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Back to the Future: Outer Space Policy Review of the Past for Clues to the Future

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BACK TO THE FUTURE OUTER SPACE POLICY REVIEW OF THE PAST FOR CLUES TO THE FUTURE

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ABSTRACT

Sixty years later, Professor Paul B. Larsen revisits and discusses seven outer space legal issues identified by early space law experts and their current impacts on space policy. The first section addresses the ambiguous boundary of the non-sovereign outer space legal regime which, increasingly causes states to claim control of non-sovereign outer space. Second, Larsen analyzes how the lack of outer space regulation by an international agency like the International Civil Aviation Organization has encouraged states to seek to control outer space unilaterally. Third, although the original aim of space law experts was for outer space to be free for exploration and use by all states, increasingly, outer space is being controlled by competing groups of states. Fourth, outer space was originally dedicated to peaceful use with minimal allowance for the military uses then in effect, but now military uses are voluminous and growing, with conflicts possible in the near future. Fifth, all persons in outer space were originally military acting as envoys of mankind to be rescued in the event of accidents. However, the sixth section explores how persons in outer space are increasingly now employed by competing non-governmental operators or perform military functions, not acting as envoys of mankind. Lastly, the adoption of a private international law convention on liability might require non-governmental operators to obtain adequate insurance coverage to reimburse for conjunctions, as a condition for permission to enter outer space.

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I. INTRODUCTION

As humans move into outer space, we increasingly think of planet Earth as one unit in relation to other planets rather than as sections of planet Earth contending with each other. An example of the latter is China and Russia conflicting with the United States and NATO. That new way of thinking grew after the devastation of World War II, which evidenced the futility of war and led to the creation of the United Nations. The current local wars in the Ukraine and the Middle East may be viewed as lessons in the futility of local wars.

Movement of peoples from the Earth towards outer space began with the launch and orbit of the Sputnik satellite in 1957, which triggered active work on a legal framework for outer space.[1] After ten years of active public debate among lawyers familiar with the issues, the states agreed in 1967 on the Outer Space Treaty (OST), which established a legal framework based on then-current space technology.[2] But subsequent political, technical, military, and commercial additions have weakened the 1967 OST resulting in current and prospective conflicts in outer space. The space power states in particular have established special outer space military authorities which view outer space as a warfighting military domain.[3]

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[1] Paul B. Larsen, *A Sample of Space Law Opinion*, 27 Ohio State L. J. 462, 467–70 (1966) [hereinafter *Space Law Opinion*].

[2] *See generally* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[3] Jon Harper, *US Military Publishes New Joint Warfighting Doctrine*, DefenseScoop (Sept. 13, 2023), https://defensescoop.com/2023/09/13/us-military-publishes-new-joint-warfighting-doctrine/ [https://perma.cc/SEN6-BY4S]; *War in Space is No Longer Science Fiction*, The Economist (Jan. 31, 2024), https://www.economist.com/international/2024/01/31/america-china-and-russia-are-locked-in-a-new-struggle-over-space [https://perma.cc/D22A-SZYJ] [hereinafter *War in Space*] (quoting Christopher Grady, vice-chairman of America's joint chiefs of staff, who

As of 2023, the value of the global space industry was estimated at $469 billion and is expected to grow to $1 trillion by 2030.[4] The number of tracked orbiting space objects measuring larger than 10 centimeters has grown to 27,896.[5] Their traffic is without effective international management resulting in ever greater danger of collisions.[6] The danger of outer space conjunctions is further increased by the rapid growth of uncontrolled space debris in orbit.[7] Lack of space traffic coordination leads to conjunctions causing conflicts among states and satellite operators.[8] Danger of conflicts in outer space also exists on non-sovereign outer space celestial bodies such as the Moon and other planets. Space powers are currently planning to control and permit their non-governmental (i.e., commercial) entities to mine resources on the Moon and other planets, leading to possible conflicts with other space powers wishing to exploit valuable outer space resources.[9] Recent discord in the United Nations Open Ended Working Group (OEWG) on Reduction of Threats Through Norms, Rules and Principles of Responsible Behavior underscores the difficulty states face in addressing the increasing danger of conflicts in outer space.[10]

The magnitude of current conflicts in outer space justifies a re-examination of the discussion leading up to the 1967 OST. How

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said "[s]pace has emerged as our most essential warfighting domain"); Rebecca Boyle, *What We Do to the Moon Will Transform It Forever*, N.Y. TIMES (Jan. 21, 2024), https://www.nytimes.com/2024/01/21/opinion/moon-commercial-companies-transform.html [https://perma.cc/Y8BQ-2CAJ].

[4] Boyle, *supra* note 3.

[5] Theresa Hitchens, *US Leads World in 2023 Launches, Sats on Orbit: Study*, BREAKING DEF. (Jan. 4, 2024), https://breakingdefense.com/2024/01/us-leads-world-in-2023-launches-sats-on-orbit-study/ [https://perma.cc/Q7XE-BAQ7].

[6] Bruce McClintock et al., *The Time for International Space Traffic Management is Now*, RAND (June 5, 2023), https://www.rand.org/pubs/research_briefs/RBA1949-1.html [https://perma.cc/R2QK-FJR9].

[7] European Space Agency, *One Million Astronomical Objects*, YOUTUBE (Dec. 26, 2023), https://www.youtube.com/watch?v=0Cm0AaHk6bY [https://perma.cc/GC48-Q8KL] [hereinafter *One Million Astronomical Objects*] (explaining that one million space debris objects larger than one centimeter are orbiting Earth and are large enough to cause considerable damage to spacecraft.).

[8] McClintock et al., *supra* note 6.

[9] Paul B. Larsen, *Is There a Legal Path to Commercial Mining on the Moon?*, 83 UNIV. PITT. L. REV. 1, 6 (2021).

[10] Ephrat Livni & Vivienne Walt, *The Cost of Nuclear War in Space*, N.Y. TIMES (Feb. 24, 2024), https://www.nytimes.com/2024/02/24/business/dealbook/the-cost-of-nuclear-war-in-space.html [https://perma.cc/MD2R-7TP9]; Brian Weeden, *2022 Open-Ended Working Group on Reducing Space Threats*, SECURE WORLD FOUNDATION 1, 2 (Oct. 2023), https://www.nytimes.com/2024/02/24/business/dealbook/the-cost-of-nuclear-war-in-space.html [https://perma.cc/65CR-PJR7].

did legal experts in the 1950s and 1960s view the future of outer space? Did the negotiators of the OST fail to recognize fundamental principles or ideas that could have saved the world from the dangerous conflicts now facing the Earth? Is it too late for strong advocacy for an international outer space treaty organization like the International Civil Aviation Organization (ICAO) to ameliorate the current great danger of international conflict in outer space?

The early visions of a legal framework for outer space were developed in the 1950s and 1960s,[11] leading up to the 1967 OST negotiated by the United Nations.[12] During that time period, there was much discussion of relevant issues among space law legal experts. Their visions were recorded in a contemporary survey by the author in 1964–1965, funded by a research grant from the German Alexander von Humboldt Foundation.[13] Twenty-two space law experts responded to a space law questionnaire either in person or by mail.[14] The focus of the questionnaire was on the fundamental legal issues of outer space.[15] Space law was then in its embryonic state and the persons working seriously in the field were easily identifiable.[16] They included European experts such as Alex Meyer, Isabella Diederiks-Verschoor, and Julian Verplaetse,[17] as well as American space lawyers such as John Cobb Cooper, Myres McDougal, and Ivan Vlasic.[18] The survey, *A Sample of Space Law Opinion*, was published in the Ohio State Law Journal in 1966.[19] The twenty-two space law experts were divided into four main groups.[20] Eight experts came from space powers, the US and the USSR, which were the states that had already launched

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[11] Alex Meyer, *Legal Problems of Outer Space*, 28 J. Air L. & Com. 339, 340 (1961). *See generally* Alex Meyer, Address at the Third International Astronautical Congress: Legal Problems of Flight into the Outer Space (Sept. 1952).

[12] Outer Space Treaty, *supra* note 2.

[13] *Space Law Opinion*, *supra* note 1, at 462. The University of Cologne, Institute of Air, Space and Cyber Law was the location for the research, although it involved much international travel. With the kind agreement of the then-director of the Institute, Alex Meyer, a space law expert, the author contacted other recognized space law experts in 1964.

[14] *Id.*

[15] *Id.*

[16] *Id.*

[17] *See generally* Julian G. Verplaetse, International Law in Vertical Space (1960).

[18] *See generally* Myres S. McDougal, Harold D. Lasswell & Ivan A. Vlasic, Law and Public Order in Space (Yale University Press, 1963).

[19] *See generally Space Law Opinion*, *supra* note 1. The survey was submitted to the Committee on the Peaceful Uses of Outer Space (COPUOS) Legal Subcommittee by Dr. Nandasiri Jasentuliyana, a lawyer assisting the UN Legal Committee.

[20] *Space Law Opinion*, *supra* note 1, at 462–63.

satellites into outer space.[21] The non-space power group consisted of the remaining fourteen space lawyers.[22] They came from Canada, United Kingdom, Germany, the Netherlands, Belgium, Yugoslavia, Argentina, and Poland.[23] Four of the legal experts were members of the COPUOS Legal Subcommittee, whereas the remaining eighteen were not.[24] They came from nine different states.[25]

A Sample of Space Law Opinion, published in 1966, highlights the conflicts and controversies discussed by the legal experts preparing the OST in 1967.[26] Those topics continue to cause conflicts today.[27] Technological, economic, and political issues have developed to such an extent that it may be difficult to detect the original issues. Several of the issues have become so controversial that they may cause military conflicts in outer space contrary to the wish of the early space law experts who desired to dedicate outer space to peaceful uses.[28]

The issues raised by the questionnaire and discussed in *A Sample of Space Law Opinion* generally focused on the global nature of activities in outer space.[29] They stress the communality of outer space as later reflected in OST Article II, which states that no one state or individual may appropriate outer space including celestial bodies, and Article I's declaration that "outer space shall be carried out for the benefit and in the interests of all countries . . . and shall be the province of mankind."[30] Seven of the main issues will be discussed below.

II. BOUNDARY OF THE NON-SOVEREIGN OUTER SPACE LEGAL REGIME

A. The Ambiguous Boundary

The twenty-two space law experts in *A Sample of Space Law Opinion* discussed whether outer space is different from air space and

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[21] *Id.*
[22] *Id.*
[23] *Id.*
[24] *Id.*
[25] *Id.*
[26] *Id.* at 462.
[27] Ram Jakhu & Nishith Mishra, *The Beginning of the End of International Space Law*, *in* Human Flourishing: The End of Law 845 (Brill, 2023).
[28] *See War in Space*, *supra* note 3.
[29] *Space Law Opinion*, *supra* note 1, at 468–78.
[30] Outer Space Treaty, *supra* note 2, at art. I–II.

should therefore be subject to a different legal regime.[31] The experts were all familiar with Article I of the 1944 Chicago Convention on International Civil Aviation (Chicago Convention), which provides that "every State has complete and exclusive sovereignty over the airspace above its territory."[32] The space law experts tended to view outer space as virgin territory to be used for peaceful purposes, particularly so because the early formation of space law began right after World War II.[33] Wernher von Braun, the German developer of rockets created to bomb England, had premonitions of the future use of rockets in outer space, realizing that military use of outer space would be dangerous to both friend and foe.[34] Therefore, he favored peaceful use of outer space.[35] That was the formative legal principle of the space law experts.[36] While experts agreed outer space warranted a different legal regime than air space, most wanted to delay a specific orbital delimitation of air space until further development of space technology.[37] But some experts from the two space powers, the US and the USSR, favored specifically defined delimitation of air space from the beginning.[38]

The 1967 OST reflected the visions of the space law experts regarding division between air space and outer space by adopting a different legal regime for outer space. Article II states that, "[o]uter space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[39] While the OST did not expressly state a specific altitude, it did so indirectly by stating in Article IV that states are prohibited from placing "in orbit" space objects "carrying nuclear weapons or any other

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[31] *Space Law Opinion*, *supra* note 1, at 472–73.

[32] Convention on International Civil Aviation art. 1, Dec. 7, 1944, 15 U.N.T.S. 295 [hereinafter Chicago Convention].

[33] *Space Law Opinion*, *supra* note 1, at 474.

[34] *See* Owen Edwards, *Wernher von Braun's V-2 Rocket*, SMITHSONIAN (Aug. 2011), https://www.smithsonianmag.com/arts-culture/wernher-von-brauns-v-2-rocket-12609128/ [https://perma.cc/6NB5-D6QJ].

[35] *See* Michael J. Neufeld, et al., *Wernher von Braun's Ultimate Weapon*, 63 BULLETIN OF THE ATOMIC SCIENTISTS 50, 50 (2007). *See also* Address at the Third International Astronautical Congress: Legal Problems of Flight into the Outer Space, *supra* note 11.

[36] *Space Law Opinion*, *supra* note 1, at 474.

[37] *Id.* at 468–69; *see also* FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 135–63 (2d ed. 2017).

[38] *Space Law Opinion*, *supra* note 1, at 468–69.

[39] Outer Space Treaty, *supra* note 2, at art. II.

weapons of mass destruction."[40] Minimum orbital altitude is thus identified as being outer space, subject to the OST.[41]

The absence of a specified division between air space and outer space leaves the reach of national jurisdiction unclear. That uncertainty is magnified by OST Article VIII, which declares that launching states retain jurisdiction over their registered space objects and personnel on board when launched into outer space.[42]

The uncertainty has left room for states to claim different delimitations. For instance, in the Bogota Declaration, seven equatorial states claimed the space below the geostationary orbit level (roughly 24,000 miles) is subject to their national sovereignty.[43] But Australia, Denmark, and certain other countries have adopted the minimum orbital level (60 miles) as the level at which outer space begins.[44] The latter altitude is increasingly accepted as the dividing line between sovereign air space and non-sovereign outer space.[45] Recent national claims by space powers and allies have also begun to cut across and confuse existing concepts of national jurisdiction in outer space. States that signed the Artemis Accords (currently, the US and forty-one other states) have agreed to respect signatories' national mining claims on the Moon.[46] They also agree to establish and respect reasonable safety zones around their mining claims.[47] Further complicating the mix is the 2020 Trump Space Policy Statement, which asserts that outer space is a military domain used for warfighting purposes,[48] and is difficult to harmonize with the OST prohibition on national appropriation of outer space by "any other means."[49]

The increasing deployment of special military forces and weaponry for both defensive and offensive purposes in outer space between the US/NATO allies and Russia/China allies increasingly disregards efforts to establish specific division between air

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[40] *Id.* at art. IV. Minimum orbit is approximately 60 miles above sea level.

[41] *See id.*

[42] *See id.* at art. VIII.

[43] LYALL & LARSEN, *supra* note 37, at 160–62.

[44] *Id.*

[45] *See id.*

[46] *See Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes*, NASA § 10, ¶ 2 (Oct. 13, 2020) [hereinafter *Artemis Accords*]. State parties to the Artemis Accords claim that extraction of space resources does not constitute national appropriations under OST Article II.

[47] *Id.* at § 11, ¶ 7–11.

[48] The National Space Policy, 85 Fed. Reg. 81755, 81769 (Dec. 9, 2020).

[49] Outer Space Treaty, *supra* note 2, at art. II.

space and outer space.[50] Initially, the distinction of air space and outer space would have seemed natural.[51] But the Space Race saw a growing recognition of outer space as a military domain for fighting wars, which in turn spurned the unbridled military race between the space powers that has disregarded the distinction between air space and outer space.[52]

B. Evaluation

The space law experts advocated for a clear difference between air space and outer space but did not agree on a defined borderline between the two regimes.[53] Subsequent political and technological development make such a division even more difficult. To revive the space law experts' concept of a clear distinction between the two regimes, one option is for states to simply amend the OST by adding a delimitation of air space. This is supported by Article 1 of the Chicago Convention, which recognizes that states have sovereignty over air space above their territory.[54] The upper limit of air space has become an issue because spacecraft pass through airspace to reach outer space as well as on their reentry.[55] Thus, states could add a delimitation of air space to Article 1. COPUOS has discussed the division between air space and outer space.[56] That discussion could establish a delimitation guideline for states to follow. A second option is for states like Australia or Denmark, which recognize an upper delimitation of air space at 100 kilometers (60 miles), to bring a lawsuit in the International Court of Justice (ICJ) against a state interfering with its space objects under the 100-kilometer limit.[57] The ICJ might

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[50] *See War in Space*, *supra* note 3.

[51] *See Space Law Opinion*, *supra* note 1, at 468.

[52] *See War in Space*, *supra* note 3.

[53] *Space Law Opinion*, *supra* note 1, at 463.

[54] Chicago Convention, *supra* note 32, at art. I.

[55] The Federal Aviation Administration awarded astronauts wings to people flying over 50 miles above the earth. It no longer does so. *See FAA Ends Commercial Space Astronaut Wings Program, Will Recognize Individuals Reaching Space on Website*, Fed. Aviation Admin. (Dec. 10, 2021), https://www.faa.gov/newsroom/faa-ends-commercial-space-astronaut-wings-program-will-recognize-individuals-reaching [https://perma.cc/V8VS-VDBC].

[56] Frans G. von der Dunk, *The Delimitation of Outer Space Revisited: The Role of National Space Laws in the Delimitation Issue*, 51 Space, Cyber, and Telecomms. L. Program Fac. Publ'ns 254, 254 (1998).

[57] *See* Tommaso Sgobba & Mini Gupta, *Proposing an International Convention for an Intermediate Region Between Airspace and Outer Space Instead of the "Karman Line"*, 9 J. of Space Safety Eng'g 127, 127 (2022). Another state might try to seize a defunct foreign satellite to clear outer space of space debris.

then use the OST's prohibition on placing nuclear weapons in orbit as the legal precedent for recognizing 100 kilometers as the limit.[58]

III. OUTER SPACE REGULATION BY AN INTERNATIONAL LEGAL REGIME

A. Visions of Outer Space Regulation

Almost all of the legal experts interviewed for the Space Law Survey had extensive air law backgrounds.[59] They were familiar with the 1944 Chicago Convention establishing the ICAO as the UN agency for international civil aviation decision-making.[60] ICAO establishes international standards and recommended practices as annexes to the Convention.[61] ICAO member states are required to implement the ICAO standards and practices, but they retain the ability to opt out when needed.[62] In its early years, the ICAO did not indicate interest in regulating outer space.[63]

The legal experts interviewed by the author in 1964–1965 favored an international treaty organization for outer space to establish international standards and recommended practices for outer space activities.[64] The two space powers, USA and the USSR, were competing for the proverbial high ground.[65] They were focused on national defense and viewed the OST as a disarmament treaty.[66] They agreed in the OST that outer space should not be subject to national domination by any state, but they did not agree on establishing an international space agency to adopt international standards prohibiting national appropriation of and claims to sovereignty of outer space.[67] During the OST negotiations, developing countries expressed their resentment of the space powers' domination of space, instead preferring an international organization, like ICAO, to establish common

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[58] Outer Space Treaty, *supra* note 2, at art. IV.

[59] *Space Law Opinion*, *supra* note 1, at 462–63.

[60] Chicago Convention, *supra* note 32, at art. 37.

[61] Paul S. Dempsey, *The Intersection of Air Law & Space Law*, *in* Pub. Int'l Air L. 741, 762 (2008).

[62] *Id.* at 763; Paul B. Larsen, *Space Activities and Their Effect on International Civil Aviation*, 9 Proc. on Outer Space 159, 163 (1966).

[63] *See Dempsey*, *supra* note 61, at 762.

[64] *Space Law Opinion*, *supra* note 1, at 469–70.

[65] *See generally* Sun Tzu, The Art of War 84 (Luzac & Co., 1910).

[66] Paul B. Larsen, *Outer Space Arms Control: Can the USA, Russia and China Make This Happen*, 23 J. of Conflict & Sec. L. 137, 156 (2018) [hereinafter *Outer Space Arms Control*].

[67] Outer Space Treaty, *supra* note 2, at art. I.

international standards and recommend practices for their future outer space activities.[68] The European Union (EU) also sought to establish an international code of conduct establishing universal rules of behavior for outer space activities.[69] But the space powers went in a different direction. They have pursued unilateral approaches rather than a common approach to the regulation of outer space.[70]

The states negotiating the OST formed COPUOS to become a standing forum for discussion of outer space issues, but it lacked the decision-making capability of a separate agency for outer space issues.[71] COPUOS can only adopt voluntary guidelines like the 2007 Space Debris Guidelines.[72] Furthermore, action by COPUOS requires consensus of all the states, which is difficult to accomplish, and as of 2024, states have instead opted for parallel processes resulting in polarization among competing states.[73]

B. Examples of Unilateral Space Management by States in the Absence of an International Agency for Outer Space

1. Unilateral Space Traffic Management by the United States[74]

The US has adopted national space traffic regulation for US-registered spacecraft. US non-governmental satellites are registered

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[68] *See Outer Space Arms Control*, *supra* note 66, at 148.

[69] *See* European External Action Service (EEAS), *International Code of Conduct for Outer Space Activities* (Mar. 31, 2014).

[70] Jakhu & Mishra, *supra* note 27, at 845.

[71] G.A. Res. 1348 (XIII), at 5 (Dec. 13, 1958).

[72] *Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space*, United Nations iv (2010) [hereinafter *Space Debris Mitigation Guidelines*].

[73] Press Release, General Assembly, *Consensus Scuttled in First Committee over Two Competing Draft Resolutions on Space Security, Creating Parallel Processes, Polarization, Say Speakers*, U.N. Press Release GA/3730 (Oct. 31, 2023). National regulation of national traffic in outer space was left with the state of registry by OST Article VIII. Outer Space Treaty, *supra* note 2, at art. VIII. Individual states cannot control foreign traffic in outer space, because outer space is not subject to national sovereignty. *Id.* at art. I. Thus, the states coordinate among themselves or coordinate within the COPUOS. *See id.* at art. VIII; Dempsey, *supra* note 61, at 763. However, COPUOS resolutions are not binding. Chicago Convention, *supra* note 32, at 368. The states resort to national regulation of space traffic by adopting national or regional space traffic management. *See* Outer Space Treaty, *supra* note 2, at art. VIII.

[74] *See generally* Paul B. Larsen, *Minimum International Norms for Managing Space Traffic, Space Debris, and Near Earth Object Impacts*, 83 J. Air. L. & Com. 739 (2018); Paul B. Larsen, *Space Traffic Management—The Bin Cheng Model*, 44 J. Space L. 483 (2020) [hereinafter *Space Traffic Management*].

by the US Government.[75] Each satellite must be authorized by the Federal Aviation Administration (FAA), which imposes construction and operating requirements before granting authority to launch into orbit.[76] The US Department of Commerce (DOC) also regulates space traffic with the objective of promoting US civilian space traffic.[77] The DOC relies on Department of Defense (DOD) tracking and space operators' self-interest in protecting their satellites from collisions.[78] Active space traffic regulation is done by the Federal Communications Commission (FCC), an independent US government agency which requires radio frequency and orbital permits for non-governmental operators.[79] The FCC issues a heavy monetary fine to a civilian satellite operator that fails to remove its defunct satellites in accordance with its FCC permit.[80] Active space traffic management by the FCC could conceivably become part of International Telecommunication Union (ITU) regulation of radio frequencies by international space traffic management the same way the FCC has decided to regulate the use of radio frequencies by US registered satellites.[81]

2. Space Traffic Management by the European Union and European Space Agency

European space operators are subject to regulation by the EU and European Space Agency (ESA).[82] The EU is in the process of adopting space traffic management measures.[83] Many Europeans feel that US space traffic policy favors US satellite operators and

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[75] *See Space Traffic Management*, *supra* note 74, at 492. *See also* Convention on the Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.T.S. 695, 1023 U.N.T.S. 15 [hereinafter Registration Convention].

[76] *Id.*

[77] *Id.* at 489.

[78] *See* Clayton Swope, *Mission Authorization: Decoding the Space Policy Dilemma*, CSIS (Dec. 20, 2023), https://www.csis.org/analysis/mission-authorization-decoding-space-policy-dilemma [https://perma.cc/K2GX-SKZZ]; Paul B. Larsen, *Profit or Safety: Which Way Is Outer Space Headed?*, 86 J. Air L. & Com. 531, 545–46 (2021) [hereinafter *Profit or Safety*].

[79] *Profit or Safety*, *supra* note 78, at 564.

[80] *Space Traffic Management*, *supra* note 74, at 494–95. The FCC is the US agency that implements ITU rules and decisions. *See infra* Section VII.

[81] *Space Traffic Management*, *supra* note 74, at 510.

[82] *ESA and the EU*, European Space Agency, https://www.esa.int/About_Us/Corporate_news/ESA_and_the_EU [https://perma.cc/2GLT-MRW7].

[83] *Draft Council Conclusions on "Space Traffic Management: State of Play"*, at 1, COM (2023) 15231 final (Nov. 16, 2023) [hereinafter *Draft Council Conclusions*].

thus handicaps European civilian space operators.[84] Therefore, they will adopt unilateral European space traffic management in the short term.[85] In the long term, the ESA and EU favor uniform international space traffic management. Ultimately, they feel that all the satellite operators, whether they be European, US, Chinese, Russian, or non-space powers, should be subject to common international space traffic rules for the purpose of maximum safety and collision avoidance, which is in line with the wishes of the original space law experts.[86]

3. China and Russia

In 2021, China complained to the United Nations that Space X's Starlink satellites caused conjunctions with the Chinese Space Station.[87] The US authorizes and supervises Starlink in accordance with OST Article VI.[88] The US makes space traffic information available on its military tracking system.[89] But the US and Chinese tracking systems are not connected, which may cause conjunctions. The US invited Chinese and Russian space traffic to use US space traffic tracking, but China and Russia declined to do so, instead using their own space traffic systems because they view US traffic systems to be linked to US military services and to favor US space traffic.[90] Thus, despite the rapid growth of orbiting space objects and the increasing danger of conjunctions,

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[84] *See generally* Gerard Brachet & Xavier Pasco, *The 2010 US Space Policy: A View from Europe*, 27 SPACE POL'Y 11, 14 (2011).

[85] *See Draft Council Conclusions*, *supra* note 83, at 1.

[86] Aurelie Pugnet, *European Space Agency Pushes for Space Debris Treaty*, EURACTIV (Nov. 6, 2023), https://www.euractiv.com/section/global-europe/news/european-space-agency-pushes-for-space-debris-treaty/ [https://perma.cc/7A9J-7MY7]; Paul B. Larsen, *Space Traffic Management Standards*, 83 J. AIR L. & COM. 359, 387 (2018) [hereinafter *Space Traffic Management Standards*].

[87] U.N., Comm. On the Peaceful Uses of Outer Space, Information Furnished in Conformity with the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, U.N. Doc. A/AC.105/1262 (Dec. 6, 2021).

[88] Outer Space Treaty, *supra* note 2, at art. VI.

[89] *See generally* SPACE-TRACK, https://www.space-track.org/ [https://perma.cc/JU4C-W3L7].

[90] *See* Sandra Erwin, *Space Force Official: Lack of Communication with China Increases Risk of Mishaps in Orbit*, SPACE NEWS (May 17, 2023), https://spacenews.com/space-force-official-lack-of-communication-with-china-increases-risk-of-mishaps-in-orbit/ [https://perma.cc/4WMX-R3U5].

China and Russia rely on their own unilateral space traffic tracking systems.[91]

4. Other States' Space Traffic Management

Space traffic from states other than the USA, China, Russia, and the EU collect traffic information available from domestic as well as foreign sources.[92] They invite foreign satellite operators to use their traffic management systems.[93]

5. Military Tracking of Space Traffic

Space objects can be disruptive and dangerous to military as well as to civilian space traffic. Military authorities therefore track military and civilian satellites as well as large debris regardless of nationality.[94] DOD tracks these objects not only for conjunctions dangers, but also for military threats.[95] DOD shares information with civilian space operators. China and Russia similarly maintain their own independent space tracking systems linked to their military authorities and share some information with other states.[96] Some military functions and the purposes of military space traffic are kept secret and are not disclosed.[97]

6. Space Debris Interference with Satellite Traffic in Outer Space

Space debris from defunct satellites and past collisions present a growing danger of conjunction with satellites. The US military

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[91] The separation of the national tracking systems illustrates the dangers of uncoordinated systems of space traffic management. *See, e.g.*, Kristin Burke, *The PLA's New Base for Space Situational Awareness—Opportunities and Challenges for the U.S. China Aerospace Studies Institute*, CHINA AEROSPACE STUDIES INSTITUTE 1 (Sept. 2023).

[92] Marlon E. Sorge, et al., *Space Traffic Management: The Challenge of Large Constellations, Orbital Debris, and the Rapid Changes in Space Operations*, CTR. FOR SPACE POL'Y AND STRATEGY 5 (Sept. 2020).

[93] Nayef Al-Rodhan, *Space Traffic Control: Technological Means and Governance Implications*, SPACE REV. (Apr. 16, 2018), https://www.thespacereview.com/article/3473/1 [https://perma.cc/H5AQ-QHPH].

[94] *See* Jon Gertner, *Infinite Battlefield*, N.Y. TIMES MAG., Nov. 12, 2023, at 9.

[95] *See id.*; Eric Lipton, *Pentagon Puts Missile-Tracking System in Orbit*, N.Y. TIMES Feb. 16, 2024, at A13.

[96] *See* Al-Rodhan, *supra* note 93.

[97] For example, Russia is known to have closely tracked several INTELSAT satellites for military purposes. *See Russian Satellite Maneuvers Illustrate Why U.S. Alarm Bells are Ringing*, SPACE NEWS (Nov. 6, 2015), https://spacenews.com/editorial-russias-orbital-provocations/ [https://perma.cc/Q7PM-UQAE].

space tracking service tracks all large space debris objects weighing more than fifty pounds, but there are millions of smaller debris objects which can cause significant damage to existing satellites.[98] The danger of conjunctions with space debris in Low Earth Orbit (LEO) is particularly great. Since the orbits of debris cannot be controlled, debris can only be avoided by a satellite navigating around them.[99] Space objects including space debris are subject to the Convention on the International Liability for Damage Caused by Space Objects.[100] The Voluntary Space Debris Guidelines adopted in 2007 by COPUOS have succeeded in mitigating space debris conjunctions somewhat but not sufficiently to avoid all conjunctions.[101]

The guidelines advocate stronger construction of space objects, careful orbiting, avoidance of destruction, and break-up.[102] They also promote time limits on orbits of satellites.[103] But the danger of collisions with satellites continues to grow because of the increases in space debris and orbiting satellites.[104] Individual states' enforcement of mandatory space debris standards, like the ICAO standards and practices, would vastly improve safety of space traffic as originally envisioned by space law experts in the 1950s and 1960s.[105] But as of 2024, the states have not been able to agree on effective international space debris regulation. Instead, the states are pursuing unilateral approaches. For example, the European states are adopting a European space debris treaty.[106] The US is also moving towards its own space debris legislation.[107] Obviously, differing unilateral space debris regulations have inherent dangers of conjunctions.

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[98] *One Million Astronomical Objects*, *supra* note 7.

[99] Editorial Board, *Space Junk is Out of Control. Here's Why—and What to Do About It*, WASH. POST (Nov. 2, 2024), https://www.washingtonpost.com/opinions/interactive/2023/space-junk-debris-removal/ [https://perma.cc/F4LF-VHKU].

[100] The Convention on International Liability for Damage Caused by Space Objects art. 1, Oct. 9, 1973, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[101] Trevor Owen, et al., *On the UN Space Debris Mitigation Guidelines: A Review and Proposal for Effective Norm Building*, COPUOS 14 (2023).

[102] *Space Debris Mitigation Guidelines*, *supra* note 72, at 2–3.

[103] *Id.*

[104] *Editorial Board*, *supra* note 99.

[105] *See Space Law Opinion*, *supra* note 1, at 464.

[106] *See, e.g.*, *Draft Council Conclusions*, *supra* note 83, at 1.

[107] Jeff Foust, *Senate Passes Orbital Debris Bill*, SPACE NEWS (Nov. 1, 2023), https://spacenews.com/senate-passes-orbital-debris-bill/ [https://perma.cc/D9YQ-3JXT].

C. Evaluation

Is it possible to return to the space law experts' vision of outer space regulated by an international space agency through establishment of international space traffic standards and recommended practices by an international treaty organization like ICAO? Standards and recommended practices by an international space organization could be implemented and enforced by the national states. That would be a significant improvement of space traffic safety. At the moment, such improvement appears unlikely.[108] The congestion of space traffic is rapidly increasing, and major collisions are predicted.[109] However, it is possible that a major collision in outer space will speed up the development of international space traffic rules, as happened with air traffic.[110]

An alternative to an international space agency would be an international uniform code of conduct establishing improved rules of the road for outer space traffic. For example, the international code of conduct proposed by the EU would significantly reduce the danger of conjunctions for outer space traffic.[111] Establishment of an international code of conduct would require international agreement and continuous coordination.

Another improvement would be for states to refrain from testing anti-satellite weapons which cause large quantities of space debris, as was the case with the Chinese ASAT tests in 2007 and the Russian ASAT tests in 2021.[112] States could also increase their situational awareness of safety dangers and become more transparent in their outer space activities.

IV. CONTROL OF OUTER SPACE BY INDIVIDUAL STATES

The early space law experts agreed that outer space should be legally different than sovereign airspace. Outer space should not be subject to national appropriation by individual states. Instead, the experts strongly favored regulation of outer space activities by

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[108] *See* Erwin, *supra* note 90.

[109] *Space Traffic Management Standards*, *supra* note 86, at 361.

[110] *Space Law Opinion*, *supra* note 1, at 469–70; *See, e.g.*, *1956 Grand Canyon Mid-Air Collision*, Wikipedia, https://en.wikipedia.org/wiki/1956_Grand_Canyon_mid-air_collision [https://perma.cc/5XQR-W3G4] (describing how a collision led to strict air traffic management).

[111] EEAS, *supra* note 69.

[112] *See, e.g.*, Shannon Bugos, *Russian ASAT Test Creates Massive Debris*, Arms Control Ass'n (Dec. 2021), https://www.armscontrol.org/act/2021-12/news/russian-asat-test-creates-massive-debris [https://perma.cc/7ALT-85A6].

international treaty.[113] Professor Alex Meyer expressed the preference that national control of celestial bodies should require international agreement, which could then serve as the legal basis for the occupation of celestial bodies.[114] This basic rule came to fruition in the OST, which states that "[o]uter space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[115]

The OST requires states to specifically authorize and supervise non-governmental operators' entry into outer space to ensure their compliance with the OST.[116] Furthermore, states agreed to avoid interference with outer space activities of other states.[117] States are required to pay "due regard to the corresponding interests of all other States Parties to the Treaty."[118] States may request state-to-state consultation regarding possible interferences with their activities on the Moon or other celestial bodies.[119] However, states of registry retain jurisdiction and control over space objects that they launch while those objects are in outer space or on celestial bodies.[120]

In spite of the OST's emphatic prohibition on national appropriation by any means, issues relating to national appropriation of outer space still arise in the conduct of unilateral activities on the Moon and celestial bodies, including uses of resources and unilateral assertion of military domain over outer space.[121]

A. Unilateral Activities on the Moon and Other Celestial Bodies

Space technology has developed so that it is now possible to extract resources from the Moon; for example, China, Russia, India, Japan, and the US are preparing to mine on the Moon.[122] In the absence of an international framework to authorize and administer allocation, individual governments have decided—unilaterally

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113 *Space Law Opinion*, *supra* note 1, at 469–70.
114 Meyer, *supra* note 11, at 341.
115 Outer Space Treaty, *supra* note 2, at art. II.
116 *Id.* at art. VI.
117 *Id.* at art. IX.
118 *Id.*
119 *Id.* at art. IX.
120 *Id.* at art. VIII.
121 Outer Space Treaty, *supra* note 2, at art. II.
122 Boyle, *supra* note 3.

and in groups—to authorize their commercial companies to mine on the Moon, subject to exercises of national jurisdiction.[123]

1. Current Conflicting Claims to Lunar Resources

The Chang'e 5 and Chang'e 7 Lunar Program, adopted by China and Russia in 2007, is exploring the South Pole of the Moon as of 2024.[124] China and Russia plan to send people to the Moon in 2030 where they plan to establish a base for further exploration and commercial exploitation.[125] In 2020, NASA established its Artemis Lunar Exploration Program, which will bring "humans to the Moon for long-term exploration and utilization."[126] NASA announced a plan to place human beings on the Moon in 2025 (now delayed until 2027).[127] The Artemis Program will establish a populated space station orbiting the Moon.[128] The purpose of the station is to support and direct governmental and commercial activities on the Moon.[129] As of 2024, thirty-nine states have

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[123] *Id.*

[124] *See* Andrew Jones, *China Unveils Ambitious Moon Mission Plans for 2024 and Beyond*, SPACE (Oct. 19, 2020), https://www.space.com/china-planning-future-moon-missions-change-7 [https://perma.cc/3M65-3KR7].

[125] *See* Steven Lee Myers & Kenneth Chang, *China Brings Moon Rocks to Earth, and a New Era of Competition to Space*, N.Y. TIMES (Dec, 16, 2020), https://www.nytimes.com/2020/12/16/science/china-moon-mission-rocks.html [https://perma.cc/KS2W-9WT6]; *see also* Mike Ives, *China Makes Move Into Outer Space*, N.Y. TIMES (May 24, 2018), https://www.proquest.com/docview/2043006009?accountid=6667&parentSessionId=BswCM4fhNMiG%2BWhyzQVhNoi5tKfkqB6%2FTd5URhy8%2BEc%3D&sourcetype=Newspapers [https://perma.cc/FLS2-2VXH].

[126] *NASA's Lunar Exploration Program Overview*, NASA 1, 53 (Sept. 2020); *see also Artemis*, NASA, https://www.nasa.gov/humans-in-space/artemis/ [https://perma.cc/6HT3-QJ9P]; *Artemis Accords*, U.S. DEP'T OF STATE, https://www.state.gov/artemis-accords/ [https://perma.cc/2PDR-VP37].

[127] Sharmila Kuthunur, *NASA's Artemis 3 Astronaut Moon Landing Unlikely Before 2027, GAO Report Finds*, SPACE (Dec. 1, 2023), https://www.space.com/artemis-3-2027-nasa-gao-report [https://perma.cc/VPJ6-NTXT]; *see also* Presidential Space Policy Directive, 85 Fed. Reg. 81755 (Dec. 2020). As of 2023, NASA plans to send four astronauts around the Moon in 2024, which may be postponed to 2025 or beyond. Alok Jha, *Astronauts Are Returning to the Moon. . .Well, Sort of*, ECONOMIST (Nov. 13, 2023), https://www.economist.com/the-world-ahead/2023/11/13/astronauts-are-returning-to-the-moonwell-sort-of [https://perma.cc/59HU-4FWU]; *see* Oliver Holmes, *NASA Postpones Plans to Send Humans to Moon*, GUARDIAN (Jan. 10, 2024), https://www.theguardian.com/science/2024/jan/10/nasa-postpones-plans-to-send-humans-to-moon-artemis [https://perma.cc/ZD7N-TN82].

[128] Kathryn Hambleton & Catherine E. Williams, *NASA's Artemis IV: Building First Lunar Space Station*, NASA (Mar. 29, 2024), https://www.nasa.gov/general/nasas-artemis-iv-building-first-lunar-space-station/#:~:text=Artemis%20IV%20will%20be%20the,rocket%20and%20new%20mobile%20launcher. [https://perma.cc/V5YF-6XPX].

[129] *See id.*

joined the Artemis Program through bilateral Artemis Accords with NASA.[130] The Accords are not considered treaty obligations; however, NASA and the parties to the Accords maintain that the Accords comply with the OST.[131] The Accords establish common guidelines among parties for the exploitation of lunar space resources. The parties agree to be transparent in their lunar activities and to consult with each other; they also agree to establish reasonable safety zones to warn-off each other in order to avoid interferences.[132] The location of such safety zones will be communicated to the UN Secretary General, and the information will be publicly available.[133] The parties agree to remove debris that may interfere with the activities of other states.[134] NASA is contracting with non-governmental operators like Space-X to create a commercial marketplace for lunar mining.[135]

China, with the cooperation of Russia, is engaged in governmental and non-governmental competition with the US Artemis Program and with parties to the Artemis Accords. Russia and China are inviting other countries to be its partners in their competition with the US.[136] The two groups of states are not coordinating their lunar activities. The competing US lunar Artemis Program and the Chinese lunar program both seek to explore and exploit the Moon and other celestial bodies.[137] Neither of the two programs protect scientific exploration of the Moon.[138] Thus, there is ample room for conflicts.

B. Evaluation

The prospect of conflicting claims has led to COPUOS efforts to establish international consensus to make peaceful exploitation

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130 *Artemis*, *supra* note 126.

131 *See id.*

132 *Artemis Accords*, *supra* note 126.

133 *The Artemis Accords*, NASA § 10, ¶ 3.

134 *Id.* at § 12.

135 Kenneth Chang, *Odysseus, a Private Lunar Lander, Launches Toward the Moon*, **N.**Y. Times (Feb. 14, 2024), https://www.nytimes.com/2024/02/14/science/spacex-launch-moon-lander-intuitive.html [https://perma.cc/L2TK-ECML].

136 Andrew Jones, *Russia, China Hope to Secure Partners for Moon Base Project*, Space-News (May 31, 2021), https://spacenews.com/russia-china-hope-to-secure-partners-for-moon-base-project/ [https://perma.cc/N5UF-U52Y].

137 *See id.*

138 Daniel Clery, *Moon's Scientifically Important Sites Could Be 'Lost Forever' in Mining Rush*, Science, (Nov. 24, 2023, 8:20 AM), https://www.science.org/content/article/moon-s-scientifically-important-sites-could-be-lost-forever-mining-rush#:~:text=Scientists%20fear%20such%20mining%20could,places%20in%20the%20Solar%20System [https://perma.cc/4RDK-G4US].

of space resources possible. In 2022, the COPUOS Working Group on Legal Aspects of Space Resource Activities,[139] chaired by Andrzej Misztal and Steven Freeland, established a five-year workplan for the purpose of reaching consensus for the adoption of legal principles for utilization of outer space resources.[140] In 2023, the Working Group had an initial exchange of views.[141] In 2024, the Working Group will make a progress report to the COPUOS Scientific and Technical Subcommittee on efforts to schedule an international conference on the subject.[142] The plan is for the United Nations to convene a UN Conference on the establishment of legal principles for space resource management.[143] Further exchange of views on establishment of recommended principles is planned for 2025.[144] In 2026 and 2027, a review and preparation of final draft principles is scheduled.[145]

The 2023 COPUOS Report to the UN General Assembly concluded that members of the Working Group did not come to agreement on international regulation, and such regulation is necessary in order to protect the Moon and outer space resources from "harmful methods of exploitation."[146] Thus, the working group agreed that the 2024 UN Conference should be based on the following topics: (1) Implications of the legal framework for space resource activities; (2) The role of Information-sharing in supporting space resource activities; (3) The scope of future space resource activities; (4) Environmental and socioeconomic aspects of space resource activities; and (5) International cooperation in scientific research and technological development for space resource activities.[147] Consequently, there is international movement towards the original vision of the space law experts for an international outer space legal regime; however, the states are far from agreement.

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[139] Rep. of the COPUOS, at 26, Doc. A/78/20 (2023).

[140] Co-Chairs' Proposed Five Year Workplan and Methods of Work for the Working Group on Legal Aspects of Space Resource Activities, UNOOSA [hereinafter Five-Year Workplan].

[141] *Id.*

[142] Rep. of the COPUOS, *supra* note 139, at 48.

[143] Five-Year Workplan, *supra* note 140.

[144] *Id.*

[145] *Id.*

[146] Rep. of the COPUOS, *supra* note 139, at 28.

[147] *Id.* COPUOS agreed the 2024 UN conference should have a preliminary meeting in Luxembourg with a final meeting at UN headquarters in Vienna, Austria. *Id.*

V. MILITARY DOMINION OF OUTER SPACE

In the 1950s and 1960s, the space law experts envisioned that outer space activity would be for peaceful exploration rather than military uses.[148] Their outer space visions were based on World War II's military use of rockets by German scientists led by Werner von Braun, who developed military rockets to bomb England.[149] Von Braun viewed post-World War II military use of rockets as being dangerous to friends as well as to enemies. He therefore favored non-military uses.[150] One of the twenty-two space law experts, Professor Alex Meyer, agreed with that view in his 1952 paper on future regulation of outer space law, citing Werner von Braun's statement that "we have invented the rockets for the flight to the places and not in order to destroy our own."[151] Meyer and von Braun believed that military uses of outer space would be destructive for both enemies and for the states that launched military rockets into outer space.[152] That vision may prove true today.[153]

The 1945 UN Charter was another source of international peace and security in outer space. The states agreed in the Charter "to maintain international peace and security" and that "armed force shall not be used, save in the common interest."[154] This view also came to fruition in Article 1 of the UN Charter, where the states agreed

> To maintain international peace and security, and to that end: to take effective collective measures for the prevention and removal of threats to the peace and for the suppression of acts of aggression or other breaches to the peace, and for the suppression of acts of aggression or other breaches to the peace.[155]

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148 *Sample Law Opinion*, *supra* note 1, at 464.

149 Edwards, *supra* note 34.

150 *See* Neufeld, *supra* note 35, at 50.

151 Meyer, *supra* note 11, at 341–42; *see also* Paul B. Larson, *Outer Space Management—The Alex Meyer Model*, in LIBER AMICORUM–INSTITUTI IURIS AERIS, SPATIALIS ET CYBERNETICI IN CENTENARIUM (Wolters Kluwer, forthcoming May 2025). Meyer was one of the legal experts interviewed for *Space Law Opinion*, *supra* note 1. Subsequently, von Braun was brought to the US by the DOD to develop US rockets for military uses! *Id.*

152 *See* Meyer, *supra* note 11, at 340–42.

153 *Id.* The overall destructive effect of military uses of outer space is illustrated by the prospect of a Russian launch of nuclear weapon in outer space in 2024. William J. Broad, *Atomic Bombs in Space are Back to Scare Us Again*, N.Y. TIMES (Mar. 12, 2024), https://www.nytimes.com/2024/03/06/science/space-nuclear-bomb-putin.html [https://perma.cc/8SNW-AEBN]; Livini & Walt, *supra* note 10; *see also War in Space*, *supra* note 3.

154 U.N. Charter preamble, art. 1. Article 103 says that the UN Charter prevails in conflicts with other international agreements.

155 *Id.* at art. 1.

The UN General Assembly resolved in 1961 that the UN Charter applies in outer space.[156] General Assembly Resolution 1962 (XVIII) of 1963 recognized the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes.[157] This statement was repeated in the 1967 OST Article I.[158]

The United Nations began negotiations on an outer space legal framework right after the Russian launch of Sputnik in 1957 and the importance of military reconnaissance in the 1960s caused the then two space powers, the US and the then USSR, to value the military advantage of access to the high ground of outer space.[159] Thus, the negotiations of the OST focused on national defense.[160] Consequently, the two space powers agreed that outer space should be free for exploration and use by all states and should not be subject to sovereignty or to appropriation of any kind.[161] OST Articles II, III, IV, and IX provide limitations on military uses of outer space.[162] Outer Space is also subject to limits established by other treaties like the UN Charter and the prohibition on nuclear testing in outer space.[163]

The race by military authorities to control outer space grew after negotiations of the OST in 1967.[164] Additional states, such as China and India, have since joined the space race.[165] Russia's focus on outer space has been disrupted by the break-up of the USSR in 1992 and the subsequent war in the Ukraine, while the

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156 G.A. Res. 1721 (XVI), at 6 (Dec. 20, 1961).

157 G.A. Res. 1962 (XVIII), at 15 (Dec. 13, 1963).

158 Outer Space Treaty, supra note 2, at art. I.

159 *See* Tzu, *supra* note 65, at 84; LYALL & LARSEN, *supra* note 37, at 447.

160 President Lyndon Johnson described the OST as a treaty on national defense. Gerhard Peters & John T. Woolley, *Remarks at the Signing of the Treaty on Outer Space*, THE AM. PRESIDENCY PROJECT (Jan. 27, 1967), https://www.presidency.ucsb.edu/documents/remarks-the-signing-the-treaty-outer-space [https://perma.cc/3PEG-SFZ5].

161 Outer Space Treaty, *supra* note 2, at art. I.

162 *Id.* at art. II, III, IV, IX.

163 *See, e.g.*, Limited Test Ban Treaty, Aug. 5, 1963, 480 U.N.T.S. 43.

164 *See* Sandra Erwin, *New Report Calls for DOD Investments in Lunar Space Infrastructure*, SPACENEWS (Jan. 17, 2024), https://spacenews.com/new-report-calls-for-dod-investments-in-lunar-space-infrastructure/#:~:text=Galbreath%20suggests%20that%20DoD%20needs,Chinese%20advantage%2C%E2%80%9D%20he%20said [https://perma.cc/9G3V-NQSV]; *Outer Space Arms Control*, *supra* note 66, at 156.

165 *See* Associated Press, *India Joins an Elite Club as First to Land a Spacecraft Near the Moon's South Pole*, NPR (Aug. 23, 2023), https://www.npr.org/2023/08/23/1195411957/india-joins-an-elite-club-as-first-to-land-a-spacecraft-near-the-moons-south-pol [https://perma.cc/J7YJ-S8ZF].

US has increased its lead in the military space race.[166] As of 2024, the US is preparing for both defensive and offensive war in outer space.[167] The US views the Chinese and Russian outer space military activities as threats.[168] The DOD is increasing US military defensive and offensive weaponry in outer space to maintain military dominance of outer space.[169] China, Russia, India, and other states have likewise continued the arms race with the US.[170] Negotiations to stop the race are at a stalemate.[171] Those negotiations have primarily taken place in the UN Disarmament Committee where Russia and China proposed a treaty on the Prevention of an Arms Race in Outer Space (PAROS).[172] The US rejected the proposal because it contained other conditions not related to outer space.[173] Most recent negotiations have been in the UN General Assembly Working Group on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behavior.[174] One difficulty in reaching agreement is that military and civilian activities in outer space are difficult to distinguish because space objects are inherently dual-use. For example, US, Chinese, and Russian Global Navigation Satellite Systems (GNSS) are used for both civilian and military purposes. Civilian GNSS is not encrypted; consequently, it is easily jammed and spoofed.[175] Military

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166 *See* Andrew Jones, *Russia's War on Ukraine has Caused Lasting Damage to International Spaceflight Cooperation*, SPACE (Mar. 7, 2023), https://www.space.com/russia-war-ukraine-damage-international-spaceflight-cooperation [https://perma.cc/BPZ2-QUX3].

167 R.A. Ramey, *Armed Conflicts on the Final Frontier: The Law of War in Space*, 48 A.F.L. REV. 1, 126 (2000); *see also War in Space*, *supra* note 3.

168 Helen Davidson, *The New 'Space Race': What are China's Ambitions and Why is the US so Concerned?*, GUARDIAN (May 4, 2024), https://www.theguardian.com/world/article/2024/may/05/the-new-space-race-what-are-chinas-ambitions-and-why-is-the-us-so-concerned [https://perma.cc/QZM9-D855].

169 *See id.*; *Space Policy Review and Strategy on Protection of Satellites*, U.S. DEP'T OF DEF. 10 (Sept. 2023); Theresa Hitchens, *New Joint Force Space Doctrine Clarifies Space Command's 'Offensive,' 'Defensive' Ops*, BREAKING DEF. (Oct. 23 2023), https://breakingdefense.com/2023/10/exclusive-new-joint-force-space-doctrine-clarifies-space-commands-offensive-defensive-ops/ [https://perma.cc/Q6UQ-CCZV]; *see also* Lipton, *supra* note 95.

170 *See* Associated Press, *supra* note 165.

171 *Outer Space Arms Control*, *supra* note 66, at 158.

172 *See id.* at 148.

173 *Id.*

174 *Overview: Open-Ended Working Group on Reducing Space Threats*, UNITED NATIONS (2022), https://meetings.unoda.org/open-ended-working-group-on-reducing-space-threats-2022 [https://perma.cc/UW4S-ZXZS]; *see* G.A. Res. 75/36 (Dec. 7, 2020); *see generally* Larsen, *supra* note 66, at 148.

175 LYALL & LARSEN, *supra* note 37, at 337–58.

GNSS is encrypted, but encryption has been endangered by recent quantum technology.[176]

A. Evaluation

The 1964–1965 *Sample of Space Law Opinion* expressed the predominant view among space law experts that "outer space is reserved for peaceful purposes."[177] The two space powers, USSR and USA, insisted on limited space in the OST for outer space military activities as indicated in the OST.[178] That limited room was subsequently enlarged by the space powers into the current view of outer space as a warfighting military domain.[179] Is it too late to reverse the drift towards war in outer space and to return to the view of the early space law experts reserving outer space for peaceful uses?

The UN Secretary General expressed special concern about the outer space arms race in a 2023 policy brief.[180] He stated that, in view of the growing risk of military conflicts in outer space, there is need for "additional normative frameworks" to stop weaponization and to prevent military confrontations in outer space.[181] The risks of conflict are exacerbated by increasing commercial activities combined with the related efforts of military authorities to protect their national activities in outer space.[182] Moreover, military and commercial outer space activities are often mixed (dual-use).[183] The concern of the United Nations regarding the long-term sustainability of outer space is evidenced by COPUOS efforts in cooperation with other UN Agencies to prevent military disruption.[184] Thus, there are significant voices urging a return to the space law experts' vision of reserving outer space for peaceful uses.

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176 *Id.*; Sydney J. Freedberg Jr., *Saving Schrödinger's Cat: Getting Serious About Post-Quantum Encryption in 2024*, Breaking Def. (Dec. 28, 2023), https://breakingdefense.com/2023/12/saving-schrodingers-cat-getting-serious-about-post-quantum-encryption-in-2024/ [https://perma.cc/M23Q-5SKS]; *see also* Lipton, *supra* note 95.

177 *Space Law Opinion*, *supra* note 1, at 464.

178 Outer Space Treaty, *supra* note 2, at art. II, IV, IX.

179 Harper, *supra* note 3; *War in Space*, *supra* note 3; Boyle, *supra* note 3; Hitchens, *supra* note 5.

180 *See generally* U.N. Secretary-General, For All Humanity—The Future of Outer Space Governance (May 2023) [hereinafter For All Humanity].

181 *Id.* at 17.

182 *Id.*

183 *Id.* at 18.

184 *See generally* For All Humanity, *supra* note 180, at 9–12; *see also* G.A. Res. A/76/3 (Oct. 23, 2021).

In the *Sample of Space Law Opinion* there was advocacy for regulation of space activities by an international treaty and a strong central agency.[185] War in outer space is destructive and is not winnable.[186] It is contrary to the interest of humanity; it is therefore hoped that states will return to the original vision of outer space as reserved for peaceful purposes.

VI. RESCUE AND RETURN OF PEOPLE AND RETURN OF SPACE OBJECTS FROM OUTER SPACE

The space law experts of the 1950s and 1960s viewed astronauts as envoys of mankind who should be relieved if in distress.[187] The 1962 UN General Assembly Resolution XVIII likewise expressed the desire to consider astronauts as envoys of mankind into outer space.[188] States agreed they should be entitled to all possible assistance.[189] Furthermore, the 1968 Agreement on the Rescue and Return of Astronauts (ARRA)[190] provides for the rescue and return of astronauts to the launching state.[191]

ARRA separates rescue and assistance obligations in the jurisdiction of a signatory from rescue and assistance events outside that party's jurisdiction.[192] In view of current developments in lunar mining, ARRA's Article 3 duties to render assistance could be considered applicable to non-governmental lunar mining activities within the protected area of the mining activity.[193] ARRA Article 2 requires states to "take all possible steps" to render assistance and inform the UN Secretary General of the steps taken.[194] Rescue events that happen in locations not under the jurisdiction of any state must be taken by any state that has the means to render assistance, but there is no duty to "take all possible steps."[195] Additionally, Article 10 of the 1979 Moon Agreement states that

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185 *Space Law Opinion*, *supra* note 1, at 464.

186 Livini & Walt, *supra* note 10; *War in Space*, *supra* note 3 (quoting General Chance Saltzman, Chief of Space Operations of the United States Space Force).

187 *Space Law Opinion*, *supra* note 1, at 467.

188 G.A. Res. 1962 (XVIII), *supra* note 157, at ¶ 9.

189 Outer Space Treaty, *supra* note 2, at art. V.

190 G.A. Res. 2345 (XXII), at annex (Dec. 19, 1967) [hereinafter ARRA]. The name of the treaty refers to "astronauts." But the text of the agreement is more limited; it refers to personnel of spacecraft.

191 *See id.*; *see also* LYALL & LARSEN, *supra* note 37, at 117–35.

192 ARRA, *supra* note 190, at art. 1.

193 *See* ARRA, *supra* note 190, at art. 2; *The Artemis Accords*, *supra* note 133, § 11.

194 ARRA, *supra* note 190, at art. 2.

195 ARRA, *supra* note 190, at art. 3.

any person on the Moon shall be regarded as an astronaut entitled to the assistance provided for astronauts in ARRA.[196]

The question arises whether persons who are not "personnel of spacecraft" should be entitled to rescue assistance under ARRA. Should people sent to the Moon to mine it receive full ARRA assistance? As travel into outer space has become more common, the tasks of the miners sent into outer space differ from the original objective of astronauts as "envoys of mankind."[197] According to OST Article VIII, states have jurisdiction and control over their spacecraft and personnel on board their spacecraft.[198] States have begun to adopt different national regulations applicable to their nationals traveling in outer space. US law distinguishes between flight crews and flight participants because of the different nature of the two activities.[199] Flight crew must have special training to operate flight equipment whereas flight participants, whose training does not involve flight equipment, are treated differently.[200] Thus, people sent to the Moon to mine it for commercial purposes may not be regarded as envoys of mankind into outer space. However, the Moon Agreement would still require them to receive the same care as astronauts sent to explore outer space.[201]

A final source of assistance in outer space is the OST Article V obligation of astronauts of one state to assist the astronauts of another state.[202] However, commercial competition among nongovernmental operators may interfere with their legal duty to render all possible assistance.

A. Evaluation

All twenty-two space law experts interviewed in 1964–1965 favored future international agreement on rescue and return of astronauts and space vehicles.[203] The 1968 ARRA reflects the early development of outer space technology and uses of outer space.[204] The initial focus of the space law experts was on exploration. The space law experts did not foresee the large variety of people

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196 G.A. Res. 34/68, art. 10, ¶ 1 (Dec. 5, 1979) [hereinafter MA]. The MA has not been adopted generally.

197 Outer Space Treaty, *supra* note 2, at art. VIII.

198 *Id.*

199 51 U.S.C. § 50902.

200 *Id.* § 50902(2), (20).

201 MA, *supra* note 196, at art. 10.

202 Outer Space Treaty, *supra* note 2, at art. V.

203 *Space Law Opinion*, *supra* note 1, at 467.

204 ARRA, *supra* note 190.

occupied with military and commercial outer space uses.[205] Envoys of mankind should be protected, but the international duty to assist and return scientists, explorers, commercial entrepreneurs, military personnel, and tourists should vary. The return of various defunct space objects and space debris left on celestial bodies is even more problematic. The launching state of space debris is often impossible to ascertain.

VII. LIABILITY

The twenty-two space law experts envisioned conjunctions in outer space mostly in terms of international private law. Established international private law like the Warsaw Convention on International Carriage by Air governs liability for damages.[206] The space law experts thought liability for outer space conjunctions based on fault would be difficult for complainants to prove.[207] However, they favored the structure of the Warsaw Convention, which presumes fault of the offending airline operator with a limited liability regime.[208] Some space law experts favored a regime based on strict liability. The Rome Convention, for instance, establishes absolute liability for surface damage by airplanes.[209] Thus, the space law experts supported use of these air law conventions as guides for outer space liability.[210]

The *Trail Smelter* Arbitration[211] and the *Corfu Channel* case[212] established the prevailing public international law holding that a state may become liable for damage caused to another state and formed the legal basis for the 1967 OST. Article VII of the OST makes the launching state internationally liable for damage to other states and for injury to their persons.[213] Article VII was evidently established for conjunctions between state-owned space

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[205] *Space Law Opinion*, *supra* note 1, at 464.

[206] Warsaw Convention on International Carriage by Air, Oct. 12, 1929, 137 L.N.T.S. 11 [hereinafter Warsaw Convention]. The Warsaw Convention on International Carriage by Air was replaced subsequently by the 1999 Montreal Convention for the Unification and Certain Rules for International Carriage by Air, May 28, 1999, 2242 U.N.T.S. 309. *See generally* PAUL B. LARSEN, JOSEPH SWEENEY & JOHN GILLICK, AVIATION LAW 1331–50 (2d ed. 2012).

[207] *Space Law Opinion*, *supra* note 1, at 466.

[208] *See id.*

[209] LARSEN, SWEENEY & GILLICK, supra note 206, at 784–85.

[210] *Space Law Opinion*, *supra* note 1, at 466.

[211] Trail Smelter Case (United States v. Canada), Arbitration Award, 3 R.I.A.A. 1911, 1965 (1938).

[212] Corfu Channel Case (United Kingdom of Great Britain and Northern Ireland v. Albania), Judgment, 1949 I.C.J. Rep. 244, 250 (1949).

[213] Outer Space Treaty, *supra* note 2, at art. VII.

objects.[214] Offending states became absolutely liable.[215] Actions for damages have to be brought by the offended state directly against the offending state and all parties to the OST are subject to this regime. After 1967, most states adopted the 1971 Liability Convention, which is also intended to govern state relationships.[216] The Liability Convention continues to require absolute liability for surface damage.[217] However, it requires claimants to prove fault in order to recover damages in all other situations and locations—a drastic change from OST Article VII, which favors the states that were, at that time, the major sources of space traffic and space debris.[218]

The OST and the Liability Convention require states to make claims against other states at a time when activities in outer space are mostly government operated. Subsequently, outer space, particularly in the LEO and geostationary orbits, have become crowded by non-governmental operators.[219] Information about the traffic of the thousands of satellites in orbit is inadequately distributed. Even more importantly, the millions of pieces of space debris in orbit have greatly increased the danger of conjunctions.[220]

Importantly, the OST and the Liability Convention do not prohibit claimants from bringing claims under national liability law against the offender, regardless of whether the offender be a state or a non-governmental operator.[221] Non-governmental operators have the option to bring a claim against foreign and national offenders under national liability laws applicable in outer space. However, that requires the national court to have jurisdiction over the offender, so that option is often unavailable.

Most damages from outer space conjunctions now affect non-governmental operators who have difficulty processing claims under the two liability treaties. The procedure for collecting compensation for outer space conjunctions is illustrated by the Cosmos 954 case, which is the only case that has invoked the Liability Convention.[222] The Canadian government brought claim against

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214 *See id.*

215 *Id.*

216 Liability Convention, *supra* note 100. The Convention uniquely applied to surface damage by Russian Cosmos 954 satellite in Northern Canada in 1978. *See* LYALL & LARSEN, *supra* note 37, at 107.

217 Liability Convention, *supra* note 100, at 189.

218 *Id.* at 190.

219 Larsen, *supra* note 9, at 6.

220 *One Million Astronomical Objects*, *supra* note 7.

221 Outer Space Treaty, *supra* note 2, at art. VII.

222 Cosmos 954 Case (Canada v. Soviet Socialist Republic), Settlement (1981).

the USSR for damages caused over northern Canada by nuclear debris created by the surface crash of a defunct Russian satellite. Normally, the Claims Commission is specially convened for each individual claim and decides liability claims under the Liability Convention.[223] But this particular claim was settled by the two parties before it reached that stage.[224]

Under the Liability Convention, processing claims for outer space conjunctions can be difficult for non-governmental operators because they must first persuade their own governments to bring claims under the two treaties on liability. They cannot themselves bring claims against the offender because they lack status.[225] Furthermore, their governments control the presentations of evidence for and against the claim.[226] However, governments have many other considerations to weigh before bringing claims against other governments. The potential defender and offender governments may be involved in important and delicate negotiations on other subjects, which they do not want to disturb by bringing compensation claims.

A. Evaluation

Several of the space law experts interviewed by the author were familiar with the Warsaw Convention and the Rome Convention.[227] Both treaties concerned private liability of the operator, contrasting the government-on-government liability regimes of the OST and Liability Convention.[228] That experience carried over into their thinking about liability for outer space activities.

The nature of liability for outer space conjunctions has developed greatly since the 1967 OST and the 1972 Liability Convention. Proof of fault by the claimant is difficult in outer space, particularly relating to damages caused by space debris.[229] Thousands of space debris pieces have been created by the intentional destruction of defunct satellites. The flood of space debris in

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[223] Liability Convention, *supra* note 100, at art. XIV.

[224] Cosmos 954, *supra* note 222.

[225] Paul B. Larsen, *Does New Space Require New Liability Laws?*, 68 ZLW 196, 202 (2019) [hereinafter *New Liability Laws*].

[226] *See id.* at 204; Liability Convention, *supra* note 100, at art. XIV.

[227] *Space Law Opinion*, *supra* note 1, at 466.

[228] Warsaw Convention, *supra* note 206, ch. III; Rome Convention, 4493 U.N.T.S. 182, 198 (1952).

[229] Liability Convention, *supra* note 100, at art. I, XIV. The Convention applies to space objects, which can be construed to include space debris.

those orbits, some of which force frequent moves of the International Space Station, create many conjunctions.[230]

The Warsaw (now, Montreal) and Rome conventions provided the space law experts extensive experience with direct action against operators of aircraft, which could be applied to operators of space objects.[231] Presumed fault of the offender in outer space could be particularly helpful to the many upstart non-governmental operators who are entering outer space. Considering that most traffic in outer space is comprised of non-governmental operators, the space law experts' idea of modelling a private international law liability convention for space traffic after the Warsaw, Montreal, and Rome Conventions for airline carriage should be reexamined. A private law treaty is a much more effective dispute solution for non-governmental operators.

VIII. REQUIRED INSURANCE OR BOND TO COMPENSATE FOR LIABILITY OF NON-GOVERNMENTAL OPERATORS

Liability for damages caused by space objects can be significant depending on where the damage takes place. A conjunction can occur in several ways: it may be between two space spacecraft, like the collision of non-governmental Iridium with defunct Russian COSMOS spacecraft; it may involve surface damage like the COSMOS 954 collision with the surface of northern Canada; or it may be a fatal collision with the International Space Station.[232]

The space law experts thought liability for outer space conjunctions would involve governmental as well as non-governmental operators, which indeed has developed in the present time.[233] They were concerned with expedited compensation for liability by non-governmental operators.[234] Most of the space law experts therefore thought spacecraft operators should obtain insurance or bond to be available to compensate for damages caused by space objects.[235] A large majority of the space law experts favored bond, security, or insurance modelled after the 1952 Rome

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[230] Editorial Board, *supra* note 99.

[231] *See Space Law Opinion*, *supra* note 1, at 465, 472–75.

[232] Cosmos 954, *supra* note 222. COSMOS 1408 was a defunct Russian satellite that was intentionally destroyed by a Russian ASAT in 2021, causing a cloud of space debris which endangered the International Space Station. *Kosmos 1408*, WIKIPEDIA, https://en.wikipedia.org/wiki/Kosmos_1408#Destruction [https://perma.cc/GH4F-2AZW].

[233] *Space Law Opinion*, *supra* note 1, at 467.

[234] *Id.*

[235] *Id.*

Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface.[236]

The Rome Convention is based on absolute liability of the aircraft operator, but liability is limited.[237] The limitation increases based on the weight of the aircraft.[238] The operator may be required to obtain adequate insurance or to post a bond to cover the risk.[239] Another example is a US law that requires non-governmental licensees to either obtain insurance or prove financial responsibility to compensate the US Government for potential liability incurred under the OST or the Liability Convention.[240] The amount of insurance or proof of responsibility is limited by law to $500 million for third party claims and $100 million for liability claims for damage to government property.[241] The licensing authority may establish lower limits based on its evaluation of potential liability.[242] The United Kingdom also requires applicants for launch permits to obtain insurance or prove financial responsibility, as do other states.[243]

The space law experts would require operators to obtain insurance or post bond before being issued operating permits.[244] Some favored the Convention on Third Party Liability in the Field of Nuclear Energy.[245] A number of other options exist for insurance or bond to compensate for damages caused by non-governmental operators. The existing US and other national laws could be broadened to require licensee applicants to prove their financial responsibility or obtain insurance for damages brought against the offending operator in national courts.[246] The extended law could permit the claimant to bring action in local courts similar to private claims brought under the Warsaw Convention (now the Montreal Convention) or the Rome Convention. The claims

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236 *Id.* at 473.

237 Rome Convention, *supra* note 228, at ch. II, art. 11(1).

238 *Id.*

239 *See id.* at ch. II, art. 15.

240 51 U.S.C. § 50914.

241 *Id.* § 50914(a)(1)–(3).

242 *Id.*

243 Lyall & Larsen, *supra* note 37, at 104–06.

244 *Space Law Opinion*, *supra* note 1, at 667.

245 *Id.*; Paris Convention on Third Party Liability in the Field of Nuclear Energy, Nuclear Energy Agency, https://www.oecd-nea.org/jcms/pl_20196/paris-convention-on-third-party-liability-in-the-field-of-nuclear-energy-paris-convention-or-pc [https://perma.cc/8C7Q-FL5F]. Article 13 of this Convention requires the operator to have insurance or other financial security up to the limit of the operator's liability, which is regulated by the convention. *Id.*

246 *See, e.g.*, 51 U.S.C. § 50914.

would be based on fault, but the offender could be presumed liable as in the Warsaw Convention for aircraft.[247] The cost of the insurance would become an ordinary business cost. Damages would be not only to property, but also for death and personal injury as under the Warsaw Convention.[248]

A second option could be for states to adopt a protocol to the Liability Convention to enlarge their liability regime by requiring non-governmental operators to obtain insurance sufficient to satisfy private claims for damages caused by non-governmental operators' flights in outer space.[249] The amount of insurance for private claims could be similar to the insurance required to reimburse the authorizing government for its liability under the Liability Convention.

A third option could be a protocol to the Registration Convention requiring governments to file a bond at the time of registry by the registering government.[250] Governments would require operators to file bonds similar to governmental requirements to file evidence of insurance to reimburse the government for liability under the Liability Convention.[251] The protocol could specify the size of the bond and the use of the bond. The administration of the bond could be through the state registry, which would pay compensation as ordered by a court of law adjudicating a claim. Parties to a dispute might enter into a settlement with which the registrar would comply.[252]

A fourth option could be for the International Telecommunication Union (ITU) to require non-governmental space operators to compensate for potential damages as a condition for obtaining cleared radio frequencies and related orbits necessary for operation in outer space. The bond would be akin to the bond required by the FCC of applicants for radio frequencies and related orbits.[253] The ITU requirement, enforced by national government agencies like the FCC, would require all non-governmental

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[247] Warsaw Convention, *supra* note 206, at ch. III, art. 21.

[248] *Id.* at ch. III, art. 17.

[249] Liability Convention, *supra* note 100.

[250] Registration Convention, *supra* note 75, at art. II.

[251] *See* 51 U.S.C. § 50914.

[252] LYALL & LARSEN, *supra* note 37, at 75–117.

[253] *See* 47 C.F.R. § 26.165 (2023). Bond becomes payable if a licensee fails to meet specific satellite implementation requirements listed in 47 C.F.R. § 25.164 (2021). In one case, the agency levied a fine on a space operator for failure to comply with its FCC deorbiting plan. The operator admitted liability and paid a $150,000 fine. Imran Rahman-Jones, *US Issues First Ever Fine for Space Junk to Dish Network*, BBC (Oct. 3, 2023), https://perma.cc/2RWK-Q79V.

operators to post a bond or have insurance to insure payment of compensation by operators causing conjunctions. FCC enforcement activity would be in tune with its ITU radiofrequency obligations. The ITU would also have to participate in order to resolve a difficult international coordination and enforcement problem. For the ITU, and in turn the FCC, to permit use of the bond to pay for the liability incurred in collisions between two non-governmental operators would be an unusual step. However, the ITU has been open to performing such functions under extraneous space law treaties.[254] For example, it is open to possibly serving as temporary supervisory authority under Article XXVIII of the 2012 Berlin Space Protocol.[255]

A. Evaluation

Neither OST Article VII on liability nor the Liability Convention existed in 1964–1965 when the space law experts were interviewed. They were generally aware of the dangers of outer space and the need to assure compensation for liability and relied on existing private international law as a guide. While the states and the operators of space objects have managed to resolve disputes informally without bringing claims into court,[256] the prospect of traffic congestion may trigger the need for a private international law dispute settlement machinery.[257] If a private international law liability convention for space traffic is adopted, it could require insurance or bond to compensate for liability of non-governmental operators.

IX. CONCLUSION

The twenty-two space law experts, interviewed in 1964–1965, envisioned outer space as an undivided entity subject to uniform

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254 *See* Berlin Protocol to the Convention on International Interests in Mobile Assets on Matters Specific to Space Assets, UNIDROIT (2012), https://www.unidroit.org/instruments/security-interests/space-protocol/overview/#:~:text=The%20Protocol%20to%20the%20Convention,from%2027%20February%20to%209 [https://perma.cc/4VWU-CBN3]; Paul B. Larsen, *Berlin Space Protocol Update*, 64 ZLW 361, 378 (2015).

255 *See Berlin Space Protocol Update*, *supra* note 254, at 378.

256 Allison Torline, *Looking Back While Looking Up: A Review of Space Arbitration Topics*, Kluwer Arb. Blog (Feb. 22, 2023), https://arbitrationblog.kluwerarbitration.com/2023/02/22/looking-back-while-looking-up-a-review-of-space-arbitration-topics/ [https://perma.cc/5N2H-JCZY].

257 *See* Donald J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. Geophysical Res. 2637, 2637 (1978).

common law for all space and celestial bodies.[258] But outer space has since become subject to the different legal regimes of individual states for national uses. Non-governmental operators are now major users, and military forces have entered in a new way. Outer space has become increasingly integrated into life on Earth including activities like telecommunications and GNSS. These activities have changed the character of outer space. Some of these changes have led to improvements in outer space management. But many changes have led to confusion and the deterioration of safety. States would benefit from reexamining the visions of the early space law experts in view of recent developments. The following are conclusions regarding seven fundamental issues.

A. Delimitation of Outer Space

The absence of a clear division between sovereign air space and non-sovereign outer space causes confusion on the legality of acting in outer space. It invites unilateral actions in outer space and leads to conflicts among contesting states.[259] A firm limit between outer space and air space would benefit exploration and uses of outer space. While the twenty-two space law experts did not agree on a specific delimitation, they expected one to be established. Even a guideline based on the lowest orbit level agreeing with OST Article IV would have a stabilizing effect.[260]

B. International Space Regulation by an International Regime

The space law experts were familiar with ICAO. They did not favor sovereignty in outer space; however, they did favor a uniform, safe, and predictable international regime.[261] The increase in space traffic volume and the prospect of traffic congestions and the danger of conjunctions increased the demand for an ICAO-type of traffic management based on internationally established regulations. International agreement and cooperation would be required for such an establishment. In the absence of international agreement, COPUOS might settle on the establishment of international guidelines.

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[258] *Space Law Opinion*, *supra* note 1, at 464.
[259] Jakhu & Mishra, *supra* note 27, at ch. 28.
[260] Outer Space Treaty, *supra* note 2, at art. IV.
[261] *Space Law Opinion*, *supra* note 1, at 469–70.

C. Regulation of Outer Space by Individual States

The space law experts intended for outer space to be free for exploration and exploitation by all. They did not want individual states to control outer space. Nevertheless, the states are beginning to exercise unilateral dominium. Their common objective is to maximize use of outer space. That favors the most powerful states, which are likely get into conflict with each other unless they can agree on international standards to be enforced by each state or voluntary guidelines. Common rules would not only favor the competing space powers—they would also give developing states an opportunity to participate and help prevent war in outer space.

D. Military Dominion Over Outer Space

The space law experts envisioned outer space to be for peaceful purposes.[262] The view of the most powerful states is increasingly that outer space is a warfighting military domain.[263] The warfighting vision further escalates the danger of war in outer space which includes the possibility of a nuclear war in space that may not be winnable.[264] The establishment of outer space national military commands further increases the danger of war. The UN Secretary General is right that an "additional normative framework" is urgently needed.[265] There are ongoing UN efforts to create normative frameworks in COPUOS, in the UN Disarmament Conference, and in the UN Working Group on Legal Aspects of Space Resources.[266] They all require willingness of states to participate.

E. Rescue and Return of People and Space Objects from Outer Space

The space law experts supported the rescue and return of astronauts and space objects at a time when astronauts were primarily explorers.[267] Commercial and military space activities had not yet developed at that time. The space law experts may have wanted a differentiated treatment of spacecraft personnel if they

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[262] *Space Law Opinion*, *supra* note 1, at 464.

[263] Harper, *supra* note 3; *War in Space*, *supra* note 3; Boyle, *supra* note 3. Hitchens, *supra* note 5.

[264] *War in Space*, *supra* note 3; Livini & Walt, *supra* note 10.

[265] For All Humanity, *supra* note 180, at 17.

[266] *See* Five-Year Workplan, *supra* note 140.

[267] *Space Law Opinion*, *supra* note 1, at 477.

had been presented with the more complex variety of spacecraft personnel and space objects existing currently.

F. A Liability Regime for Outer Space Based on Private International Law

The space law experts agreed that outer space activities should be subject to international liability law.[268] They were experienced in private international law. They naturally imagined space activities being subject to private law treaties like the Warsaw and Rome Conventions.[269] Development of non-governmental space traffic and the danger of conjunctions with the explosion of space debris did not occur until the beginning of the New Space Race in the 1980s. The outer space need for international regulation of liability is now primarily at the non-government level, which is where the space law experts envisioned space law liability should be housed when interviewed in 1964–1965. Thus, their vision is now relevant and should be considered for adoption in current times.

G. Required Insurance Bond to Compensate for Liability of Non-governmental Operators

The continuing increase in space objects, the lack of comprehensive space traffic management, and the need for expedited resolution of claims require a private international law dispute settlement machinery. A private international regulation of liability could be established and modeled after the Warsaw (now, Montreal) Convention, or the Rome Convention in the form of required insurance amounts or a minimum bond. The insurance or bond requirements could be part of a private international liability regime applicable to direct action in national courts of the participating countries. Adoption of the regulation would free national governments from having to bring lawsuits on behalf of non-governmental operators, which is increasingly beyond the capability of national governments.

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[268] *Id.* at 472–73.
[269] *Id.* at 465–66.