, intelligent information sharing, and technical assistance would change the principles and rules of state responsibility in space law.

Decision-making AI in space technologies causes a gradual change from human-assisted analysis and selection to human-to-computer selection to information analysis to autonomous machine analysis without the need for human behavior and its decision-making and implementation. It is gradually operating without human intervention. It has challenged the current space legal regime regarding liability in monitoring and control, which is one of the duties of states in outer space activities. It cannot be entirely consistent with

8 M.A. Gray, *The International Crime of Ecocide*, 26 Cal. W. Int'l L.J. 215, 238 (1996). at 242; Robert Rosenstock and Margo Kaplan, *The Fifty-Third Session of the International Law Commission*, 96 Am. J. Int'l L. 412, 416 (2002).

9 *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Seabed Mining Advisory Opinion at 117 (Seabed Dispute Chamber of the International Tribunal of the Law of the Sea, Case No 17, 1 February 2011)*.

the behavior of AI in which human decision-making has no role in AI's decision-making.

The current space law regime does not impose direct obligations on non-state entities. Instead, all responsibilities and obligations are assumed by the states. Article 6 of the 1967 Space Treaty stipulates that the space activities of non-governmental organizations must be subject to the continued supervision and control of states and that the regime does not apply directly to the private sector. Limiting the obligations and reparations associated with space activities to the states has essentially removed the regime from the rule of law and made it more like a policy. With the growing space economic and commercial activities, establishing a space law that applies directly to all actors in outer space, both governmental and non-governmental entities, is rooted in the rule of law. Unless there is a move beyond a state-centered space legal regime, international space law cannot address many of the issues raised, such as responsibility, jurisdiction, and the choice of a substantive law that is sound and enforceable.

No international body has compulsory jurisdiction to hear and issue judicially, legally, and arbitrarily the disputes between states and enforce their rulings. International jurisdiction over outer space disputes is based on the consent of all states that are parties to the solving conflict. In addition, since space law treaties do not impose direct obligations and duties on non-governmental organizations, there is no basis for international jurisdiction over non-governmental space actors. The limitation of the jurisdiction in the current space law regime becomes clearer when private entities directly seek to claim compensation from space activities. In such circumstances, jurisdiction is determined by national law unless parties to the dispute agree to refer the dispute to an arbitrator.

Although the principles of space law prohibit states from exercising sovereignty in space, it enshrines the principles of public international law that recognize the power of states to exercise their authority over extraterritorial action under certain conditions. International Customary Law recognizes five indicators for a state to conduct a private entity's extra-regional conduct: territorial, protection, national, passive, and global. Accordingly, the national laws of the competent states can logically extend to solve disputes over decision-making AI caused by space technologies. Even a state can enact specific national laws that give its courts or agencies jurisdiction to solve disputes about AI-based space activities. In any case, the jurisdiction of the state is considered appropriate only if such national law satisfies one of the five indicators of the jurisdiction of extraterritorial jurisdiction.¹⁰

10 G.A. Long, Legal Basis for a State's Use of Police Power Against Non-Nationals to Enforce Its National Space Legislation at 3, 70th IAC, Washington, DC, (Oct. 23, 2019).

The states are internationally obligated to establish a system to issue licensing and oversee the private sector activities under their national law. However, they can fulfill this duty and obligation according to their national way. The responsibility rules can be formulated within a comprehensive national space law or different laws and regulations. The procedure for issuing national licenses and permits differs from state to state, based on national law and regulation. This indicates that despite the growth of space activities of the private sector, the national state still governs the actions (including AI) through issuing licenses for the private entities. If a state fails to adopt such specified regulations, not only will it not be able to comply with Article 6 of the 1967 Space Treaty, but it will also fail to protect its national benefits and interests in outer space.

The United States is a technologically developed state that seeks to adopt the right of “appropriateness” of law and regulations for claims against decision-making AI—in general, proving the liability to compensate against a machine is made in the United States, claiming negligence of the owner/operator, or based on the manufacturer’s fault/negligence. The realization of negligence requires human intervention and product liability for software design or manufacturing defects, and failure to warn of foreseeable damage is relational. A design defect imposes liability when there is a predictable risk of damage, and the designer can prevent or limit the risk by using a rational alternative design. A deficiency of the production plan occurs when standards are not observed. Non-alerting occurs when the responsible party fails to safely provide instructions on using the software.¹¹ Legal issues of substantive law arise where the dispute relates to a space-based technology that is not covered by the space treaties or if a private entity decides to claim damage directly resulting from a space activity. If such a claim is brought to the jurisdiction of that state, the provisions of the conflict of law of that state may guide determining the substantive law and regulations. Judicial authorities in the United States have accepted the principles of customary international law, which are enshrined in an international treaty as the substantive law for resolving disputes.¹²

The flexibility criterion is consistent with the approach generally accepted by the European Commission (EC) on using AI. The European policy provides a flexible framework that can determine whether the launching state meets standards of care or is the state standard compatible with a function of an

11 J. Chung, A. Zink, H Watson - Can I Sue You for Malpractice? Examining the Liability of Artificial Intelligence in Medicine, 11 *Asia-Pacific J. of Health L. Pol'y & Ethics* 51, 68 (Nov. 2017), <http://eiblejournal.org/index.php/APHLE/article/view/84>.
M. Sword, To Err Is Both Human and Non-Human, 88 *UMKC L. Rev.* 211, 224 (2019).

12 *Castle John v. NV Mabeco*, 77 ILR 537 (Belgium Court of Cassation 1986); *Institute of Cetacean Research v. Sea Shepherd Conservation Society*, 708 F.3d 1099 (9th Cir. 2013).

intelligent space object that has caused damage to outer space. The European Union has enumerated some non-comprehensive aspects of human monitoring, including 1) reviewing and validating a Decision-making AI before or immediately after implementation, 2) monitoring the AI system at work and the ability to intervene in real-time and deactivate AI system, and 3) impose operational restrictions to ensure that the AI system does not make some decisions.¹³

What will be the situation when the responsibility of the launching state is impermissible according to the current space law regime? Is it possible to establish the responsibility of another entity based on the general principles? In case of damage due to lack of required supervision and control, can the launching state be held liable to fulfill its international responsibility for the damages and violation of the international obligation of due care?

Article 6 of the 1967 Space Treaty imposes unconditional and international responsibility on the launching state. The launching state can ignore or limit its responsibility for damage caused by an intelligent space object if flexible standards of due care are adopted. The flexible standards allow the launching state to argue that it has carried out due care, the private sector has the nationality of a third state, and the negligence that caused responsibility is attributable to that third state. This approach would shift the international responsibility from the launching state to the main state of the private space actor. Failure of a third state to properly implement surveillance standards, depending on the circumstances, may reduce or limit the liability based on the fault of the launching state under Article 3 of the Liability Convention. This change is not implemented automatically because compliance with the required due care standards depends on either the technological capabilities of the third state in AI or the availability of financial means to acquire such a specialty.

In addition to setting international space law and regulation for AI to ensure uniformity and coherence of rules on governing the state responsibility in monitoring the performance of AI application in outer space, it is necessary to pay special attention and set standards to establish the state responsibility for decision-making AI in the field of outer space activities. In this respect, licensing and supervision of decision-making AI in space technology can be entrusted to a single international authority and enjoy integrated management benefits. The international community, such as the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS), can use the states' procedures to draft and codify related international regulations. At that point, the designation of the responsible state would be based on the

13 European Commission, White Paper on Artificial Intelligence - A European approach to excellence and trust, COM (2020) 65 final (Brussels, 19.2.2020) available at https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf

regime that may be used to address damage or injury caused by using AI in outer space activities.

Therefore, firstly, laws and regulations on AI should be adopted by national legislators because currently, they ignore the issue of AI application in space technology. As a result, there are no specific regulations in this area that the states follow in the national space activities. The new concept of responsibility for AI, which has a machine character and has nothing to do with human behavior, can be used instead of the standard "reasonable man" used in current national and international law. It seems that the concept of a "common-sense robot" should enter into national space laws and then regulate international space treaties. Secondly, states need to follow uniform international regulations on AI. The lack of international rules on AI poses complex and potential problems for applicable law in resolving disputes to determine responsibility and liability for the misuse of AI and its decisions in space activities. Suppose AI is used in space technology, then its decision-making causes damage to space objects of another state where the responsibility under the space law regime is unrecognizable. In that case, it is unclear what substantive law should govern the state's responsibility on supervision, control, and compliance with the standard of due care.

4. Conclusion

The current space law regime has limitations and shortcomings. The regime uses rules and principles that are sometimes very general and vague. Unsurprisingly, there are limitations to govern the regime over AI system in space-based activities with no background or application in the ratified treaties. Moreover, after several decades, the current regime has not successfully met the needs of space activities and technologies in access, exploration, and use of outer space. A reason could be the ever-growing presence of private actors that raises concerns. The lack of international rules and standards in a new space law regime to deal with the above developments generally become more noticeable when a space technology causes damage or increases the risks of access to outer space due to a technology that uses decision-making AI.

The liability for defects in the design of an AI system depends on the specific industry or application that uses it. It can also be consistent with non-compliance with the rule of necessary due care to control and monitor space activities, ultimately establishing international responsibility and liability. Nevertheless, the concept of responsibility and liability relying on non-human behavior, an emerging perspective, perhaps requires adopting new liability rules and regulations for the AI system. The concept of responsibility for AI, the concept of a "common-sense robot," can be used instead of the standard "reasonable man."

The massive development of data and information, particularly the acquisition of confidential information of individuals and the violation of states' privacy and national security interests through AI decisions, challenges the international responsibility of states. There are yet no international rules to regulate it, although a few states have developed their national space law in this regard. The international space community needs to create a new roadmap, policy, and rules to regulate responsibility and liability standards for decision-making AI and its attribution to a commercial actor or a state because of the shortcoming to imply control and licensing. The UNCOPUOS is expected to put this issue on its agenda, adopt the relevant regulations in the framework of soft rights as a resolution or a guideline, advise the states to adopt related national law, and approve a hard law as a treaty for creating the uniformity of regulations.