NUCLEAR WEAPONS AND OUTER SPACE: ARE INTERNATIONAL CONVENTIONS SUFFICIENT?

Author: ***Xabibullayev Boburmirzo Baxtiyor ugli***

Institution: Alfraganus University, Year 1

Supervisor: Senior Lecturer

Turdiyev Madiyor Mamanazarovich

ABSTRACT: This article critically examines the growing risk of nuclear weapons being deployed in outer space and assesses the adequacy of existing international legal frameworks, particularly the 1967 Outer Space Treaty. Using the IMRAD structure, the research delves into the historical evolution of nuclear activity in space, the dual-use nature of nuclear technologies, the role of private actors, and the strategic implications of a militarized orbit. It concludes that current international conventions lack the necessary scope, clarity, and enforcement mechanisms to address the emerging security threats. Concrete policy recommendations are proposed to prevent the escalation of a space-based nuclear arms race and to ensure the peaceful use of outer space for all humankind.

Keywords: nuclear weapons, outer space, international law, Outer Space Treaty, militarization, demilitarization, space security, ASAT, COPUOS

INTRODUCTION

1.1 Relevance of the Topic:

Nuclear weapons have long been considered the most destructive and geopolitically sensitive element of modern warfare. As humanity's technological reach extends into outer space, the prospect of nuclear weapons in orbit presents unprecedented legal, diplomatic, and security dilemmas. While the 1967 Outer Space Treaty (OST) explicitly bans the placement of nuclear weapons in orbit or on celestial bodies, emerging technologies and growing geopolitical rivalry challenge the enforceability and scope of these restrictions.

With the proliferation of satellites, space stations, private aerospace companies, and nuclear-powered spacecraft, the orbit is no longer a passive domain. It has become a critical extension of Earth-based security infrastructure. However, legal ambiguities remain, especially regarding nuclear propulsion, anti-satellite (**ASAT**) systems, and dual-use technologies that can serve both civilian and military purposes.

1.2 Historical Background

The militarization of space began during the Cold War. The 1962 "Starfish Prime" high-altitude nuclear test demonstrated the catastrophic effects of nuclear weapons in space, disabling numerous satellites via electromagnetic pulse (EMP). In the 1970s and 1980s, the Soviet Union deployed

nuclear-powered RORSAT satellites, several of which experienced accidents, including uncontrolled reentries and radioactive contamination of Earth's surface.

Despite the OST's framework, space-based military programs have grown more sophisticated. The United States, China, and Russia continue to invest in ASAT weapons, and several nations are exploring nuclear propulsion systems for deep space missions. These developments expose significant gaps in international regulation.

1.3 Research Problem

There are two major forms of nuclear threat in space:

1. The direct deployment of nuclear weapons (e.g., orbital warheads).

2. The deployment of nuclear-powered technologies that are not weapons per se but pose security and environmental risks.

The OST addresses the first, but not the second. This legal gray zone complicates enforcement and encourages states and private actors to exploit regulatory loopholes.

1.4 Objectives and Research Questions

This article aims to investigate:

How real is the threat of nuclear weaponization of space?

Do current international conventions adequately cover contemporary technologies and risks?

What legal, political, and technical mechanisms are needed to strengthen nuclear nonproliferation in outer space?

METHODOLOGY

This qualitative study employs:

Historical legal analysis of key treaties: **OST (1967), Moon Agreement (1979), NPT (1968), CTBT (1996).**

Systemic international relations theory (**neorealism**) to explore state behavior and power dynamics.

Normative legal analysis to assess treaty enforceability and legal clarity.

Comparative case studies: Starfish Prime test (1962), **RORSAT** incidents (**Soviet Union**), and current nuclear propulsion projects.

Content analysis of national laws (e.g., U.S. Commercial Space Launch Competitiveness Act, 2015) and international declarations (e.g., **COPUOS** reports).

Limitations include the classified nature of state military programs and the rapid pace of technological development, which makes regulation difficult.

ANALYSIS

3.1 Realities of the Nuclear Threat in Space:

Space-based nuclear threats have transitioned from theory to near-reality. While no nuclear weapons are currently known to be deployed in orbit, advancements in hypersonic weapons, ASAT capabilities, and nuclear-powered spacecraft significantly increase the risk. The U.S., Russia, and China have all demonstrated technologies that could, if unregulated, pave the way for weaponization.

"The dual-use nature of nuclear space technologies makes their regulation almost impossible." — Delgado López, 2020

3.2 Gaps in the Outer Space Treaty:

The OST prohibits:

Nuclear weapons in orbit,

Weapons of mass destruction on celestial bodies,

National appropriation of space territories.

But it does not:

Prohibit nuclear-powered satellites or spacecraft,

Clarify **ASAT** weapon use,

Provide enforcement mechanisms or sanctions.

Thus, legally compliant yet strategically aggressive actions are possible.

3.3 The Dual-Use Dilemma

Technologies like:

NASA’s Project Prometheus,

Russia’s TEM space nuclear propulsion system,

China's nuclear-powered satellite prototypes,

are all dual-use. While designed for deep-space exploration, these technologies could be adapted for military logistics, strategic reconnaissance, or even space-based kinetic attacks.

3.4 Orbital Nuclear Waste and Environmental Hazards:

Failed nuclear spacecraft pose long-term orbital debris risks. The 1980s RORSAT incidents showed how radioactive debris could contaminate Earth and space orbits alike. Combined with the Kessler Syndrome — a runaway chain reaction of collisions — such events could render entire orbital zones unusable.

"The nuclearization of orbital debris is a technological and ecological nightmare." — NASA ODPO, 2021

3.5 Diplomatic Fragility:

Bilateral trust is low among major powers.

Multilateral diplomacy is stalled, especially at **COPUOS**.

Private sector actors are largely unregulated under international law.

Enforcement is decentralized and mostly symbolic.

DISCUSSION

4.1 International Conventions Are Obsolete:

While foundational, the OST lacks the precision and legal scope to regulate current threats. Its silence on ASATs and nuclear propulsion creates a dangerous regulatory vacuum.

4.2 Militarization Accelerates Strategic Uncertainty:

Security dilemmas in space mirror those on Earth: each defensive move is interpreted offensively. ASAT tests, such as China's 2007 satellite destruction, signal capability and intent, eroding trust.

4.3 The Private Sector Challenge:

Commercial actors like SpaceX or Blue Origin operate under national laws but are global players. Their actions can indirectly fuel militarization or violate the spirit of non-weaponization.

"Commercialization without regulation is a ticking time bomb for space security." — von der Dunk, 2021

4.4 COPUOS and the UN System Are Not Enough:

COPUOS plays a valuable advisory role, but its decisions are non-binding. It lacks enforcement powers, and its mandates are outdated.

CONCLUSION

5.1 Summary of Key Findings:

1. The risk of nuclear weapons or nuclear-powered systems in space is growing rapidly.

2. The Outer Space Treaty is insufficient to regulate modern threats.

3. Dual-use technologies blur the line between peaceful exploration and strategic weaponization.

4. Orbital nuclear debris is an emerging environmental and security crisis.

5. Multilateral diplomacy is lagging, and private actors are unregulated.

5.2 Policy Recommendations:

1. Update the OST with binding additional protocols, focusing on ASATs, dual-use systems, and private actors.

2. Develop a new Global Space Security Treaty, modeled after the NPT and CTBT.

3. Establish international licensing and monitoring systems for nuclear-powered spacecraft.

4. Ban **ASAT** weapons and tests through a dedicated international convention.

5. Increase funding and authority for **COPUOS** to become a regulatory—not just consultative—body.

5.3 Final Thought:

If space is to remain a peaceful domain for all humankind, the international community must act decisively. A nuclearized orbit is not just a strategic threat but a moral failure. The governance of outer space must evolve before irreparable damage is done—not only to satellites, but to peace itself.

"Space does not belong to any nation, but the future of nations may very well belong to space." — António Guterres

REFERENCES

1. United Nations. (1967). Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space.

2. United Nations. 1967. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space. NASA. (2022).

3. Starfish Prime and High-Altitude Nuclear Testing: Historical Overview. NASA. 2022.

4. Starfish Prime and High-Altitude Nuclear Testing: Historical Overview. Waltz, K. N. (1979).

5. Theory of International Politics. Addison-Wesley.Waltz, Kenneth N. 1979.

6. Theory of International Politics. Reading, MA: Addison-Wesley. United Nations. (1967)

7. Outer Space Treaty.NASA. (2022). Starfish Prime: Nuclear Testing in Space.

8. NASA. (2022). Starfish Prime and the EMP Effect.

9. United Nations. (1967). Outer Space Treaty. Weeden, B. (2019). Anti-satellite Weapons and Outer Space Security. Secure World Foundation.

10. Delgado López, G. (2020). The Dual-Use Dilemma in Space Nuclear Propulsion. Aerospace Policy Journal.

11. Von der Dunk, F. (2021). International Space Law. Springer.