TO BOLDLY GO WHERE NO LAW HAS GONE BEFORE: LIABILITY FOR SPACE-RELATED ACTIVITIES

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INTRODUCTION

Recent years have witnessed an unprecedented proliferation of space-related activities, driven by an increasingly diverse array of State[1] and private actors in pursuit of an ever-broadening range of ambitions. As known risks mutate and intensify, and new risks continuously emerge, the law governing liability for extraterrestrial mishaps must keep pace, ensuring that the final frontier does not become a lawless domain of unchecked harm. This Article is the first to comprehensively and systematically appraise the weaknesses and gaps in existing law on liability for space-related activities and propose guidelines for legal development and reform, corresponding not only to present-day needs but also to a farsighted vision of the future.

Contemporary space law is an amalgam of international and domestic components. The international legal framework that applies to space-related activities (the so-called "Corpus Juris Spatialis"[2]) is based on five treaties.[3] It solidified in the 1960s and 1970s, shortly after the launch of Sputnik 1, the first artificial satellite.[4] During this era, space ventures were dominated by the governments of the United States and the Soviet Union.[5] These activities did not normally transcend the bounds of Earth's orbit while lunar exploration

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1. In this Article, the capitalized "State" refers to a sovereign country and the lowercase "state" denotes one of the fifty U.S. states.

2. *See* Barton Beebe, Note, *Law's Empire and the Final Frontier: Legalizing the Future in the Early Corpus Juris Spatialis*, 108 YALE L.J. 1737, 1738–39 (1999).

3. 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 *OST*]; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119; Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter *Liability Convention*]; Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereinafter *Registration Convention*]; Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 22 [hereinafter *Moon Agreement*].

4. *See* Yun Zhao, *Space Commercialization and the Development of Space Law*, *in* OXFORD RSCH. ENCYC. PLANETARY SCI. 1, 2–3 (Peter Read et al. eds., 2017) (discussing the history of the international regime). These are the only international treaties on the subject. The United Nations General Assembly and other international bodies adopted several resolutions and principles concerning different aspects of space activity, but none is binding. *Id.* at 7–8.

5. *See id.* at 2–3.

symbolized the pinnacle of the space race.[6] Their main purposes were scientific research, advancement of communication technology, and military surveillance.[7] The international framework addressed, to a limited extent and with the contemporaneous geopolitical, economic, technological, and perceptual constraints, the prospect of ensuing harms and their allocation through liability rules.[8] However, the negotiating countries were mostly concerned with physical injuries caused within their territories by fragments of foreign, State-launched space objects, not with "exotic" outer space incidents, and the liability regime was drafted accordingly.[9] The international framework, including the outdated liability scheme, has remained mostly stagnant since.[10]

National systems of space legislation and regulation have developed since the late 1950s and gained momentum in the 1980s and onwards as more nations joined the space club.[11] However, there has been no noteworthy innovation in national laws governing liability for space-related activities in recent decades. At any rate, some of the more futuristic deep space tort disputes to be discussed herein cannot be resolved by discrete national systems and entail a fundamental reform in international space law.[12] The lack of progress on the international level makes these disputes patently insoluble on any level.

This legal stagnation stands in stark contrast to the dramatic technological and economic advances. First, the number and nature of participants in space activities have considerably evolved. While the drafters of the international framework envisioned U.S. and Soviet government-sponsored projects, the number of countries engaged in space activities has surged, and the risks and costs associated with these activities have led to more multinational cooperation.[13] Additionally, and more importantly, private actors, such as Blue

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6. The Voyager probes, which had more ambitious missions, were launched only in 1977.

7. *See* Zhao, *supra* note 4, at 5 (discussing use of satellites for military and communication purposes).

8. Marc S. Firestone, Comment, *Problems in the Resolution of Disputes Concerning Damage Caused in Outer Space*, 59 TUL. L. REV. 747, 749–58 (1985) (discussing the international liability regime).

9. Herbert Reis, *Some Reflection on the Liability Convention for Outer Space*, 6 J. SPACE L. 125, 127 (1978).

10. Kendra Webb, Comment, *To Infinity and Beyond: The Adequacy of Current Space Law to Cover Torts Committed in Outer Space*, 16 TUL. J. INT'L & COMPAR. L. 295, 296 (2007). The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes (2020) are non-binding, do not offer significant innovations, and were not signed by major spacefaring countries such as China and Russia. *See The Artemis Accords*, NASA https://www.nasa.gov/artemis-accords/ (July 24, 2025) [https://perma.cc/562Y-PMHC] (including links to the Artemis Accords and a list of its signatories); *Artemis Accords*, U.S. DEP'T OF STATE, https://www.state.gov/bureau-of-oceans-and-international-environmental-and-scientific-affairs/artemis-accords [https://perma.cc/7SFY-R5UZ] (last visited Sep. 20, 2025).

11. Zhao, *supra* note 4, at 3–4 (discussing national legislation).

12. *See infra* Part III.

13. *See, e.g.*, *The Growth of Global Space Capabilities: What is Happening and Why it Matters: Hearing Before the Subcomm. on Space & Aeronautics of the H. Comm. on Sci. & Tech.*, 111th Cong. 17, 19 (2009) (statement of Marty Hauser, Vice President for Rsch. & Analysis, Washington Operations, the Space Foundation) ("Lots of countries have active space programs . . . increasing opportunities for more international collaboration. Benefits can be found . . . . To maximize the return on smaller budgets, many nations seek to develop limited

Origin, SpaceX, and Virgin Galactic, have assumed significant roles in space exploration and utilization.[14] While private enterprise can be traced back to the 1980s,[15] the twenty-first century brought a significant shift from State-funded scientific (and military) activities to commercial activities, starting with telecommunication services, navigation aid, and remote sensing.[16] Second, space ventures are proliferating and gradually reaching greater distances and new destinations far beyond Earth's orbit.[17] Third, new uses of space once confined to the realm of science fiction, such as tourism and recreation,[18] shipping,[19] mining,[20] or even settlement,[21] are planned. Fourth, general technological advances pose new risks to most types of activities, including space-related ones. For example, cyberattacks, imperfections of artificial intelligence models, and autonomous system failures might cause accidents involving space objects, their personnel, or other parties.[22]

The Article holistically evaluates international and national laws, but its innovative structure follows fundamental distinctions in international space law

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capabilities with the expectation that they will be able to partner with another nation that has complementary capabilities.").

14. *See* Brian Abrams, Note, *First Contact: Establishing Jurisdiction over Activities in Outer Space*, 42 GA. J. INT'L & COMPAR. L. 797, 799 (2014); Alexander P. Reinert, Note, *Updating the Liability Regime in Outer Space: Why Spacefaring Companies Should Be Internationally Liable for Their Space Objects*, 62 WM. & MARY L. REV. 325, 326, 329–32, 354 (2020).

15. Michael C. Mineiro, *Assessing the Risks: Tort Liability and Risk Management in the Event of a Commercial Human Space Flight Vehicle Accident*, 74 J. AIR L. & COM. 371, 373–74 (2009) (discussing the history of private space activities); Van C. Ernest, Note, *Third Party Liability of the Private Space Industry: To Pay What No One Has Paid Before*, 41 CASE W. RESERVE L. REV. 503, 503–04, 509 (1991) (same); Reinert, *supra* note 14, at 329 (same). Private activities were boosted in the U.S. by the enactment of the Commercial Space Launch Act of 1984. *See* 51 U.S.C. §§ 50901–23.

16. Paul B. Larsen, *Commercial Operator Liability in the New Space Era*, 113 AM. J. INT'L L. UNBOUND 109, 109 (2019) (discussing this trend); Trevor Kehrer, Comment, *Closing the Liability Loophole: The Liability Convention and the Future of Conflict in Space*, 20 CHI. J. INT'L L. 178, 189–90 (2019) (same); Sam Logterman, Note, *Astronomical Arbitration: Why Amending the Liability Convention Is the Best Step Forward for Interstellar Adjudication*, 30 MINN. J. INT'L L. 183, 185 (2021) (same); Zhao, *supra* note 4, at 5, 11 (same).

17. *See, e.g.*, Amanda Barnett, *10 Things: Going Interstellar*, NASA https://science.nasa.gov/solar-system/10-things-going-interstellar/ (May 13, 2025) [https://perma.cc/PKQ8-GH7Q].

18. The first space tourist was a U.S. citizen who paid around $20 million to visit a Russian space station in 2001. *See* John Daniszewski, *Russia Welcomes U.S. 'Space Tourist' as a Hero*, L.A. TIMES (May 7, 2001), https://www.latimes.com/archives/la-xpm-2001-may-07-mn-60363-story.html [https://perma.cc/4LWA-WRMT]. *See also* Abrams, *supra* note 14, at 799–800 (discussing commercial space flights); Mineiro, *supra* note 15, at 373–74 (same); Zhao, *supra* note 4, at 4–6 (same).

19. *See* Daisuke Wakabayashi, *Dreaming of Suitcases in Space*, N.Y. TIMES (Mar. 7, 2022), https://www.nytimes.com/2022/03/07/technology/inversion-suitcases-space.html [https://perma.cc/Z9CW-MKBX].

20. *See* Abrams, *supra* note 14, at 799 (discussing mining plans). Mining may be subject to some restrictions under international law. For example, article 11 of the Moon Agreement provides that the moon and its natural resources are "the common heritage of mankind" and that States must establish an international regime for exploiting such resources. *Moon Agreement*, *supra* note 3, at 25.

21. *See* Kirsten Grind, *Elon Musk's Plan to Put a Million Earthlings on Mars in 20 Years*, N.Y. TIMES (July 12, 2024), https://www.nytimes.com/2024/07/11/technology/elon-musk-spacex-mars.html [https://perma.cc/Z9ZT-NU2A].

22. *See* Kehrer, *supra* note 16, at 191–94 (discussing cyberattack risks).

to highlight and address the broader issues rather than any idiosyncrasies of specific national systems. At its core lies the ubiquitous legal term "space object" which—though not clearly defined in any of the treaties—seems to include launch vehicles, satellites, starships, space stations, and even structures in space settlements. The existing international regime is geocentric, in the sense that it revolves around Earth-launched space objects. Within this purview, the primary legal distinction is between (1) harm caused *by* space objects and (2) any wrong committed or harm caused *on board* space objects. A third, seemingly lawless realm includes futuristic space incidents that do not involve Earth-launched objects. The Article's structure follows this analytical trichotomy.

Part I focuses on harm caused *by* Earth-launched space objects. This category of cases, which is the only one that the drafters of the international regime vividly envisioned and feared, is unsurprisingly subject to the most developed legal framework. A space object may cause harm on Earth (as when fragments fall to the ground), in the atmosphere (as when a fragment hits an airplane), or in outer space (as when satellites collide).[23] Harm may be caused by the space object itself or by detaching components (either intentionally detached, such as fuel tanks, litter, rocket parts, lens caps, etc., or unintentionally detached through natural erosion, explosion, or collision[24]), with or without human error. A specific case of harm caused by space objects, which is probably the most analyzed in legal literature, is that of orbital debris which poses considerable risk to people and objects in outer space and sometimes also on Earth.[25] Victims can be nationals or nonnationals of the launching country and may have avenues of redress under the international scheme, their domestic law, and foreign law.[26] Part I considers these nuances, pinpointing various weaknesses in the existing framework and suggesting some modifications.

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23. *See, e.g.*, Edward R. Finch, Comment, *Outer Space Liability: Past, Present and Future*, 14 INT'L LAW. 123, 123–24 (1980) (discussing harms caused by the fall of the Soviet satellite Kosmos in Canada and by the fall of the U.S. Skylab in Australia); Joel Stroud, *Space Law Provides Insights on How the Existing Liability Framework Responds to Damages Caused by Artificial Outer Space Objects*, 37 REAL PROP., PROB. & TR. J. 363, 364–65 (2002) (discussing harm caused by space objects colliding with other objects or falling on Earth); Luke Punnakanta, Note, *Space Torts: Applying Nuisance and Negligence to Orbital Debris*, 86 S. CAL. L. REV. 163, 164, 170–71 (2012) (discussing harm caused by space debris and the crashing of various space objects on Earth).

24. *See* Punnakanta, *supra* note 23, at 166.

25. *See generally, e.g.*, Lawrence D. Roberts, *Addressing the Problem of Orbital Space Debris: Combining International Regulatory and Liability Regimes*, 15 B.C. INT'L & COMPAR. L. REV. 51 (1992) (discussing such instances and their legal implications); Delbert D. Smith, *The Technical, Legal, and Business Risks of Orbital Debris*, 6 N.Y.U. ENV'T L.J. 50 (1997) (same); James P. Lampertius, Note, *The Need for an Effective Liability Régime for Damage Caused by Debris in Outer Space*, 13 MICH. J. INT'L L. 447 (1992) (same); Peter T. Limperis, Note, *Orbital Debris and the Spacefaring Nations: International Law Methods for Prevention and Reduction of Debris, and Liability Regimes for Damage Caused by Debris*, 15 ARIZ. J. INT'L & COMPAR. L. 319 (1998) (same); Punnakanta, *supra* note 23, at 166–67; Mark J. Sundahl, Note, *Unidentified Orbital Debris: The Case for a Market-Share Liability Regime*, 24 HASTINGS INT'L & COMPAR. L. REV. 125 (2000) (same).

26. *See* Punnakanta, *supra* note 23, at 176–181 (discussing Canada's Liability Convention claim against the Russian government); *Liability Convention*, *supra* note 3.

Part II discusses wrongful conduct and harmful events *on board* Earth-launched space objects. This topic is particularly challenging when the relevant event occurs in outer space, outside any traditional territorial jurisdiction. The international regime does not provide liability rules or a dispute resolution mechanism as in the case of harm caused *by* space objects. Moreover, at first glance, it appears to preclude resolution of onboard cases by terrestrial courts. Article II of the Outer Space Treaty of 1967 (OST) makes it clear 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."[27] Put differently, no State can extend its sovereignty, including its jurisdiction and laws, into outer space.[28] Resolution of onboard tort cases may therefore entail some extension of terrestrial jurisdiction and law, as an exception to the general principle. Part II critically evaluates the two currently used extension methods: (1) the OST extension of State jurisdiction to registered space objects and (2) mission- or locus-specific agreements on jurisdiction, applicable tort law, specific loss allocation schemes, and dispute resolution mechanisms.

Lastly, Part III analyzes space incidents not involving Earth-launched objects, either because the objects that cause harm or on which a wrong is committed were not launched from Earth, or because the incident occurs outside any artificial space object. Here, existing law is mostly silent, and a fundamental reform is necessary. The Article explains and critically assesses three possible ways to handle these deep space incidents: a nationality-based extension of terrestrial jurisdiction, a modified registration-based extension of terrestrial jurisdiction, and the establishment of new space legal systems, possibly developing and applying their own tort law.

I. HARMS CAUSED BY EARTH-LAUNCHED SPACE OBJECTS

A. On Earth

1. Roadmap

The first subcategory of space-related torts pertains to Earth-launched space objects causing damage on Earth or in airspace. Real-world examples include a satellite reentering the atmosphere and crashing on a farm,[29] a

27. *OST*, *supra* note 3, at 2413. The Moon Agreement reiterates this principle as applied to the moon and other celestial bodies in the solar system. *Moon Agreement*, *supra* note 3, at 25.

28. The exception to the nonappropriation principle is geosynchronous orbits (enabling satellites to revolve at the same rate as Earth, thereby getting a constant view of a particular area) which are allocated by the International Telecommunication Union. *See* Punnakanta, *supra* note 23, at 168; Stroud, *supra* note 23, at 370–71.

29. Libby Cathey, *Space Satellite Crashes in Front Yard of Michigan Home*, ABC NEWS (Oct. 27, 2019, at 09:40

fragment of a launch vehicle falling into a village,[30] and a jettisoned device from the International Space Station striking a family house.[31] The international liability regime distinguishes between two classes of potential victims—(1) nationals (natural or juridical) of the State that launched or from whose territory one launched the space object causing the injury, as well as foreigners involved in the object's operation, and (2) uninvolved foreigners. The international regime does not apply to victims of the first class, only to those of the second.[32] Therefore, claims by nationals (and foreigners involved in the object's operation) are subject exclusively to national law[33] while uninvolved foreigners can choose between international and national law.[34] This Part discusses the two classes in turn. In both, one may envisage two possible types of defendants: (1) a State (or a relevant agency)—when that State (or agency) designed, constructed, maintained, launched, or operated the space object *or* when it permitted and monitored such activity by a private entity under domestic legislation and regulatory schemes—and (2) a private entity designing, constructing, maintaining, launching, or operating the space object.

2. Nationals of the Launching State

a. State Liability

A State can sometimes be liable under national law for injuries caused on Earth by its space-related activities (direct liability) or for failing to properly regulate private activities that caused injuries (indirect liability). Let us start with the former case, using the United States as an example. U.S. nationals harmed by government-launched space objects in U.S. territory or airspace, such as people whose person or property is injured by falling debris, may invoke the Federal Tort Claims Act (FTCA).[35] Under this statute, private parties can sue the federal government in federal courts for personal or property damage

CT), https://abcnews.go.com/US/space-satellite-crashes-front-yard-michigan-home/story?id=66562086 [https://perma.cc/5B5E-DD2D].

30. Aadil Brar, *Video Shows China's Falling Rocket Debris Exploding in Village*, NEWSWEEK, https://www.newsweek.com/china-falling-long-march-rocket-debris-explodes-village-1855676 (Dec. 27, 2023, at 05:00 ET) [https://perma.cc/L5DN-SEKE].

31. Robert Hart, *Who Is Responsible for Space Debris Falling on Your Home? Florida Family Sues NASA to Find Out*, FORBES, https://www.forbes.com/sites/roberthart/2024/06/24/who-is-responsible-for-space-debris-falling-on-your-home-florida-family-sues-nasa-to-find-out/ (June 24, 2024, at 14:28 ET) [https://perma.cc/V7J4-R5S4].

32. *Liability Convention*, *supra* note 3, at 2395; *see also* Joseph A. Bosco, *The United States Government as Defendant—One Example of the Need for a Uniform Liability Regime to Govern Outer Space and Space-Related Activities*, 15 PEPP. L. REV. 581, 585, 590 (1988) (discussing instances when the international regime applies or doesn't); Kehrer, *supra* note 16, at 202 (same); Larsen, *supra* note 16, at 111 (same).

33. Bosco, *supra* note 32, at 590; *see* Larsen, *supra* note 16, at 112.

34. *See* Bosco, *supra* note 32, at 589–90; Larsen, *supra* note 16, at 112.

35. *See* ANDREW W. MURNANE & DANIEL INKELAS, CONG. RSCH. SERV., RS21426, LIABILITY ISSUES ASSOCIATED WITH THE SPACE SHUTTLE COLUMBIA DISASTER 4 (2003).

caused by the negligent or wrongful acts and omissions of government employees perpetrated within the scope of their employment.[36] Federal courts then need to apply the law of the place (usually one of the fifty states) "where the *act or omission* occurred,"[37] not that of the place of injury.[38] In theory, the FTCA could be used when federal employees' negligence in space-related activities causes accidents within or over U.S. territory, as in the case of the Columbia space shuttle crash in 2003, which resulted in the death of seven crew members.[39]

However, the FTCA is relatively restrictive in terms of the grounds and general conditions for liability and the scope of damages. A few notable examples will suffice. First, imposition of liability requires proof of negligence or wrongful conduct[40] and therefore cannot be based on strict liability theories. This puts U.S. nationals at a disadvantage compared to non-nationals, who are protected under the strict liability rule of the international regime (to be discussed below),[41] or even nationals harmed by private space activities, who can invoke strict liability theories under domestic tort law.[42] Second, the FTCA does not allow claims based upon the exercise of (or failure to exercise) a discretionary function or duty by a federal employee or agency.[43] Thus, if federal employees exercised discretion in making decisions leading to an accident, claims under the FTCA may be barred. Third, the FTCA does not allow victims to recover punitive damages.[44]

In addition, the FTCA might be inapplicable to injuries sustained by *participants* in the U.S. space program, as opposed to other (uninvolved) victims. First, many participants, including astronauts, are military personnel. Under *Feres v. United States*,[45] the U.S. government cannot be liable for injuries caused by members of the armed forces to other members while on active duty.[46] This doctrine was extended to injuries caused by federal civil employees to members of the armed forces during activities incident to their service.[47] To the extent

36. *See* 28 U.S.C. § 1346(b)(1).

37. *Id.* (emphasis added); *see also* S. Pac. Transp. Co. v. United States, 462 F. Supp. 1193, 1213 (E.D. Cal. 1978) (explaining that in most cases applicable law is state tort law); Bosco, *supra* note 32, at 593 (reiterating governing law of FTCA claims).

38. Richards v. United States, 369 U.S. 1, 9–10 (1962).

39. *See* Marcy Darsey, Comment, *"To the Stars, Despite Adversity": Liability for the* Columbia *Space Shuttle Tragedy*, 42 HOUS. L. REV. 457, 458, 465–67 (2005) (discussing NASA's negligence).

40. Laird v. Nelms, 406 U.S. 797, 802–03 (1972).

41. Bosco, *supra* note 32, at 593–95.

42. *See infra* Part I.A.2.b.

43. 28 U.S.C. § 2680(a); *see also* Bosco, *supra* note 32, at 600–04 (discussing the applicability of the discretionary function doctrine); Darsey, *supra* note 39, at 483–84 (same).

44. 28 U.S.C. § 2674; Bosco, *supra* note 32, at 594.

45. 340 U.S. 135 (1950).

46. *See id.* at 136–38, 146.

47. United States v. Johnson, 481 U.S. 681 (1987); *see also* Bruce A. Brown, Comment, *Commercial Law and Liability Issues of the Space Transport System*, 23 A.F. L. REV. 424, 434 (1982–83) (discussing *Feres* and space accidents); Anne R. Riley, United States v. Johnson*: Expansion of the* Feres *Doctrine to Include Servicemembers'*

that the victim was injured while in service, the FTCA does not apply.[48] Accordingly, a federal district court denied an FTCA action by the widow of the space shuttle Challenger's pilot following its explosion in 1986, holding that the deceased's activity was "incident to his military service."[49] Second, most participants in the U.S. space program, including some of the astronauts, are federal civil employees.[50] According to the Federal Employees' Compensation Act (FECA), federal civil employees cannot bring actions under the FTCA with respect to injuries sustained while in the performance of their duties.[51] To conclude, the FTCA offers no avenue of redress to certain categories of victims and a relatively restrictive one to others.

An even more limited legal path in the U.S. is the National Aeronautics and Space Act, which authorizes NASA to consider, settle, and pay claims arising from U.S. space activities.[52] Such claims cannot normally exceed $25,000.[53] They are limited to physical harm (bodily injury, death, and property damage) "resulting from the conduct of the Administration's functions" (most notably "plan[ning], direct[ing], and conduct[ing] aeronautical and space activities").[54] These claims may be settled and paid at NASA's discretion even if the U.S. "could not be held legally liable to the claimant[s]" under the FTCA.[55]

Turning to indirect liability, space-related activities carried out by private entities are generally subject to governmental regulation, licensing, and monitoring.[56] For example, in the United States, the Department of Transportation, through the Federal Aviation Administration, licenses commercial space launch and reentry.[57] Theoretically, a regulator failing to

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FTCA Suits Against Civilian Government Employees, 42 VAND. L. REV. 233 *passim* (1989) (discussing the *Feres* doctrine more generally).

48. *See* Bosco, *supra* note 32, at 597–98; Darsey, *supra* note 39, at 475–80. Military personnel may resort to the more limited statutory disability and death benefits. *See* 38 U.S.C. §§ 1122, 1311 (affording benefits in cases of military death).

49. Smith v. Morton Thiokol, Inc., 712 F. Supp. 893, 897–98 (M.D. Fla. 1988), *aff'd sub nom.*, 877 F.2d 40 (11th Cir. 1989), *cert. denied*, 493 U.S. 1069 (1990); Darsey, *supra* note 39, at 470–71 (discussing the case further).

50. *See* MURNANE & INKELAS, *supra* note 35, at 2; Darsey, *supra* note 39, at 474–75 (discussing the death of civilian astronaut Kalpana Chawla in the Columbia disaster).

51. 5 U.S.C. §§ 8101(1), 8102, 8116(c); Bosco, *supra* note 32, at 598–99. Civil employees are entitled to more limited remedies under the FECA itself.

52. 51 U.S.C. § 20113(m)(1).

53. *Id.* If NASA deems a claim exceeding $25,000 meritorious it must "report the facts and circumstances to Congress for its consideration." *Id.* § 20113(m)(2).

54. *Id.* §§ 20112(a)(1), 20113(m)(1).

55. 14 C.F.R. § 1261.301(b) (2025).

56. Art. VI of the OST provides that private entities' activities in outer space must be authorized and supervised by the respective State Party. *OST*, *supra* note 3, at 2415. Domestic legislation usually sets the framework for such authorization and supervision. *See* Reinert, *supra* note 14, at 343. The ensuing regulatory variance might lead to a race to the bottom among launching countries.

57. 51 U.S.C. §§ 50901–23; 14 C.F.R. §§ 450.1–450.219 (2025); Logterman, *supra* note 16, at 191. *Cf.* Wet van 24 januari 2007, houdende regels omtrent ruimtevaartactiviteiten en de instelling van een register van ruimtevoorwerpen (Wet ruimtevaartactiviteiten), Stb. 2007, 80 [Act of Jan. 24, 2007, Incorporating Rules Concerning Space Activities and the Establishment of a Registry of Space Objects (Space Activities Act)] ch.

properly perform its regulatory tasks, or awarding or failing to revoke or suspend a license when the licensee does not meet the relevant standards, may be sued in tort for ensuing injuries, as in the analogous contexts of driving[58] and aviation accidents.[59] However, such actions might encounter several often insurmountable obstacles.

Most importantly, issuing a license may be deemed a discretionary function covered by the governmental tort immunity.[60] In *United States v. Varig Airlines*,[61] this immunity defeated tort actions against the U.S. for the Federal Aviation Administration's alleged negligence in awarding airworthiness certifications to airplanes subsequently involved in accidents, and it seems reasonable to assume that space regulators will be treated equally. Even though this immunity is relatively wide-ranging, the victim-plaintiff can avoid it in the appropriate cases by showing that the State or the agency failed to follow mandatory licensing requirements.[62] Thus, in *Berkovitz v. United States*,[63] the Supreme Court held that the discretionary function exception to the waiver of sovereign immunity under the FTCA does not apply "when a federal statute, regulation, or policy specifically prescribes a course of action for an employee to follow."[64]

Furthermore, the highly complex nature of space regulation and supervision, involving numerous interrelating factors—from general policy considerations to technical specifications—might make it exceptionally difficult to establish the government's negligence, which is required under the FTCA and many theories of liability.[65] Also, in some cases, particularly where a licensee habitually violates applicable law, courts may conclude that the State's negligence in issuing or failing to revoke the license was not the proximate cause

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2 § 1 sec. 3(1) (Neth.) (prohibiting space activities without a license from the Minister of Economic Affairs) [hereinafter Space Activities Act]; Michael Listner, *A Comprehensive First Look at Denmark's Domestic Space Law*, SPACE REV. (May 31, 2016), https://www.thespacereview.com/article/2994/1 [https://perma.cc/C9NH-8YEP] ("Space activities may be performed by Danish citizens only with prior approval of the Minister of Education and Science . . . .").

58. *See* 7A AM. JUR. 2D *Automobiles and Highway Traffic* § 101 (2025).

59. *See* Mineiro, *supra* note 15, at 376 (discussing air traffic control liability for aviation accidents).

60. *See, e.g.*, Thompson v. Dep't of Highway Safety & Motor Vehicles, 692 So. 2d 272, 273 (Fla. Dist. Ct. App. 1997) (discussing a driver's license); 57 AM. JUR. 2D *Municipal, County, School, and State Tort Liability* § 184 (2025) (discussing liability for negligent licensing of drivers); Joseph A. Bosco, *Liability of the United States Government for Outer Space Activities Which Result in Injuries, Damages or Death According to United States National Law*, 51 J. AIR L. & COM. 809, 845–50 (1986) (explaining that licensing, regulatory actions, etc., are within the discretionary function).

61. 467 U.S. 797, 814–20 (1984).

62. *See, e.g.*, Trewin v. State, 198 Cal. Rptr. 263, 265 (Ct. App. 1984) ("Where a public entity is under a mandatory duty . . . designed to protect against the risk of a particular kind of injury, that public entity is liable for an injury of that kind proximately caused by its failure to discharge the duty . . . ."); 57 AM. JUR. 2d *Municipal, County, School, and State Tort Liability* § 176 (2025) (explaining that the immunity does not apply to licensing if a mandatory duty is breached).

63. 486 U.S. 531 (1988).

64. *Id.* at 536.

65. *Cf.* Ronen Perry, *Who Should Be Liable for the COVID-19 Outbreak?*, 58 HARV. J. ON LEGIS. 253, 289 (2021) (demonstrating a similar problem in the context of pandemic response).

of the injuries, which ought to be attributed to the licensee's misfeasance.[66] All these add up to a slim chance of liability for negligent regulation or supervision.

Nevertheless, most of the formal limits of and practical constraints on State liability for harm caused by space objects are not unique to this context and are similarly troubling in other areas of State action and regulation.[67] The law's imperfections are general. Therefore, to the extent that amendments and modifications are due, they must be considered and made at a much higher level of abstraction, which transcends the boundaries of this article.

b. Private Entities' Liability

If an injury was caused on Earth or in airspace by a private individual or entity, such as spaceship crew members, operators, or manufacturers, liability is usually governed by the law of torts—including negligence and product liability law where relevant—of the polity in which the wrongdoing or the accident occurred.[68] Specifically, if an injury was caused in the U.S. by a private entity (rather than the government), an action can be brought in the competent court under the law of torts of the state in which the harm or wrongdoing occurred.[69] For instance, if a private entity was negligent in launching a space object from Florida or landing it there, resulting in injury in Georgia, the victim may bring an action in a Georgia court or (depending on the amount) in a federal district court.[70] The competent court in a cross-border tort case usually needs to choose between the law of the place of the injury, here Georgia tort law, and the law of the place of the wrongful conduct, namely Florida tort law.[71] Between these two, courts tend to choose the more favorable option for the plaintiff.[72]

66. *See, e.g.*, Southworth v. State, 392 N.E.2d 1254, 1255 (N.Y. 1979) (denying an action against the state for death caused by an improperly licensed driver for lack of proximate causation); Bockelman v. State, Dep't of Transp., 366 N.W.2d 550, 554 (Iowa 1985) (denying liability for failure to suspend driving license of a habitual offender for lack of proximate causation). Admittedly, this problem will not arise in all cases. *See, e.g.*, Washoe County v. Transcon. Ins. Co., 878 P.2d 306, 308 (Nev. 1994) (holding the county's negligent licensing of a day-care center in which children were abused was the proximate cause of the abuse).

67. *See, e.g.*, Perry, *supra* note 65, at 286–90 (discussing claims in the context of COVID-19).

68. *See* Mineiro, *supra* note 15, at 376–77, 380 (comparing space-related claims to claims for commercial aviation accidents).

69. *See id.* at 380–81 (explaining that the applicable law is state tort law). State tort law is not preempted by relevant federal legislation.

70. *See* 28 U.S.C. § 1332 (granting diversity jurisdiction).

71. The traditional position in the U.S. is that the law of the place of the harm determines liability, not the law of the place of the conduct. RESTATEMENT (FIRST) OF CONFLICT OF LAWS §§ 377–79 (A.L.I. 1934) ("The place of wrong is in the state where the last event necessary to make an actor liable for an alleged tort takes place."); Sidney E. Cook, Comment, *Long Distance Torts*, 10 LA. L. REV. 329, 330 (1950). Nowadays, many jurisdictions apply the law of the state with the most significant relationship to the occurrence and the parties based on the place of injury, the place of conduct, the parties' residence and nationality, and the place where their relationship is centered. RESTATEMENT (SECOND) OF CONFLICT OF LAWS § 145 (A.L.I. 1971). Still, the place of the injury plays an important role in the analysis. *Id.* §§ 145 cmt. e, 146–47, 157. *See also infra* Part II.B.2 (detailing which state law applies).

72. Symeon C. Symeonides, *Plaintiff's Choice of Law in Cross-Border Tort Conflicts*, 56 N.Y.U. J. INT'L L. & POL. 379, 380–90 (2024).

Similarly, if a space object manufactured in Florida crashes in Georgia due to a design defect, causing physical injury, the manufacturer may be strictly liable under Georgia (or Florida) product liability law.[73]

Ascertaining a private entity's negligence may often benefit from the underlying regulatory scheme. Thus, a space accident would normally lead to an investigation by a regulatory body, and the ensuing report may help substantiate negligence and causation.[74] Moreover, private entities wishing to carry out space activities are subject to statutory and regulatory requirements, including the obligation to obtain a license from the competent government authority and meet various safety requirements.[75] Failure to comply with relevant statutory and regulatory requirements may be deemed negligence per se and give rise to liability, to the extent that the plaintiff's injury can be attributed to the defendant's noncompliance, or at least serve as prima facie evidence of negligence.[76] Compliance with statutory and regulatory standards is usually considered evidence of due care in negligence actions and of lack of a defect in product liability actions, even though such evidence is rarely conclusive.[77] Thus, parties involved in the manufacturing, launch, or operation of space objects may fend off tort actions under this somewhat weak regulatory compliance doctrine.

At times, special liability rules may pertain to certain types of space activities or actors. For example, operators of commercial space transportation vehicles may be subject to the heightened standard usually applicable to "common carriers."[78] Furthermore, space-related activities, particularly rocket-based launches, flights, and landings, may be deemed abnormally dangerous activities, and therefore subject to strict liability, at least until they become "a matter of

73. *See* GA. CODE ANN. § 51-1-11(b)(1).

74. *Cf.* Darsey, *supra* note 39, at 464–67, 485–86 (discussing the findings of the Columbia Accident Investigation Board).

75. *See supra* notes 56–57 and accompanying text.

76. *See* RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 14 (A.L.I. 2010) (stipulating that violation of a statute designed to protect a class to which the victim belongs against the type of accident caused is negligence); RESTATEMENT (SECOND) OF TORTS §§ 286, 288B (A.L.I. 1965) (stating that violation of a statutory or regulatory provision is negligence if that provision intended to protect a class of people which includes the plaintiff and the particular interest invaded against the kind of harm caused, and evidence of negligence suggests otherwise); Richard C. Ausness, *The Case for a "Strong" Regulatory Compliance Defense*, 55 MD. L. REV. 1210, 1239 (1996) ("In most jurisdictions, unexcused violations of state statutes are treated as negligence per se."). Some jurisdictions treat violations of administrative regulations as evidence or prima facie evidence of negligence rather than negligence per se. *Id.* at 1240–41. Arguably, the negligence per se doctrine can be applied to private entities violating certain international space norms, such as those outlined in the OST. Jaime José Hurtado Cola, *Tort Liability of Non-State Actors for Violations of the Outer Space Treaty,* 57 TORT TRIAL & INS. PRAC. L.J. 541, 598–604 (2022).

77. *See* RESTATEMENT (SECOND) OF TORTS § 288C (A.L.I. 1965) ("Compliance with a legislative enactment or an administrative regulation does not prevent a finding of negligence where a reasonable man would take additional precautions."); Ausness, *supra* note 76, at 1241–47 (showing that regulatory compliance constitutes some evidence of due care or non-defective product design).

78. *See* Mineiro, *supra* note 15, at 377–78.

common usage . . . ."[79] This doctrine is limited to physical harm caused outside the space object, as opposed to harm to participants in the space object's mission, such as crew members, passengers, or cargo owners.[80] Lastly, manufacturers of space vehicles or their components are subject to strict product liability.[81]

Tort actions for space-related injuries may also be subject to special immunities. For example, in some jurisdictions (such as Florida and Virginia), the legislature granted immunity to space flight operators compliant with risk disclosure provisions against participants' claims.[82] Also in the U.S., if the private entity manufactured the space object or the faulty component that caused injury under contract with the federal government and followed government-set contractual specifications, it can invoke the government contractor defense under *Boyle v. United Technologies Corporation*.[83] *Boyle* extended the federal government's discretionary function immunity "to contractors who provide[d] equipment to the government under [reasonably precise] government-[approved] specifications."[84] Because the defense derives from the discretionary function doctrine, it covers claims by civilians (not only by members of the armed forces).[85] There is some controversy, however, on whether the *Boyle* doctrine applies only to military or also to non-military equipment.[86]

In many countries, special legislation applies to accidents involving space objects. Several European countries, such as Denmark and the United Kingdom, imposed strict liability on private entities engaged in space activities (usually owners of space objects) for personal injuries and property damage caused by their objects on Earth or in airspace.[87] In the Netherlands, the license holder's strict liability for its space activity is not explicitly limited to personal

79. *See id.* at 384–88 (discussing the various criteria for identifying abnormally dangerous activities in the context of space activities under RESTATEMENT (SECOND) OF TORTS § 520 (A.L.I. 1977)); Barton E. Showalter, Comment, *In Space, Nobody Can Hear You Scream "Tort!*," 58 J. AIR L. & COM. 795, 808 (1993) (finding space launches to be abnormally dangerous activities).

80. *See* Showalter, *supra* note 79, at 809 (suggesting that such a limit applies to space missions); *cf.* RESTATEMENT (SECOND) OF TORTS § 520A cmt. e (A.L.I. 1977) (applying that limit to aviation accidents).

81. *See* Mineiro, *supra* note 15, at 396–97. *See generally* RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIAB. § 2 (A.L.I. 1998) (providing definitions and stating products are defective by manufacture, design, inadequate instructions, or lack of warning if defect was present during sale or distribution).

82. FLA. STAT. ANN. § 331.501 ("[A] spaceflight entity is not liable for injury to or death of a participant or crew resulting from spaceflight activities" if that participant has been informed of the risks and has given informed consent); VA. CODE ANN. § 8.01-227.9 (2025) (same); Mineiro, *supra* note 15, at 381–82.

83. 487 U.S. 500, 512 (1988).

84. Sean Watts, Boyle v. United Technologies Corp. *and the Government Contractor Defense: An Analysis Based on the Current Circuit Split Regarding the Scope of the Defense*, 40 WM. & MARY L. REV. 687, 687 (1999).

85. *Id.* at 697, 701.

86. *Id.* at 695–702 & n.62.

87. Lov Om Aktiviteter i det Ydre Rum [Outer Space Activities Act] § 11(1) (Den. 2016); Space Industry Act 2018, c. 5, § 34(2) (UK).

injury and property damage.[88] Strict liability for space activities is subject to a contributory negligence defense[89] and often capped.[90] In some countries, including the U.S., private entities seeking authorization for space activities are required to obtain insurance covering their liability to persons and property (at times up to a certain limit).[91]

To conclude, national laws on private entities' liability for injuries on Earth or in airspace are well developed: they follow the general principles of domestic tort law and do not require an overhaul. Because the international liability regime does not apply to nationals of the State that launched, or from whose territory one launched the space object, or foreigners involved in the object's operation, the interrelation between this regime and domestic law need not be discussed at this point.[92]

3. Non-Nationals of the Launching State

a. International Law

When a space object launched by or from one State causes harm to another State or its nationals that were uninvolved in the object's operation, the international liability regime comes into play.[93] Article VI of the OST holds States responsible for national activities in outer space, whether "carried on by governmental agencies or by non-governmental entities . . . ."[94] Accordingly, Article VII provides that any State launching an object into outer space or from whose territory or facility an object is launched is liable for damage caused to other States or their nationals *by* that object or its components on Earth, in the air, or in outer space.[95] The Liability Convention of 1972 reiterates this general

88. Space Activities Act, *supra* note 57, ch. 4 sec.12(2) (Neth.).

89. Space Industry Act 2018, c. 5, § 34(3) (UK); *cf.* Outer Space Activities Act, *supra* note 87, § 11(3) (Den.) (limiting the defense to intent or gross negligence).

90. *See, e.g.*, Space Industry Act 2018, c. 5, § 12(2) (UK).

91. 51 U.S.C. § 50914(a)(1) ("When a launch or reentry license is issued or transferred . . . the licensee or transferee shall obtain liability insurance . . . in amounts to compensate for the maximum probable loss . . . ."). If damages exceed the statutory ceiling, the U.S. government pays the remainder up to a certain amount. 51 U.S.C. § 50915. *See also* BUNDESGESETZ ÜBER DIE GENEHMIGUNG VON WELTRAUMAKTIVITÄTEN UND DIE EINRICHTUNG EINES WELTRAUMREGISTERS [WELTRAUMGESETZ] [FEDERAL LAW ON THE AUTHORISATION OF SPACE ACTIVITIES AND THE ESTABLISHMENT OF A NATIONAL REGISTRY (OUTER SPACE ACT)], BUNDESGESETZBLATT [BGBL] No. 132/2011 § 4(4) (Austria) (obligating operator to obtain insurance coverage in the public interest); Outer Space Activities Act, *supra* note 87, § 13(1) (Den.) (allowing imposition of insurance requirements on operator); Space Activities Act, *supra* note 57, ch. 2 § 1 sec. 3(4) (Neth.) (requiring insurance coverage for licensees); FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 104–06 (2d ed. 2018) (discussing mandatory insurance in several jurisdictions); Larsen, *supra* note 16, at 112 (same); Mineiro, *supra* note 15, at 392–93 (same).

92. *See infra* notes 135–36 and accompanying text.

93. *See* Firestone, *supra* note 8, at 749–62 (discussing the history and specifics of the international liability regime).

94. *OST*, *supra* note 3, at 2415.

95. *Id.*

principle[96] and sets out the details. All main actors in space exploration, including the U.S., Russia (formerly the USSR), and China, are signatories.[97] Yet despite its great promise, it was invoked only once in over fifty years, following the crash of Kosmos 954, a Soviet nuclear reconnaissance satellite, in Canada.[98]

The implementation of the general liability principle under the Liability Convention offers a seemingly extensive coverage. First, a launching State is defined as either (1) a State which launches, procures launching of, or attempts to launch a space object, or (2) a State from whose territory or facility the object is launched.[99] Thus, State liability covers harm caused by objects launched not only by or on behalf of the State but also by others, including private entities operating from its territory.[100] For example, a crash of a Blue Origin or SpaceX object launched from the U.S. might give rise to liability of the U.S. government, while the private entities are not liable at all.[101] If there are two or more launching States (for instance, if Germany and France construct a satellite and launch it from Kazakhstan, there are three), all are jointly and severally liable,[102] and if one paid compensation it has a right for indemnification against the others.[103] A transfer of a space object to another State or entity does not change the identity of the launching State. Launching States may therefore require permission for transfers, to control the risk of liability for space activities carried out by new owners.[104] Permission may be conditional on the succeeding owner's commitment to indemnify the launching State for any liability that might arise from the operation of the object.[105]

Second, State liability under the Convention covers harm caused not only by the space object as such but also by any of its components or its launch vehicle.[106] The term "components" may be interpreted broadly to encompass

96. *Liability Convention*, *supra* note 3, at 2392.

97. The U.S. and the Soviet Union were among the original signatories of the convention. *Id.* art. XXVVIII. China acceded in 1988. *See* Convention on International Liability for Damage Caused by Space Objects, Accession – China, Dec. 20, 1988, 1527 U.N.T.S. 311.

98. *See* Andre G. DeBusschere, *Liability for Damage Caused by Space Objects*, 3 J. INT'L L. & PRAC. 97, 99–100 (1994) (explaining that the claim was settled); Kehrer, *supra* note 16, at 185–86 (same); Larsen, *supra* note 16, at 109 (same); Logterman, *supra* note 16, at 183–84, 189–90 (same); Sraavya Poonuganti, Comment, *It's Raining Rockets: Heightening State Liability for Space Pollution*, 23 CHI. J. INT'L L. 490, 499–500 (2023) (same).

99. *Liability Convention*, *supra* note 3, at 2392; *see also* Armel Kerrest & Caroline Thro, *Liability for Damage Caused by Space Activities*, *in* ROUTLEDGE HANDBOOK OF SPACE LAW 59, 60–61 (Ram S. Jakhu & Paul Stephen Dempsey eds., 2016) (discussing the definition).

100. Punnakanta, *supra* note 23, at 174. This is consistent with article VI of the OST, which holds states responsible for national activities in outer space, "whether such activities are carried on by governmental agencies or by non-governmental entities . . . ." *OST*, *supra* note 3, at 2415.

101. Some advocate amending the Convention to impose direct liability on private entities responsible for space accidents. *See, e.g.*, Reinert, *supra* note 14, at 350–53, 355–56.

102. *Liability Convention*, *supra* note 3, at 2394.

103. *Id.*

104. *See, e.g.*, Outer Space Act, *supra* note 91, § 8 (Austria); Outer Space Activities Act, *supra* note 87, § 15(2) (Den.).

105. *See, e.g.*, Outer Space Activities Act, *supra* note 87, § 15(2) (Den.); Listner, *supra* note 57.

106. *Liability Convention*, *supra* note 3, at 2392.

smaller pieces of debris generated by or detached from a space object.[107] It may even include a space object's payload, at least when not designed to separate or move independently in space, making injuries caused by cargo items located within the space object or attached to it actionable.[108]

Third, Article II of the Liability Convention provides that liability for harm caused on the surface of the Earth or to an aircraft in flight is "absolute."[109] To be exact, liability is strict: it is based on a causal link between the operation of the space object and the harm, irrespective of the defendant's fault, but the launching State is exempted if the damage was caused by gross negligence or intentional conduct of the claiming State or any persons it represents.[110] This limited version of the contributory negligence defense is quite difficult to establish.

Still, the international liability regime has several constraints. First, it applies only to damage caused *by* space objects. Damage caused *on board* space objects, such as that inflicted by crew members or anything in their control or possession on the person or property of others, is not covered (except, perhaps, in the case of harm caused on board a vessel by payload, as explained above).[111] Harms caused on space objects, including space stations, starships, and space settlements, will therefore be discussed separately below.

Second, the scope of liability is limited and unclear. The Convention imposes liability only for physical harm—loss of life, personal injury, impairment of health, and property damage.[112] The heads of damages covered under these rubrics and the appropriate quantum of damages under each head might be subject to controversy among jurisdictions.[113] For instance, it is unclear whether impairment of health should be interpreted to include direct mental anguish.[114] Even if it should, it is undecided whether the Convention covers indirect (relational) loss, namely harm that does not directly flow from the object's operation but from a consequence thereof, such as emotional harm

107. *See, e.g.*, Joel A. Dennerley, *State Liability for Space Object Collisions: The Proper Interpretation of 'Fault' for the Purposes of International Space Law*, 29 EUR. J. INT'L L. 281, 287 (2018) (arguing that even small fragments of space objects are components); Roberts, *supra* note 25, at 64 (same); Lampertius, *supra* note 25, at 453 (same); Sundahl, *supra* note 25, at 135–36 (same).

108. Carl Q. Christol, *International Liability for Damage Caused by Space Objects*, 74 AM. J. INT'L L. 346, 357 (1980); S. Gorove, *The US/International Space Station: Legal Aspects of Space Objects and Jurisdiction and Control*, *in* MANNED SPACE STATIONS – LEGAL ISSUES: PROCEEDINGS OF THE EUROPEAN SPACE AGENCY COLLOQUIUM 27, 28 (1990), *available at* https://adsabs.harvard.edu/full/1990ESASP.305...27G [https://perma.cc/GUE7-752X].

109. *Liability Convention*, *supra* note 3, at 2392–93.

110. *Id.* at 2394.

111. *See supra* note 108 and accompanying text.

112. *Liability Convention*, *supra* note 3, at 2392.

113. *See* Bosco, *supra* note 32, at 589 (discussing the difference between the common law and Soviet concepts of compensation for bodily injuries in the 1980s); Firestone, *supra* note 8, at 762, 771 (explaining that the Convention is unclear on heads and quantum of damages).

114. Christol, *supra* note 108, at 360, 362.

following a physical injury to a direct victim.[115] Additionally, the Convention does not allow recovery for purely economic losses, direct or indirect. Surprisingly, it was invoked by Canada to recover the costs of cleaning nuclear debris following the crash of the Soviet Kosmos 954 satellite across its territory.[116] This might imply endorsement of a "permissive reading" of the Convention.[117] But it may well be that the cleaning cost, being a purely economic loss, was not truly covered by the Convention.[118] Alternatively, one may consider the cleaning cost as the cost of repair of (unowned) property rather than a purely economic loss.[119] Either way, the question of economic loss was not decided because the Soviet Union settled the case.[120] Note also that the scope of damages under the Convention corresponds to the extent of the harm,[121] so punitive damages are precluded. [122] In theory, amendments to the Convention can remove the uncertainties and expand liability, but controversies among States on the proper scope of liability in conjunction with international tensions make such amendments impractical.

Third, any claim under the Convention is pursued in an out-of-court process which does not generate an enforceable outcome. Initially, a claim is presented by the claiming State to the launching State through diplomatic channels or, in the absence of diplomatic relations between the two, through a third State.[123] If the diplomatic negotiations do not generate a settlement within a year, each party can request the establishment of a three-member Claims Commission.[124] Even though the Claims Commission is a quasi-judicial body, in the sense that it can decide (1) whether a claim is meritorious and (2) what the scope of damages should be,[125] its decision is recommendatory (unless the

115. *See, e.g.*, *id.* at 360–62, 364 (arguing that causation suffices and that both direct and indirect losses are recoverable); Finch, *supra* note 23, at 126 (discussing the lack of clarity); Firestone, *supra* note 8, at 771–72 (same); Kerrest & Thro, *supra* note 99, at 67 (same).

116. *See* DeBusschere, *supra* note 98, at 99–100; Christol, *supra* note 108, at 346–47; Kehrer, *supra* note 16, at 185–86; Kerrest & Thro, *supra* note 99, at 66; Larsen, *supra* note 16, at 109; Punnakanta, *supra* note 23, at 176.

117. Logterman, *supra* note 16, at 190.

118. *See* Christol, *supra* note 108, at 347; Kehrer, *supra* note 16, at 186; Punnakanta, *supra* note 23, at 176–77.

119. *See* Andrew Brearley, *Reflections upon the Notion of Liability: The Instances of* Kosmos 954 *and Space Debris*, 34 J. SPACE L. 291, 307, 314 (2008) (arguing that the environmental harm was "damage to Canadian property"); Bryan Schwartz & Mark L. Berlin, *After the Fall: An Analysis of Canadian Legal Claims for Damage Caused by Cosmos 954*, 27 MCGILL L.J. 676, 716–17 (1982) (arguing that cleaning costs were costs of removing property damage to Canadian territory).

120. *See supra* note 98.

121. *Liability Convention*, *supra* note 3, at 2397; Kerrest & Thro, *supra* note 99, at 67.

122. *See* Christol, *supra* note 108, at 366–68 (defending this position while discussing a minority view whereby the Commission can award punitive damages); Finch, *supra* note 23, at 126.

123. *Liability Convention*, *supra* note 3, at 2396.

124. *Id.* at 2398–99.

125. *Id.* at 2399–400.

parties agree that it shall be binding).[126] There is no enforcement mechanism. When the launching State and the claiming State have an adversarial relationship, the recommendation might not be followed.[127] Adding to the distinct procedure, claims under the Convention are subject to a limitation period of one year from the occurrence of the injury or the identification of the liable State or from the discovery of these facts if they were reasonably unknown.[128]

Fourth, and most importantly, as opposed to traditional tort law, the international regime does not necessarily connect the injurer and the victim. On the one hand, it does not always impose liability on those responsible for the injury. As explained above, even if private entities designed, constructed, launched, operated, or maintained the space object involved, they are not liable. The launching State is also liable when control over the space object is transferred to or seized by another entity (from another State), or when intervening third parties affect the space object's operation.[129] While this constraint seems acceptable from a compensatory perspective, given governments' unrivaled capacity to compensate victims, it is highly problematic in view of the other fundamental goals of civil liability. Specifically, if those responsible for harm evade liability, the outcome is likely unfair and the deterrent effect of liability is lost; if the nonculpable are liable, they are unfairly burdened and over-deterred.[130] On the other hand, the Convention does not necessarily offer redress to direct victims, as it allows only States to present claims.[131] If the victims are private entities, they have no standing of their own. The State pursues the claim on their behalf,[132] so the empowering effect of a civil claim is lost.[133] Thus, if a spacecraft launched by company C1 from State S1 injures the property of a private company C2 in State S2, the claim will be brought by S2 against S1. C2 cannot be sued and C1 cannot present a claim.

126. *Id.* at 2400; *see also* Finch, *supra* note 23, at 123, 126 (discussing Canada's claim against the USSR); Kehrer, *supra* note 16, at 186–87 (same); Reinert, *supra* note 14, at 336 (discussing Claims Commission process).

127. Kehrer, *supra* note 16, at 187.

128. *Liability Convention*, *supra* note 3, at 2396.

129. Kehrer, *supra* note 16, at 180, 184–85, 187–88, 192.

130. *See id.* at 181, 184, 188, 194, 202–03 (explaining that incentives are skewed). *See generally* Alan D. Miller & Ronen Perry, *The Reasonable Person*, 87 N.Y.U. L. REV. 323, 328 (2012) ("Imposing liability . . . forces potential injurers to . . . internalize[] the externalities of inefficient conduct, thereby preventing such conduct."). Arguably, the imposition of liability on a State with no control over the launched object is also inconsistent with the general international law principle that associates legal responsibility with control. Kehrer, *supra* note 16, at 194. Kehrer discussed a possible interpretation that precludes liability for injuries not caused by the launching State's conduct, based on art. XII, whereby damages must be awarded in accordance with international law and principles of justice and equity. *Id.* at 204–05.

131. *Liability Convention*, *supra* note 3, at 2395.

132. Larsen, *supra* note 16, at 111; *see* Webb, *supra* note 10, at 308–09.

133. *See* Ronen Perry, *Empowerment and Tort Law*, 76 TENN. L. REV. 959 *passim* (2009) (discussing the empowering features of the traditional tort process for victims of power abuse, which may also be relevant to some extent in less acute cases).

The problem of misalignment between the means (liability) and the ends is partly resolved through domestic laws. As explained below, the private entity responsible for the injury becomes liable under local tort law.[134] Moreover, in many countries, special legislation transfers the burden imposed on the State under the international regime in the case of injuries caused by private space activities to the respective private operators. For example, in Austria, Belgium, Denmark, the Netherlands, South Korea, Sweden, the United Kingdom, and the United Arab Emirates, if the State compensated victims for damages caused by a space activity under international law, the government has the right of recourse against the operator whose activity caused the damage.[135] The private entity's liability is often capped at the amount covered by mandatory insurance.[136] This ensures not only that victims are compensated but also that those who benefit from the activity bear its costs.

b. National Law

When a space object launched by or from one State injures uninvolved nationals of another State, the victims may often bring civil actions against governments and private entities under national laws, either (1) in the launching State's courts or (2) in the victims' jurisdiction.

The Liability Convention explicitly refers to the former case, affirming that it does not prevent the "victim" State or the people it represents from pursuing tort actions *in the courts or tribunals of the launching State* and under its laws.[137] Such claims are usually similar to those of injured nationals of the launching State, discussed in Part I.A.2 above.[138] For non-nationals of the launching State, who theoretically enjoy the international scheme, claims under the launching State's

134. *See infra* Part I.A.3.b.

135. OUTER SPACE ACT, *supra* note 91, § 11 (Austria); Loi du 17 septembre 2005 relative aux activités de lancement, d'opération de vol ou de guidage d'objets spatiaux [Space Activities Act] (Belg.), M.B., Sept. 17, 2005, art. 15(1), (7), https://www.belspo.be/; Outer Space Activities Act, *supra* note 87, § 12(1) (Den.); Space Activities Act, *supra* note 57, ch. 4 sec.12(1) (Neth.); Act on Compensation for Damage Caused by Space Objects, amended by Act No. 14839, Jul. 26, 2017, art. 3 (S. Kor.), translated in Korea Legislation Research Institute's online database, http://elaw.klri.re.kr/eng_service/main.do (service required); 6 § LAG OM RYMDVERKSAMHET (Svensk författningssamling [SFS] 1982:963) [ACT ON SPACE ACTIVITIES] (Swed.); Space Industry Act 2018, c. 5, § 36 (UK); Outer Space Act 1986, c. 36, § 10(1) (UK); Morgan M. DePagter, Comment, *"Who Dares, Wins:" How Property Rights in Space Could be Dictated by the Countries Willing to Make the First Move*, 1.2 CHI. J. INT'L L. ONLINE 116, 127 (2022) (discussing UAE Law of 2019 on the Regulation of the Space Sector). *See also* Frans G. von der Dunk, *Regulation of Space Activities in the Netherlands*, *in* NATIONAL REGULATION OF SPACE ACTIVITIES 225, 242 (Ram S. Jakhu ed., 2010) (discussing the liability regime under the *corpus juris spatialis internationalis*); Reinert, *supra* note 14, at 348 (discussing reimbursement by private operators in several countries).

136. *See, e.g.*, Space Activities Act, *supra* note 57, ch. 4 sec.12(2)–(3) (Neth.).

137. *Liability Convention*, *supra* note 3, at 2397.

138. An additional yet very narrow U.S. path, which applies only to foreign victims of wrongful conduct and not to domestic victims, is the Alien Tort Claims Act (ATCA), 28 U.S.C. § 1350 (2025). The ATCA grants jurisdiction to federal courts over civil actions by foreign nationals for domestically recognized torts committed in serious violation of international law norms, mostly by U.S. entities operating outside the U.S. *See* Cola, *supra* note 76, at 564–95 (discussing the applicability and limits of the ATCA).

domestic law may have several advantages. For example, local tort law, as opposed to the international regime, may recognize indirect emotional harm and allow punitive damages,[139] the claims are controlled by the victims, and the judgments are enforceable. A serious disadvantage might be the exorbitant cost and hassle of litigating in a foreign country, far from the victim's home, in a potentially hostile environment, under unfamiliar laws and procedures.[140] At any rate, once an action is brought in the courts of the launching State for harm caused to a nonnational, a claim under the Convention for the same damage is precluded.[141]

Actions *brought within the victims' jurisdiction* are also akin to those discussed in Part I.A.2 but might give rise to an additional legal obstacle if the defendant is a foreign launching State or any of its agencies rather than a private entity. Assume, for example, that a Russian satellite crashes onto and injures a farm in the United States. Can the farmer sue the Russian Federation or its space activities corporation Roscosmos in a U.S. federal or state court? While parties to the Liability Convention waived their sovereign immunity with respect to claims under the international regime,[142] that immunity might still bar claims against foreign States and their space agencies under domestic law.

Foreign States have been immune from liability under customary international law for centuries.[143] The U.S. originally endorsed the classical approach, granting absolute immunity to foreign governments as a matter of international grace and comity.[144] Subsequently, the State Department adopted a restrictive approach, limiting the immunity to sovereign acts, as opposed to commercial acts.[145] This theory was codified in the Foreign Sovereign Immunities Act of 1976 (FSIA),[146] whereby a foreign State is immune from the jurisdiction of federal and state courts unless a statutory exception applies.[147] The immunity applies not only to foreign States as such but also to their political subdivisions, agencies (such as a space agency), or instrumentalities, including corporations whose majority stocks are held by foreign States or their subdivisions (such as Roscosmos).[148] It does not apply to individuals acting in

139. Larsen, *supra* note 16, at 112.

140. Abrams, *supra* note 14, at 817–19.

141. *Liability Convention*, *supra* note 3, at 2397.

142. Punnakanta, *supra* note 23, at 174.

143. *See, e.g.*, Schooner Exch. v. McFaddon, 11 U.S. 116, 136–37, 145–47 (1812) (holding that every State can waive its jurisdiction by consent and that, under customary international law, jurisdiction is presumed to be waived in some cases).

144. *See* Jam v. Int'l Fin. Corp., 586 U.S. 199, 204 (2019).

145. *See id.*

146. 28 U.S.C. §§ 1602–11.

147. *Id.* § 1604.

148. *See* 28 U.S.C. § 1603(b). In the case of corporations, the foreign State must hold the majority of shares directly. *See* Dole Food Co. v. Patrickson, 538 U.S. 468, 474 (2003).

their official capacity on behalf of a foreign State,[149] but they may assert immunity under the common law.[150] Courts cannot hear claims against a foreign State without first determining that the immunity is unavailable.[151]

The exceptions to FSIA immunity include cases in which (1) the foreign State waived the immunity;[152] (2) "the action is based upon a commercial activity carried on in the United States by the foreign [S]tate; or upon act[s] . . . connect[ed to] . . . a commercial activity of the foreign [S]tate" and performed in or with "direct effect in the United States"[153]; (3) damages are sought for personal injury or property damage caused in the United States by the foreign State or its agents;[154] (4) damages are sought for personal injuries caused by certain acts of terror or support for terror by a designated State sponsor of terrorism or its agents;[155] or (5) damages are sought for physical injury occurring in the United States by an act of international terrorism and a tortious act of the foreign State (even if the act occurred outside the United States).[156]

Are any of these exceptions likely to apply to claims in U.S. courts for harm caused in the U.S. by space objects launched by foreign countries? Governments do not normally waive their immunity[157] and do not carry out space-related activities for commercial purposes.[158] While acts of terror involving space objects are not improbable, they are unlikely to be the frequent cause of space-related harm. The only exception that seems generally relevant to injuries caused by space objects is that of non-commercial torts causing harm in the United States, but its applicability is limited in several respects.

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149. *See* Samantar v. Yousuf, 560 U.S. 305, 319 (2010) ("[T]here is nothing to suggest we should read 'foreign state' in § 1603(a) to include an official acting on behalf of the foreign state, and much to indicate that this meaning was not what Congress enacted.").

150. *Id.* at 324.

151. Verlinden B.V. v. Cent. Bank of Nigeria, 461 U.S. 480, 493 n.20 (1983).

152. *See* 28 U.S.C. § 1605(a)(1).

153. *Id.* § 1605(a)(2).

154. *Id.* § 1605(a)(5).

155. *Id.* § 1605A. Four countries are currently designated as State sponsors of terrorism: Cuba, Iran, North Korea, and Syria. *See State Sponsors of Terrorism*, U.S. DEP'T OF STATE, https://www.state.gov/state-sponsors-of-terrorism/ [https://perma.cc/AC9L-DFL3].

156. 28 U.S.C. § 1605B.

157. *See* World Wide Mins., Ltd. v. Republic of Kazakhstan, 296 F.3d 1154, 1162 (D.C. Cir. 2002) ("A foreign sovereign will not be found to have waived its immunity unless it has clearly and unambiguously done so."). Implied waivers are very rarely recognized. *In re* Republic of the Philippines, 309 F.3d 1143, 1151 (9th Cir. 2002).

158. *See* Republic of Argentina v. Weltover, Inc., 504 U.S. 607, 614 (1992) ("[W]hen a foreign government acts, not as regulator of a market, but in the manner of a private player within it, the foreign sovereign's actions are 'commercial' . . . . [Its actions must be] the *type* of actions by which a private party engages in 'trade and traffic or commerce . . . .'") (quoting BLACK'S LAW DICTIONARY (6th ed. 1990)); *see also* Jam v. Int'l Fin. Corp., 586 U.S. 199, 214 (2019) (quoting *Weltover*, 504 U.S. at 614); Saudi Arabia v. Nelson, 507 U.S. 349, 360–61 (1993) (same).

First, the tort exception to foreign State immunity applies only to physical harm, namely bodily injury or property damage,[159] whereas harm caused by space objects may be purely economic or emotional. Admittedly, liability for certain types of loss, particularly economic and emotional, might be *limited* under the common law of torts regardless of the FSIA,[160] but when an action is brought against a foreign State, the immunity *bars* any lawsuit for non-physical harm.

Second, the exception does not apply where the claims are "based upon the exercise or performance or the failure to exercise or perform a discretionary function . . . ."[161] This rule, which "was designed to place foreign states in the same position as the United States" when sued in tort,[162] replicates the discretionary function exception to government liability under the FTCA.[163] Courts consider the extent to which the specific decisions of the foreign officials have involved an exercise of discretion and were grounded in considerations of social, economic, and political policy.[164] To the extent that a decision or an act leading to space-related harm can be classified as an exercise of discretionary functions, as many decisions and acts of space agencies are, the foreign State and its space agency are immune from liability.

Third, according to the predominant view, the exception applies, and a foreign State may be liable, only if both the tortious conduct and the physical injury occurred in the United States.[165] Torts committed outside U.S. territory do not fall within the exception, even if they may have produced effects within the United States.[166] Thus, when foreign space objects cause injuries in the

159. 28 U.S.C. § 1605(a)(5). *Cf. Foreign States Immunities Act 1985* (Cth), pt 2 s 13 (Austl.) (recognizing a tort exception to foreign state immunity only with respect to physical harm to person or property); State Immunity Act, R.S.C. 1985, c. S-18, § 6 (Can.) (same); § 5, Foreign States Immunity Law, 5769–2008, SH 2189 76, 77 (Isr.) (same); State Immunity Act 1978, c. 33, § 5 (Eng.) (same).

160. *See, e.g.*, Yehuda Adar & Ronen Perry, *Negligence Without Harm,* 111 GEO. L.J. 187, 193–94 (2022) (discussing limits on liability for economic loss and emotional harm); Ronen Perry, *Relational Economic Loss: An Integrated Economic Justification for the Exclusionary Rule*, 56 RUTGERS L. REV. 716, 723–31 (2004) (discussing limits on liability for economic loss).

161. 28 U.S.C. § 1605(a)(5)(A); RESTATEMENT (FOURTH) OF THE FOREIGN RELS. L. OF THE U.S. § 457 cmt. d (A.L.I. 2018).

162. RESTATEMENT (FOURTH) OF THE FOREIGN RELS. L. OF THE U.S. § 457 reporter's note 4 (A.L.I. 2018).

163. *In re* Terrorist Attacks on Sept. 11, 2001, 349 F. Supp. 2d 765, 794 (S.D.N.Y. 2005).

164. *Id.*

165. *See, e.g.*, Argentine Republic v. Amerada Hess Shipping Corp., 488 U.S. 428, 441 (1989) (holding that the entire tort, not only the injury, must occur in the United States); Doe v. Federal Democratic Republic of Ethiopia, 851 F.3d 7, 10 (D.C. Cir. 2017) (same); Jerez v. Republic of Cuba, 775 F.3d 419, 424 (D.C. Cir. 2014) (same); *In re* Terrorist Attacks on Sept. 11, 2001, 714 F.3d 109, 115–16 (2d Cir. 2013) (same); Jones v. Petty-Ray Geophysical, Geosource, Inc., 954 F.2d 1061, 1065 (5th Cir. 1992) (same); O'Bryan v. Holy See, 556 F.3d 361, 382 (6th Cir. 2009) (same); Frolova v. Union of Soviet Socialist Republics, 761 F.2d 370, 379–80 (7th Cir. 1985) (same); Doe I v. State of Israel, 400 F. Supp. 2d 86, 108 (D.D.C. 2005) (same); RESTATEMENT (FOURTH) OF THE FOREIGN RELS. L. OF THE U.S. § 457 cmt. a (A.L.I. 2018) (same).

166. *See Amerada Hess Shipping Corp.*, 488 U.S. at 439–40. A similar qualification exists in other jurisdictions. *See, e.g.*, *Foreign States Immunities Act 1985* (Cth), pt 2 s 13 (Austl.) ("[C]aused by an act or omission done or omitted to be done in Australia."); § 5, Foreign States Immunity Law, 5769–2008, SH 2189 76, 77

United States, the launching State will not be liable if the act or omission that led to the injury was committed elsewhere, either in the launching State itself, in a third country, or in space. This is an exceptionally harsh rule for victims.

Finally, even if the exception to the immunity formally applies, the foreign State might evade U.S. jurisdiction. Some countries, such as China, do not accept the restrictive theory of foreign sovereign immunity and may invoke absolute immunity when sued in U.S. courts.[167] Alternatively, foreign countries wishing to avoid litigation in the U.S. may reject service of legal documents.[168] Attempting to compel a foreign State to defend against civil actions in the U.S. might hinder enforcement in that foreign State[169] or even precipitate a diplomatic crisis.

As in the case of State liability for local injuries under domestic law, the problems with liability for cross-border space torts, particularly those related to the FSIA, must be addressed at a more general level because they are equally pertinent to all kinds of cross-border activities and not limited to space-related ones.[170]

B. In Outer Space

1. Domestic Law

Space objects might cause harm to other objects or to people or property on board other objects while in outer space. Thus, for example, in 1996, a fragment of the European Ariane rocket hit the French reconnaissance satellite Cerise.[171] This was the first verified collision between two artificial objects in space.[172]

(Isr.) (providing that the exception only applies if the entire tort was committed in Israel); State Immunity Act 1978, c. 33, § 5 (Eng.).

167. *See, e.g.*, Walters v. Indus. & Com. Bank of China, 651 F.3d 280, 283 (2d Cir. 2011) ("China returned the documents, claiming sovereign immunity, and thereafter entered no appearance in the Missouri action."); Jackson v. People's Republic of China, 794 F.2d 1490, 1494 (11th Cir. 1986) ("[China's] position is that under principles of international law it is immune from any suit in a domestic court of any other nation unless it consents.").

168. Article 10(a) of the Convention on the Service Abroad of Judicial and Extrajudicial Documents in Civil or Commercial Matters empowers States to object to service through postal channels. Indeed, some States opposed postal service. Convention on the Service Abroad of Judicial and Extrajudicial Documents in Civil or Commercial Matters art. 10(a), Nov. 15, 20 U.S.T. 361, 1965, 658 U.N.T.S. 163 [hereinafter *Service Convention*]. Indeed, some States opposed postal service. *See, e.g.*, *Declaration of the People's Republic of China*, HAGUE CONF. ON PRIV. INT'L L., https://www.hcch.net/en/instruments/conventions/status-table/notifications/?csid=393&disp=resdn [https://perma.cc/D47C-N492]. States can also reject other forms of service (for example, through diplomatic channels) if they believe compliance with the Service Convention's rules would infringe their sovereignty or security. *Service Convention*, *supra* note 168, at 171.

169. *See* Perry, *supra* note 65, at 272 (discussing enforcement of U.S. judgments in China).

170. *See, e.g.*, *id.* at 264–73 (discussing claims in the context of COVID-19).

171. Sundahl, *supra* note 25, at 130.

172. Nicholas Johnson, *First Natural Collision of Cataloged Earth Satellites*, 1 ORBITAL DEBRIS Q. NEWS 1, 1 (1996). For other space collisions, see Lampertius, *supra* note 25, at 450–51.

In some countries, domestic law might be inapplicable to harm caused by space objects in outer space, namely neither on Earth nor in territorial air space. The rule on liability of the U.S. and its agencies for extraterritorial injuries was set forth in *Smith v. United States*.[173] The case concerned a wrongful death in Antarctica, which is comparable to outer space in being an extraterritorial domain, with no native human population, no internationally recognized claims of sovereignty by other States, and no government and legal system of its own. A person working for a U.S. government contractor in Antarctica was killed in an accident and his widow brought a wrongful death action against the United States in accordance with the FTCA.[174] The FTCA does not apply to claims "arising in a foreign country,"[175] and the Supreme Court held that a sovereignless region with no laws of its own, such as Antarctica, is a "foreign country" for this purpose.[176] Any conduct occurring in such a region cannot give rise to a tort action against the U.S. under the FTCA.[177]

Following *Smith* and its logic, those injured by incidents occurring in outer space, another sovereignless region, cannot sue the U.S. under the FTCA.[178] According to an alternative interpretation, the term "foreign country" should be defined as a "territory subject to the sovereignty of another nation," precluding sovereignless domains, particularly those in which U.S. involvement is extensive.[179] However, this interpretation challenges *Smith* more generally, even when applied to Antarctica, and has not been endorsed.[180]

Civil liability of foreign countries and their agencies for injuries caused by their space objects in outer space is probably subject to the FSIA. Recall that a foreign State is immune from the jurisdiction of federal and state courts unless a statutory exception applies.[181] While injuries sustained on Earth could sometimes give rise to the non-commercial-torts exception, injuries sustained in outer space or caused by wrongdoing in space fail to meet the most fundamental condition of the exception to foreign State immunity, namely that the conduct and the injury occurred in the United States. Consequently, those

173. 507 U.S. 197 (1993).

174. *Id.* at 199.

175. 28 U.S.C. § 2680(k) (2025).

176. *Smith*, 507 U.S. at 201–05.

177. *Id.* at 204–05.

178. *See* Abrams, *supra* note 14, at 819; Darsey, *supra* note 39, at 480–82; Stroud, *supra* note 23, at 378.

179. *See* Lauren S.-B. Bornemann, *This Is Ground Control to Major Tom . . . Your Wife Would Like to Sue but There's Nothing We Can Do . . . . The Unlikelihood that the FTCA Waives Sovereign Immunity for Torts Committed by United States Employees in Outer Space: A Call for Preemptive Legislation*, 63 J. AIR L. & COM. 517, 519–28, 536–37 (1998) (first citing United States v. Spelar, 338 U.S. 217, 219 (1949); then citing Beattie v. United States, 756 F.2d 91, 94 n.1 (D.C. Cir. 1984) (Scalia, J. dissenting); then citing *Smith*, 507 U.S. at 219 (Stevens, J., dissenting) (finding Antarctica not to be a foreign country); and then citing Bosco, *supra* note 32, at 606–07 (predating *Smith*)).

180. *See* Bornemann, *supra* note 179, at 532, 535–36 (admitting that *Smith* bars claims for torts committed in outer space).

181. 28 U.S.C. § 1604 (2025).

injured by foreign countries' space objects in outer space cannot sue those countries in the U.S.

To conclude so far, domestic law in the U.S. does not offer redress to those injured in outer space by space objects launched by the U.S. and its agencies (as per the FTCA) or by foreign States and their agencies (as per the FSIA). The possible liability of private entities operating space objects under any domestic law remains to be discussed. Though some scholars envisage such liability,[182] courts might justifiably refuse to hear claims relating to conduct perpetrated and harm incurred in outer space, outside the sovereign territory of the respective country. Doing otherwise might constitute a violation of one of the most fundamental principles of international space law—the prohibition on claims of sovereignty in outer space.[183] If courts nonetheless decide to hear such claims, complex questions of jurisdiction and choice of law, both transnational and—in federal countries—intranational,[184] will undoubtedly arise, and the general principles of private international law might be insufficient in the new domain.

If these two obstacles are overcome, various theories of liability under domestic tort law may be considered. For example, in cases of harm caused by orbital space debris, the common law cause of action for public nuisance[185] may fit the unreasonable interference with the common right to enjoy and use outer space (as recognized by international law).[186] Negligence may also be an option. Given the difficulties in establishing negligence in space, claimants can rely on the negligence per se doctrine, whereby violations of statutory, regulatory, and potentially international norms may constitute negligence.[187] For example, if a private entity violates NASA's space debris mitigation guidelines[188] and such violation causes injury in space, it may be deemed negligent per se, just as violations of the Federal Aviation Regulations promulgated by the FAA were

182. *See, e.g.*, Abrams, *supra* note 14, at 818 (arguing that statutory causes of action could apply to outer space incidents); Larsen, *supra* note 16, at 110 (arguing that U.S. law applies when a U.S.-authorized object causes harm in space to another); Mineiro, *supra* note 15, at 389–91 (discussing private entities' liability for harm caused in space).

183. *See OST*, *supra* note 3, at 208 and accompanying text. It might also counteract the presumption against extraterritorial application of national law. The presumption generally applies to legislation. *See* William S. Dodge, *The New Presumption Against Extraterritoriality*, 113 HARV. L. REV. 1582 *passim* (2020). But it may be extended to the common law. *See* Jeffrey A. Meyer, *Extraterritorial Common Law: Does the Common Law Apply Abroad?*, 102 GEO. L.J. 301, 305–06 (2014).

184. When commercial launches are involved, any claim by a third party or space flight participant for physical injury resulting from an activity carried out under the license is within the exclusive jurisdiction of the federal courts. 51 U.S.C. § 50914(g) (2025). Federal courts may also have jurisdiction under general theories, such as diversity. Cola, *supra* note 76, at 604.

185. *See* RESTATEMENT (SECOND) OF TORTS § 821B (A.L.I. 1979).

186. *See* Cola, *supra* note 76, at 595–97.

187. *See* Punnakanta, *supra* note 23, at 180.

188. *See* PROCEDURAL REQUIREMENTS FOR ORBITAL DEBRIS MITIGATION, NPR 8715.6E (NASA 2024); PROCESS FOR LIMITING ORBITAL DEBRIS, NASA, STD 8719.14C (NASA 2021).

deemed negligent per se in tort actions for airplane crashes.[189] In Europe, standards drafted by the European Cooperation for Space Standardization[190] may serve a similar role, at least when endorsed by domestic legislation or regulation.[191]

2. International Law

Some outer-space victims may resort to the international liability regime. The distinction between nationals and non-nationals of the launching State, discussed with respect to injuries on Earth, equally applies to injuries in outer space.[192] Thus, nationals of the launching State have no redress under international law. In the absence of liability under domestic law, they might be left uncompensated, and this is a serious legal lacuna.[193] Without any liability, the important goals of liability (compensation, deterrence, and so on) cannot be achieved. The solutions proposed below to the problem of injuries caused by non-Earth-launched objects may also be applied to space injuries caused by Earth-launched objects to nationals of the launching State.[194]

In contrast, injuries to non-nationals uninvolved in the object's operation are claimable under the existing international regime, as explained above,[195] with one major difference. According to Article III of the Liability Convention, a launching State is liable for damage caused by its space object in outer space only if *fault*, as well as a *causal link* between the fault and injury, can be established.[196] Liability is not strict as in the case of injuries on Earth. The necessary fault may be that of the launching State or people for whom it is responsible, including not only State agents but also mere nationals.[197]

The term "fault" is unfortunately not defined, and even though it can be interpreted to mean negligence (creation of foreseeable unreasonable risk), the lack of a formal definition is a source of uncertainty.[198] The requirement of fault

189. *See* Wojciechowicz v. United States, 576 F. Supp. 2d 241, 273 (D.P.R. 2008), *aff'd* 582 F.3d 57 (1st Cir. 2009).

190. *Active Standards*, EUR. COOP. FOR SPACE STANDARDIZATION, https://ecss.nl/standards/active-standards/ [https://perma.cc/A742-2YWR].

191. *See, e.g.*, Bekendtgørelse nr. 1116 af 03/06/2021 om krav ved godkendelse af aktiviteter i det ydre rum m.v. pt 2 § 5 [Executive Order on Requirements for Approval of Outer Space Activities] (Den.) (providing that compliance with ECSS standards may be required).

192. *See* Bosco, *supra* note 32, at 590.

193. One may argue that given the absence of liability under international law, domestic law must offer redress. *See* Bornemann, *supra* note 179, at 531.

194. *See infra* Part III.

195. *See supra* Part I.A.3.a.

196. *Liability Convention*, *supra* note 3, at 190.

197. *See* Kerrest & Thro, *supra* note 99, at 66.

198. *See, e.g.*, MORRIS D. FORKOSCH, OUTER SPACE AND LEGAL LIABILITY 80 (1982) ("[I]t seems natural to equate fault with ordinary negligence"); Dennerley, *supra* note 107, at 288–301 (discussing other possible interpretations); Firestone, *supra* note 8, at 767–71 (discussing different meanings of the term "fault" in various jurisdictions).

theoretically alleviates some of the problems outlined with respect to injuries on Earth, where a country can be liable for injuries caused by another party's fault (an unfair burden leading to over-deterrence).[199] However, given the technological complexities, the perils and uncertainties associated with space activities, and the inability to retrieve evidence, fault might be very difficult to establish when an accident occurs in space. Negligent launching States might therefore evade liability.[200] In theory, if the State or people for whom it is responsible violated international, statutory, or regulatory norms, victims may argue that such violation is negligent per se or at least offers some evidence of negligence. Alternatively, some commentators proposed amending the Convention to shift the burden of proof,[201] but this does not seem to be a politically viable option.

Another obstacle may be the difficulty or even impossibility of establishing causation between a particular space activity or conduct and the damage, mainly due to unidentifiability problems.[202] This issue has been discussed in the context of injuries caused by space debris whose origin is not readily discernible. If all artificial objects launched into space were properly registered and then perfectly tracked (to facilitate evasion maneuvers and avoid collisions), it would be possible to identify some of the debris they generate and establish causation.[203] However, many space objects, particularly those serving military purposes, are not registered.[204] Moreover, even though there are continued advances in surveillance systems,[205] small yet potentially harmful fragments are either not tracked or incapable of being tracked.[206] Even tracked debris cannot always be identified because it is often created through an explosion or a collision between larger fragments from different sources.[207] Thus, it might be impossible to determine which space object generated the debris that caused the particular damage (including damage to other space objects).[208] At times, it might be

199. A State can still be liable for the fault of authorized private entities, but such liability can either hinge on the State's own fault in supervising these entities or be channeled to the parties at fault through domestic legislation. *See supra* notes 32–38, 185–91 and accompanying text.

200. *See* Kerrest & Thro, *supra* note 99, at 67; Lampertius, *supra* note 25, at 458.

201. *See* Lampertius, *supra* note 25, at 464–65.

202. *See generally* Ronen Perry, *The Unidentified Wrongdoer*, 56 GA. L. REV. 893 *passim* (2022) (discussing unidentifiability problems and possible solutions).

203. *See* Punnakanta, *supra* note 23, at 173; Sundahl, *supra* note 25, at 132, 136.

204. *See* Punnakanta, *supra* note 23, at 173.

205. *See id.* at 172–73; Sundahl, *supra* note 25, at 132–33; John Matson, *On the Trail of Space Trash*, SCI. AM., (Nov. 1, 2011), https://www.scientificamerican.com/article/on-the-trail-of-space-trash/ [https://perma.cc/VJ3G-AA6H].

206. *See* Dennerley, *supra* note 107, at 284; Punnakanta, *supra* note 23, at 173; Sundahl, *supra* note 25, at 127, 133, 136.

207. *See* Sundahl, *supra* note 25, at 133.

208. *See* Kerrest & Thro, *supra* note 99, at 72; Lampertius, *supra* note 25, at 459–60; Larsen, *supra* note 16, at 113; Sundahl, *supra* note 25, at 126–27, 136.

difficult to determine whether the injury was caused by an artificial space object, a natural one, or both.[209]

Several solutions may be considered for the problem of causation in the case of injuries caused by unidentifiable space debris. The simplest solution is for space entrepreneurs to purchase first-party insurance against harm incurred in space, including harm caused by unidentifiable objects.[210] While offering compensation and facilitating loss-spreading, exclusive reliance on first-party insurance absolves those responsible for the harm of any sanction, generating under-deterrence.[211]

Another option is to require each launching State to contribute a risk-based amount (corresponding to the extent of expected debris from the launched object) to an international fund that would compensate those injured by unidentifiable debris.[212] However, it is impractical to assess the risk generated by each operator in advance. While safer design may reduce the risk, hence the contribution, unpredictable human error, malfunction, or collision might subsequently increase it without being taken into account.[213] Ex ante payments into a fund, like insurance, also generate moral hazard problems: once the amount is paid, the payor is incentivized to take excessive risk.[214] Moreover, unless applied retroactively, any "pool" established now will be severely underfunded given the risks that have already accumulated for decades.[215]

A third solution is to hold each State participating in space exploration liable for space injuries on a "market-share" basis, that is, in proportion to its share in unidentifiable debris. This share can be roughly assessed by the total number of objects each state has launched into orbit (taking into account type, size, and likelihood of disintegration) or by its share in *identifiable* debris (from which unidentifiable debris originates over time).[216] The rationales for market-share liability in other contexts are equally applicable here: it ensures compensation to victims, provides some incentives for preventing the production of and removing debris (assuming domestic law can channel the burden to the responsible actors), and fairly correlates risk creation with a burden.[217] Still, to be fair and efficient, liability should not be imposed for harm

209. *See* Punnakanta, *supra* note 23, at 164; Sundahl, *supra* note 25, at 133.

210. *See* Smith, *supra* note 25, at 64–66.

211. *See* Sundahl, *supra* note 25, at 137.

212. *See* Roberts, *supra* note 25, at 70.

213. *See* Sundahl, *supra* note 25, at 138.

214. *Cf.* Ronen Perry, *Re-torts*, 59 ALA. L. REV. 987, 1007–08 (2008) (discussing the moral hazard problem in the related context of liability insurance).

215. *See* Sundahl, *supra* note 25, at 138.

216. *See* Richard Berkley, *Space Law Versus Space Utilization: The Inhibition of Private Industry in Outer Space*, 15 WIS. INT'L L.J. 421, 440 (1997); Lampertius, *supra* note 25, at 466; Limperis, *supra* note 25, at 339–41; Poonuganti, *supra* note 98, at 508–09; Roberts, *supra* note 25, at 70–73; Sundahl, *supra* note 25, at 127, 137–38, 143–47, 153–54.

217. *See* Sundahl, *supra* note 25, at 147–48.

attributable to natural elements, and it might be rather difficult to assess this share. Moreover, it might be politically difficult to amend the Liability Convention to incorporate such a mechanism.[218]

II. WRONGS AND HARMS ON BOARD EARTH-LAUNCHED SPACE OBJECTS

A. The Limits of the International Liability Regime

The OST and the Liability Convention focus on damage caused *by* space objects rather than damage caused in space by individuals and things in their possession. The drafters wanted to address what they perceived as the primary risks associated with space activities during their time, that is, space objects' crashes and collisions with cross-national effects.[219] The crash of the Soviet satellite Kosmos 954 in Canada is a good example of the kind of cases that they imagined when considering the role of international treaties.[220]

However, wrongful or harmful conduct can occur on space objects as well, and it is of particular interest when occurring in outer space, outside all States' traditional territorial jurisdiction.[221] A person might assault,[222] negligently injure or kill,[223] falsely imprison,[224] inflict emotional distress on,[225] defame,[226] violate the privacy of,[227] deceive,[228] or interfere with the contractual relations[229] of another on board a spacecraft just as they might commit such torts on Earth. Products might cause injuries to users or other parties,[230] and animals might harm humans[231] on spacecrafts just as they might on Earth. At present, these cases are uncommon because space missions are usually time-constrained and involve a limited number of carefully selected and highly trained crew members. They may become increasingly prevalent with the expansion of space activities; their purpose, complexity, and duration; and the types of people participating

218. *See* Lampertius, *supra* note 25, at 454 (explaining that drafting the Convention already entailed lengthy and difficult negotiations).

219. *See* Reis, *supra* note 9, at 127.

220. *See* DeBusschere, *supra* note 98, at 99–100; Kehrer, *supra* note 16, at 185–86; Kerrest & Thro, *supra* note 99, at 66; Larsen, *supra* note 16, at 109; Logterman, *supra* note 16, at 183–84, 189–90; Poonuganti, *supra* note 98, at 499–500; Punnakanta, *supra* note 23, at 176.

221. I will not discuss incidents occurring on space objects while still on Earth or in territorial air space, assuming that such incidents are subject to domestic law, including private international law where relevant.

222. *See* RESTATEMENT (SECOND) OF TORTS § 21 (A.L.I. 1965).

223. *See id.* § 281.

224. *See id.* § 35.

225. *See id.* § 46.

226. *See* RESTATEMENT (SECOND) OF TORTS § 558 (A.L.I. 1977).

227. *See id.* § 652A.

228. *See id.* § 525.

229. *See id.* § 766.

230. *See id.* § 402A.

231. *See id.* § 509.

therein. Space tourists, merchants, or even aspiring space settlers on longer voyages and in crowded space communities are more likely to commit torts than present-day astronauts on limited scientific missions.

The international liability regime does not currently cover onboard torts. The Liability Convention imposes liability only for injuries caused *by* space objects.[232] Unless the injury *on* board a space object was also caused *by* a space object—either the same object, as when any of its components (arguably including payload) causes an onboard injury,[233] or a different, external object—the Convention does not apply. Additionally, the Liability Convention does not cover injuries to nationals of the launching State or foreign nationals injured while participating in the operation of that space object.[234] Thus, for example, if an astronaut is negligently killed on a space object by one of its components, no claim can arise against the launching State under the international liability regime. The victim or their estate must resort to alternative liability or compensation schemes. One can imagine future cases in which foreign passengers (or residents), who cannot be regarded as participants in the space object's operation (unless participation is broadly interpreted to include mere presence), are injured by that object or any of its components. Such victims may be covered by the Liability Convention, with all the limits and constraints enumerated above.[235] But these cases would presumably constitute only a small fraction of on-board wrongs and harms.

B. The Extension-of-Sovereignty Model

1. Jurisdiction

As explained, neither the OST nor the Liability Convention specifically addresses wrongdoing and harm on board Earth-launched space objects. However, a laconic and general provision on jurisdiction in the OST provides a path for partial resolution. Recall that outer space "is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[236] In other words, no State can extend its sovereignty, including its jurisdiction and laws, into space.[237] As an exception, Article VIII of the OST stipulates that each State *retains jurisdiction and control* over any

232. *Liability Convention*, *supra* note 3, at 189.

233. Consider, for example, an astronaut injured in an explosion of scientific equipment. *See* Christol, *supra* note 108, at 357.

234. *Liability Convention*, *supra* note 3, at 191.

235. *See supra* Parts I.A.3.a & I.B.2.

236. *OST*, *supra* note 3, at 208.

237. Outer space and celestial bodies are considered *res communis* as opposed to *res nullius*. P.J. Blount, *Outer Space and International Geography: Article II and the Shape of Global Order*, 52 NEW ENG. L. REV. 95, 107–08 (2018).

launched object recorded on its *registry*, and over any personnel thereof, while in outer space or on celestial bodies.[238]

The Registration Convention of 1976 provides that every State launching an object into space must register the object domestically.[239] If more than one State is involved in the launch, they must jointly determine which one shall register the object.[240] They should then report the object to the Secretary General of the United Nations who maintains the information in a public registry.[241] Through Article VIII of the OST, the State of registry's jurisdiction, ordinarily along with its laws, extends by default to the registered object and its personnel.[242] Thus, whenever a tort is committed on a space object registered in a particular country, and each object is registered in only one, that country has jurisdiction over the dispute and its laws apply. For instance, if a tort is committed on a spacecraft registered in China (though possibly launched in cooperation with other countries), Chinese courts have the power to resolve the ensuing dispute in accordance with Chinese law.

The registration-based extension of sovereignty is not unique to space law. A similar rule applies in maritime law, where everything that happens on a ship in international waters ("the high seas") is subject to the exclusive jurisdiction of the ship's country of registration and its laws.[243] The highly developed discussion of jurisdiction and applicable law in the maritime context may assist legislatures and courts in discussing similar questions in the context of space activities.

A registration-based model appears to provide clarity and certainty but raises several questions. To begin with, the extension of sovereignty rule is limited to the space object and its personnel. Therefore, if a crew member commits a tort against another on board the object, the State of registry has jurisdiction over the matter. Presumably, if a crew member commits a tort against a non-crewmember, the case is also subject to the laws of the State of registry because it has jurisdiction over the perpetrator and the complete-tort scene. Torts committed among non-crew members are more challenging. For example, if two European space tourists fight on a U.S.-registered spacecraft and one is injured, it is unclear whether the United States has jurisdiction over the ensuing dispute. A broad interpretation of the extension of sovereignty rule

238. *OST*, *supra* note 3, at 209.

239. *Registration Convention*, *supra* note 3, at 17. The term "launching State" is defined as in the Liability Convention. *Id.* art. I(a). Some of the signatories adopted the registration model through domestic legislation. *See, e.g.*, Listner, *supra* note 57.

240. *Registration Convention*, *supra* note 3, at 17.

241. *Id.*.

242. When several States are involved, they can deviate from the default rule and assign jurisdiction by agreement. *Id.*.

243. *See* U.N. Convention on the Law of the Sea art. 92, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS]; Gorove, *supra* note 108, at 30 (explaining that registration also implies jurisdiction in maritime law).

would be that the State of registry has jurisdiction over everything that happens on board the space object and, *in addition*, over everything done by its personnel, on or off the space object. This interpretation is supported by the language of Article VIII of the OST, which extends jurisdiction to personnel "while in outer space or on a celestial body."[244] Arguably, crew members (as opposed to non-crew members) are subject to the state of registry's jurisdiction even when they get off the spacecraft while in space or on celestial bodies, implying that the State's jurisdiction over onboard activities is not limited to personnel. A narrow interpretation of the extension of sovereignty rule would be that the State of registry's jurisdiction covers only mishaps involving the space object itself while in outer space or on celestial bodies in addition to crew members' conduct (on board and possibly also off board), leaving non-crew members' wrongdoing out.

Another question is whether the State of registry's jurisdiction extends to cases in which a tort was committed on its space object but caused injury on Earth or elsewhere. The case of a NASA astronaut accused of hacking into her estranged spouse's bank account from the International Space Station (ISS) offers an example of the types of space conduct with Earth impact.[245] While the ISS is an international venture subject to a special jurisdictional regime (discussed below), the aforementioned case is relatively simple because the alleged perpetrator and the victim of the tort were both U.S. citizens, the alleged wrong was committed under U.S. jurisdiction in space, and the harm was caused in U.S. territory. Yet space torts may be committed by a national of State A on a space object registered in State B, and cause harm to a national of State C who lives in State D. Formally, the State of registry could assert jurisdiction over a tort committed in space even when the consequent injury occurs on Earth. However, the judicial interpretation of the analogous maritime jurisdiction suggests that courts may require a stronger nexus of the tort to the space activity than the place of conduct.[246] If the wrongful conduct is performed on a U.S.-registered vessel but other aspects of the tort (such as parties' nationality and,

244. *OST*, *supra* note 3, at 209.

245. *See* Mike Baker, *Space Crime Allegation Leads to Charges Against Astronaut's Ex-Wife*, N.Y. TIMES (Apr. 6, 2020), https://www.nytimes.com/2020/04/06/us/space-crime-allegation-indictment.html [https://perma.cc/BDL3-ZE4Y]; Mike Baker, *NASA Astronaut Anne McClain Accused by Spouse of Crime in Space*, N.Y. TIMES, https://www.nytimes.com/2019/08/23/us/astronaut-space-investigation.html (Aug. 23, 2019) [perma.cc/9CBY-HRZM].

246. In the past, if a tort occurred on navigable waters, the claim was within admiralty jurisdiction. Subsequently, an additional requirement was added: the tort must bear a significant relationship to traditional maritime activity. *See* David W. Robertson, *Summertime Sailing and the U.S. Supreme Court: The Need for a National Admiralty Court*, 29 J. MAR. L. & COM. 275, 286–87 (1998). Even after Congress extended admiralty jurisdiction to all cases of damage caused by a vessel on navigable waters "even though the injury or damage is . . . consummated on land" 46 U.S.C. § 30101 (2025), courts required a significant nexus to maritime activity. *See* Sisson v. Ruby, 497 U.S. 358, 362–65 (1990) (applying a nexus-based test for maritime jurisdiction).

more importantly, the place of injury) are related to another country, courts may conclude that the United States has no jurisdiction.

The jurisdictional issue becomes even more complicated when a space object registered in one State carries a space object registered in another into space (as in the case of the European Space Agency Spacelab, formerly carried by U.S. space shuttles).[247] Arguably, each State would have jurisdiction and control over its space object and its crew. Yet it would seem problematic to absolve the crew of the carried vessel from any laws applicable within the carrying vessel during the joint voyage. One possible solution is to consider the carried vessel as cargo rather than a launched object, subject exclusively to the jurisdiction of the carrying vessel's State of registry during transit, and to the jurisdiction of the carried vessel's State of registry after separation. Alternatively, crew members of the carried vessel can be subject to both States' jurisdiction. The OST does not necessarily grant the State of registry *exclusive* jurisdiction, so simultaneous jurisdiction is theoretically possible.[248] Perhaps the jurisdiction of the carried vessel's State of registry should be limited to matters relating to this vessel's operation until it is separated from the carrier.[249]

Lastly, a registration-based model necessarily fails if the space object is not registered. Indeed, some States do not register space objects or delay registration.[250] In such cases, courts can implement a substantive test based on the duty to register. In other words, jurisdiction will vest in the States that were obliged to register the space object in accordance with the Registration Convention.

2. Applicable Law

The extension of jurisdiction does not conclusively determine which laws apply to civil disputes; it merely determines which courts have the power to resolve them. Traditionally, the law applicable to a tort case in the competent court was the *lex loci delicti*, namely the law of the place of the wrong, which is the place where the last event necessary to establish liability took place (usually the place of injury).[251] Currently, in many jurisdictions, applicable law is that of the place with the "most significant relationship to the occurrence and the parties . . . ."[252] Relevant criteria in implementing this principle include the place where the injury occurred, the place where the wrongful conduct occurred, and

247. *See* Stephen Gorove, *Legal Aspects of the Space Shuttle*, 13 INT'L LAW. 153, 157–58 (1979).

248. *See id.* at 158.

249. *See id.*

250. Rochus Moenter, *The International Space Station: Legal Framework and Current Status*, 64 J. AIR L. & COM. 1033, 1044 (1999).

251. RESTATEMENT (FIRST) OF CONFLICT OF LAWS §§ 377–79 (A.L.I. 1934); Matthew R. Burnstein, Note, *Conflicts on the Net: Choice of Law in Transnational Cyberspace*, 29 VAND. J. TRANSNAT'L L. 75, 93 (1996).

252. RESTATEMENT (SECOND) OF CONFLICT OF LAWS § 145(1) (1971).

the parties' residence and nationality.[253] Under either principle, if the registered space object can be considered as part of the territory of the State of registry, the law applicable to a tort committed and having an effect on board the object would usually be the law of torts of that State. If registration merely extends jurisdiction to a sovereignless domain but does not make the space object part of the State of registry's territory, then the place of the wrong has no law of its own, and the competent court would generally apply the *lex fori* by default.[254] Therefore, applicable law will normally coincide with jurisdiction.

An additional complexity relates to federal countries. When a tort is committed on board a U.S.-registered space object, the United States has jurisdiction, but which laws apply? On this matter, the analogy to maritime law may be illuminating. Article III, Section 2 of the U.S. Constitution (the Admiralty Clause), provides that "[t]he judicial [p]ower [of the United States] shall extend . . . to all Cases of admiralty and maritime Jurisdiction . . . ."[255] Admiralty is the only substantive area of law with regard to which the Constitution grants subject-matter jurisdiction to the federal judiciary.[256] Accordingly, federal district courts have original jurisdiction, exclusive of the courts of the states, over "[a]ny civil case of admiralty or maritime jurisdiction, saving to suitors in all cases all other remedies to which they are otherwise entitled."[257]

Under the conventional view, when a federal court acquires admiralty jurisdiction, it must apply substantive maritime law.[258] The power to develop such law is implicitly vested in federal courts and Congress.[259] General maritime law is developed by the federal judiciary in accordance with the common law tradition,[260] and the constitutional grant of jurisdiction implicitly empowers Congress to legislate in this field.[261] By analogy, once federal courts acquire jurisdiction over space incidents, they must apply substantive space law, as developed by the federal legislature and courts. Existing maritime law, including

253. *Id.* § 145(2).

254. Burnstein, *supra* note 251, at 93.

255. U.S. CONST. art. III, § 2, cl. 1. For a historical analysis, see Harrington Putnam, *How the Federal Courts Were Given Admiralty Jurisdiction*, 10 CORNELL L.Q. 460 (1925).

256. *See* Steven R. Swanson, *Federalism, the Admiralty, and Oil Spills*, 27 J. MAR. L. & COM. 379, 381 (1996).

257. 28 U.S.C. § 1333 (2025). For a discussion of the original version of this statute, see THOMAS J. SCHOENBAUM, ADMIRALTY AND MARITIME LAW 2–5 (3d ed. 2001).

258. *See* E. River S.S. Corp. v. Transamerica Delaval, Inc., 476 U.S. 858, 864 (1986) (holding that admiralty jurisdiction entails application of substantive admiralty law); *see also* Yamaha Motor Corp., U.S.A. v. Calhoun, 516 U.S. 199, 206 (1996) (same).

259. U.S. CONST. art. III, § 2, cl. 1. *See* Putnam, *supra* note 255, at 460.

260. *See E. River S.S.*, 476 U.S. at 864; The Tungus v. Skovgaard, 358 U.S. 588, 611 (1959) ("The federal courts have a most extensive responsibility of fashioning rules of substantive law in maritime cases.").

261. *See* S. Pac. Co. v. Jensen, 244 U.S. 205, 215 (1917); *see also* Romero v. Int'l Terminal Operating Co., 358 U.S. 354, 361 (1959) (explaining that Article III empowered Congress to "revise and supplement the maritime law"); Panama R. Co. v. Johnson, 264 U.S. 375, 385–86 (1924) (same); Washington v. W.C. Dawson & Co., 264 U.S. 219, 227 (1924) (same).

the well-developed maritime tort law, may be a source of inspiration in the development of domestic space law.

C. Mission- or Locus-Specific Agreements

The default registration-based rule for determining jurisdiction and applicable law is a simple one. But apart from the practical (though soluble) problem of non-compliance with registration duties, it may seem unsatisfactory where several countries are involved in the design, construction, launch, or—most importantly—operation of a space object. Under the Registration Convention, there is only one State of registry per space object,[262] whereas in joint space projects, participating States may want to maintain control over at least some people or activities. In such cases, the parties involved may deviate from the default rule and consensually fashion a more nuanced regime before embarking on the joint venture. Contractual choice of jurisdiction, applicable law, dispute resolution method, or even the ultimate allocation of harm may have benefits in terms of fairness[263] and efficiency[264] (and of course certainty, which underpins both). They are common in many (predominantly commercial) contexts on Earth. For instance, while it might seem that a U.S. citizen injured on a cruise ship in U.S. territorial waters off the coast of Los Angeles could sue the cruise line in Los Angeles under California tort law, the passenger contract may stipulate that the cruise line can only be sued in Florida under Florida tort law, and courts usually respect these provisions.[265]

The contractual model has already been employed in some international space projects. An early example is the Spacelab Agreement of 1973 between the United States and several European countries concerning the integration of the European Spacelab and the U.S. Space Shuttle program.[266] Even though the agreement did not determine jurisdiction and choice of law, it allocated harm as follows: the U.S. government assumed full responsibility for damage to its nationals and property in the course of implementation of the agreement, and each of the European partners similarly assumed responsibility for damage to its nationals and property.[267] The agreement also provided rules for the allocation, among participating countries, of harm caused to nationals of non-

262. *Registration Convention*, *supra* note 3, at 17.

263. *See* Ronen Perry, *Differential Preemption*, 72 OHIO ST. L.J. 821, 867 (2011) ("[T]o the extent that the determinative law has been pre-selected by the parties themselves, no claim of unfairness can arise."); Horacio Spector, *A Contractarian Approach to Unconscionability*, 81 CHI.-KENT L. REV. 95, 99 (2006) ("[E]xcept under special conditions, informed and free consent cleanses transactional unfairness.").

264. *See* ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 283 (6th ed. 2016) ("The enforceability of a contract usually makes the parties better off, as measured by their own desires, without making anyone worse off . . . a 'Pareto-efficient' change.").

265. *See, e.g.*, Carnival Cruise Lines, Inc. v. Shute, 499 U.S. 585, 589–96 (1991).

266. Space Laboratory: Cooperative Program, Aug. 14, 1973, 24 U.S.T 2049.

267. *Id.* at 2056.

participating countries.[268] While such allocation is inconsistent with the traditional goals of tort law, as it does not necessarily impose the burden on the party who caused harm, it has some of the benefits of an agreed allocation (transactional fairness and certainty).

A more recent example is the International Space Station Intergovernmental Agreement of 1998 (the ISS Treaty), which replaced a 1988 intergovernmental agreement.[269] Drafters of the original agreement considered whether the ISS should be deemed a single space object, so that each of its elements would be regarded as a "component," and the entire venture would be registered by one country and subject to its jurisdiction, or as a cluster of independent space objects that ought to be registered separately.[270] Ultimately, the ISS Treaty obliged each contributing State to register the flight elements that it provided as its space objects.[271] Each State has jurisdiction and control over the elements it registered and over "personnel in or on the Space Station who are its nationals."[272] Put differently, the ISS has no single sovereign. Each participant's jurisdiction extends to the structural elements it contributed (such as specific labs)[273] and to its nationals on the ISS. All European participants (apart from Russia) delegated their responsibilities and assigned their powers to the European Space Agency, acting on their behalf.[274]

The mixture of extended sovereignty and nationality as bases of jurisdiction may generate concurrent jurisdiction (for example, when a U.S. national wrongs another in a Japanese module).[275] Moreover, once a participant State's jurisdiction is recognized, a choice of law question arises. While the laws of that State may apply,[276] the ISS Treaty does not provide clear guidelines, so a complex analysis of the various interests involved may be necessary.[277] These problems are partly mitigated by Article 16 of the Treaty, whereby each partner State waived all claims against *other* partner States, their related entities (contractors and suppliers, subcontractors, users, customers), and employees of

268. *Id.* at 2057.

269. Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, T.I.A.S. No. 12927 [hereinafter *ISS Treaty*]. On the history of this agreement, *see* Gorove, *supra* note 108, at 27; Moenter, *supra* note 250, at 1033–37, 1044–48.

270. *See* Gorove, *supra* note 108, at 28–29, 31; Kehrer, *supra* note 16, at 199–200.

271. *ISS Treaty*, *supra* note 269, at 5.

272. *Id.*

273. For example, the Columbus science laboratory is the largest single contribution of the European Space Agency to the ISS. Moenter, *supra* note 250, at 1036–37.

274. *ISS Treaty*, *supra* note 269, at 4.

275. *See* Gorove, *supra* note 108, at 30; Mary B. McCord, Note, *Responding to the Space Station Agreement: The Extension of U.S. Law into Space*, 77 GEO. L.J. 1933, 1939–40, 1942–44 (1989).

276. *International Space Station Legal Framework*, EUR. SPACE AGENCY, https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/International_Space_Station/International_Space_Station_legal_framework [https://perma.cc/C6LR-L8DC].

277. McCord, *supra* note 275, at 1946–48, 1956.

any of the above, for any type of damage arising from "Protected Space Operations" (launch vehicle, space station, and payload activities).[278] Each partner must also require its related entities (contractors, subcontractors, etc.) to sign a similar waiver.[279] This very broad cross-waiver does not apply to tort claims (1) between a partner State and any of its related entities,[280] (2) between related entities of the same partner State,[281] (3) for willful misconduct,[282] (4) by natural persons who sustained bodily injury, impairment of health, or death,[283] or (5) by third (non-participating) parties who cannot be governed by the agreement at all.[284] The ISS Treaty does not provide any guidelines for resolving these claims.[285] Still, a special contractual regime, deviating from the default rules, controls jurisdiction and limits liability.

Contractual choice of jurisdiction, applicable law, dispute resolution method, or specific harm allocation models may also become the norm in private space ventures. For example, spacecraft operators can require all those embarking on the spacecraft to agree that any disputes arising from onboard conduct or accidents will be resolved by the courts of a particular country under its substantive laws or through an alternative resolution method (such as arbitration or mediation).[286] Similarly, crew-member, passenger, and resident contracts may include liability waivers and disclaimers, to the extent possible under applicable law of contracts.[287] Past incidents indicate that courts may be willing to honor disclaimers, at least with respect to property damage (such as cargo).[288] The Commercial Space Launch Act requires all license holders who contract to provide private commercial space-launch services to enter into reciprocal waivers of claims, under which all parties (including the government where relevant) agree to assume their own risks of loss.[289]

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278. *ISS Treaty*, *supra* note 269, at 11–12.

279. *Id.* at 12.

280. *Id.* at 12–13.

281. *Id.*

282. *Id.* at 13.

283. *Id.*

284. *Id.*; *see also* McCord, *supra* note 275, at 1942, 1955 (explaining that the cross-waiver does not affect partner states' liability to third parties).

285. McCord, *supra* note 275, at 1955.

286. *See id.* at 1942; *ISS Treaty*, *supra* note 269, at 18.

287. In some circumstances, especially in cases of bodily injury and death, liability waivers may be held unenforceable on public policy grounds. *See, e.g.*, Dalury v. S-K-I, Ltd., 670 A.2d 795, 797–800 (Vt. 1995).

288. *See* Showalter, *supra* note 79, at 834–36 (discussing a disclaimer between the operator of a space shuttle and the cargo owner).

289. 51 U.S.C. § 50914(b)(1)(A) (2025) ("A launch or reentry license . . . shall contain a provision requiring the licensee or transferee to make a reciprocal waiver of claims with applicable parties involved in launch services or reentry services under which each party to the waiver agrees to be responsible for personal injury to, death of, or property damage or loss sustained by it or its own employees resulting from an activity carried out under the applicable license.").

III. NON-EARTH-LAUNCHED OBJECTS AND CELESTIAL BODIES

A. The Limits of the Current Legal Regime

According to Article I of the OST, "[o]uter space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies."[290] Article II adds 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."[291] In other words, no State can extend its sovereignty, including its jurisdiction and laws, into space without international agreement.[292]

The existing international legal framework addresses—directly or indirectly—injuries caused by space objects or on space objects launched from Earth. Alas, this geocentric regime leaves at least two kinds of somewhat futuristic incidents in a seemingly lawless territory: (1) incidents occurring on or by space objects that were *not* launched from Earth, be they attached to celestial bodies, such as buildings in human settlements, or floating or traveling in space, such as space stations or starships built outside Earth; and (2) incidents occurring outside any space objects, for example, on the surface of celestial bodies. How would such cases be decided? Which polity would have jurisdiction over these domains, and which laws would apply to wrongs and injuries occurring therein?

Surprisingly, these questions are partly addressed through the registration-based extension-of-sovereignty model. As explained above, each State retains jurisdiction and control over launched objects recorded on its registry and over any personnel thereof while in outer space or on celestial bodies.[293] Decades ago, space law pioneer Stephen Gorove explained that space objects and settlements constructed or assembled in space out of Earth components that were possibly registered by a specific State remain under its jurisdiction and control.[294] In his view, this conclusion is reinforced by Article VI, whereby States "bear international responsibility for national activities in outer space," because there can be no responsibility without jurisdiction and control.[295] If an entity in country C1 procures the launch of units S1, S2, and S3 (e.g., habitat,

290. *OST*, *supra* note 3, at 207–08.

291. *Id.* at 208.

292. *See* Larry S. Kaplan, *Space-Specific Remedies for Torts in Outer Space: What Path Will U.S. Law Follow?*, 22 INT'L LAWYER 1145, 1152 (1988); Moenter, *supra* note 250, at 1941. *See also Moon Agreement*, *supra* note 3, at 22, 25 (applying the same principle to the moon and other celestial bodies in the solar system). The exception to the non-appropriation principle is geosynchronous orbits. *See supra* note 28.

293. *OST*, *supra* note 3, at 209.

294. Gorove, *supra* note 247, at 161; Gorove, *supra* note 108, at 29.

295. *OST*, *supra* note 3, at 209; Gorove, *supra* note 247, at 161.

lab, and docking modules) from a launch provider in country C2 using launch vehicle S4 (a rocket, a space shuttle, etc.), S1–S3 will be registered in C1 and S4 will be registered in C2. C1 will retain jurisdiction over S1–S3 even if they are connected in deep space or on a celestial body to create a research post. C1's jurisdiction also extends to the object's personnel while in outer space or on celestial bodies, presumably even when they leave the object.

This seemingly simple solution—extending a State's jurisdiction to space objects and settlements constructed with components that the same State launched (or procured launching)—has several deficiencies that could not be envisioned when the international regime was endorsed. First and foremost, space objects and settlements can be built using materials and components found, mined, or produced in space (for example on planets, natural satellites, or asteroids). Scientists considered the use of lunar materials for space construction as early as the 1970s.[296] The visionary Moon Agreement of 1979 already includes an undertaking to establish an international regime governing "the exploitation of the natural resources of the moon as such exploitation is about to become feasible" and covering the development, rational management, expansion of use, and equitable sharing of the benefits deriving from these resources.[297] One may expect a growing use of various non-Earth materials and components in the future. As these are not launched from Earth, there can be no State of registry with jurisdiction under the OST.[298]

Second, even if all construction materials and components originated on Earth, many of them might not be individually registered. If such items are transported by a launched-and-registered vessel, and cargo items can be deemed components of the transport vessel,[299] they will be under the jurisdiction of this vessel's State of registry.[300] However, this link will normally cease once the payload leaves the transport vessel, and if it does not, a discrepancy between the State of registry (of the launching vessel and its cargo) and the State responsible for the space construction project will arise. If cargo items cannot be deemed components of the registered transportation vessel, there will be no State of registry at all and no jurisdiction over the space-constructed object.

Third, even if all components are registered, space stations and settlements can be built using a mixture of materials and parts sent by many countries, making it extremely difficult to delineate the exact boundaries of each country's jurisdiction. Fourth, registration-based jurisdiction does not seem to extend to non-crewmembers, such as passengers, visitors, or settlers, who leave the space object or the settlement to explore external space or surface.[301] Under a narrow

296. Gorove, *supra* note 108, at 29.
297. *Moon Agreement*, *supra* note 3, at 25.
298. *See* Gorove, *supra* note 108, at 29.
299. *See supra* notes 108, 233 and accompanying text.
300. *Registration Convention*, *supra* note 3, at 17.
301. *See supra* Part II.B.1.

interpretation of Article VIII of the OST, it might not cover non-crewmembers even when the wrongful or harmful conduct occurs on board the space object.[302]

To conclude, while the existing legal framework is not entirely silent on the more futuristic incidents envisaged here, it addresses them by coincidence rather than by design and remains patently incomprehensive. Space-related wrongs and harms that are not associated with Earth-launched objects entail legal innovation.

B. Nationality-Based Models

Possible solutions that could be but have not yet been generally applied to deep space wrongs and harms are nationality-based. Such models, which have been employed in other contexts, can be adopted through international cooperation and agreement. To begin with, international law has traditionally recognized a country's *criminal* jurisdiction over its nationals' misconduct—the so-called active personality principle.[303] Put differently, jurisdiction has been linked to the perpetrator's nationality. Conceivably, the international community may extend this well-recognized principle to outer space *civil* wrongdoing.

In Antarctica, which is somewhat comparable to outer space in lacking recognized territorial sovereignty,[304] a nationality-based model already applies to some civil misconduct.[305] The Antarctic Treaty of 1961 did not renounce previously asserted rights of or claims to territorial sovereignty but prohibited new claims or enlargement of existing ones.[306] When territorial claims existed before 1961, they were sometimes accompanied by the extension of the claiming State's jurisdiction to and the application of its laws in the claimed territory.[307] However, many countries do not recognize other countries' territorial claims.[308] Moreover, some countries operate scientific facilities in

302. As explained above, the extension of sovereignty rule may be interpreted narrowly to preclude wrongdoing or causation of harm by non-personnel on board the registered space object or broadly to include such wrongdoing and causation of harm. But to the extent that the narrow interpretation prevails and is deemed undesirable, a general amendment to or clarification of Article VIII of the OST is needed. *Id.*

303. *See* KENNETH S. GALLANT, INTERNATIONAL CRIMINAL JURISDICTION: WHOSE LAW MUST WE OBEY? 345–47 (2022) (discussing the nationality principle); Todd F. Chatham, Comment, *Criminal Jurisdiction in Antarctica: A Proposal for Dealing with Jurisdictional Uncertainty and Lack of Effective Enforcement*, 24 EMORY INT'L L. REV. 331, 344 (2010) (same).

304. *See supra* notes 173–77 and accompanying text.

305. The Antarctic Treaty, Dec. 1, 1959, 12 U.S.T. 794, 402 U.N.T.S. 71, *reprinted in* Secretariat of the Antarctic Treaty, Compilation of Key Documents of the Antarctic Treaty System 21 (5th ed. 2021).

306. *Id.* at 74.

307. *See, e.g.*, *Australian Antarctic Territory Act 1954* (Cth) ss 6, 10 (Austl.) (applying Australian Capital Territory law and granting jurisdiction to Australian Capital Territory courts).

308. *See* Elizabeth K. Hook, *Criminal Jurisdiction in Antarctica*, 33 U. MIA. L. REV. 489, 489–90 (1978).

areas claimed by others.[309] As an additional complication, the Antarctic Treaty allows designated observers to access all areas of Antarctica, including stations, installations, ships, and aircraft operated by any country, and facilitates the exchange of scientific personnel between expeditions and stations.[310] Thus, a person from country W can harm a person from country X while at a facility operated by country Y in a territory claimed by country Z.

Some of the resulting jurisdictional questions are resolved by Article VIII of the Antarctic Treaty, whereby observers, scientific personnel, and members of the staff accompanying any such persons ("privileged foreign nationals"), are subject to the exclusive jurisdiction of "the Contracting Party of which they are nationals in respect of all acts or omissions occurring while they are in Antarctica . . . ."[311] Nationals of a particular country are subject to its exclusive jurisdiction even when they are on a mission in other countries' facilities (or even claimed territory).[312] Thus, if a U.S. observer or scientist commits a wrong at a Russian station placed in an area claimed by the U.K., that person is subject to U.S. jurisdiction and applicable law. Admittedly, Article VIII does not resolve potential jurisdictional disputes concerning other people, such as tourists and military personnel.[313] For instance, if a German tourist wrongs a French tourist at a U.S. facility located in a U.K.-claimed territory, the four countries—not only Germany—have grounds for asserting jurisdiction. Article VIII merely states that, in cases of jurisdictional disputes, contracting parties "shall immediately consult together with a view to reaching a mutually acceptable solution."[314] While some scholars advocated for the extension of the active personality principle to other people,[315] international endorsement of such an extension is unlikely because it might undermine pre-treaty territorial claims.[316]

Applying the active personality principle to deep space wrongdoing does not seem to undermine claims of sovereignty, which are strictly prohibited under the OST, and therefore seems less objectionable. Nevertheless, it may be rejected by relevant parties for several reasons. First, criminal law focuses on punishing perpetrators for misconduct, so jurisdiction can naturally derive from the country's relation to the perpetrator and the conduct.[317] In contrast, private law typically involves bilateral interactions. The victim and the wrongdoer are

309. *See* Chatham, *supra* note 303, at 346.

310. The Antarctic Treaty, *supra* note 305, at 74, 76.

311. *Id.* at 78.

312. *See* Chatham, *supra* note 303, at 340–41.

313. *See id.*

314. The Antarctic Treaty, *supra* note 305, at 78.

315. *See, e.g.*, Eric W. Johnson, Note, *Quick, Before It Melts: Toward a Resolution of the Jurisdictional Morass in Antarctica*, 10 CORNELL INT'L L.J. 173, 194–98 (1976).

316. *See* Chatham, *supra* note 303, at 341, 355.

317. *See* Gorove, *supra* note 108, at 30 (discussing criminal jurisdiction based on "the State of the accused").

equally significant.[318] Yet if the wrongdoer and the victim are nationals of different countries, the active personality principle does not treat them as equals. The wrongdoer's nationality prevails in resolving the jurisdictional question, and victims are systematically subjected to "foreign" jurisdictions. Second, to the extent that specific countries operate or regulate the operation of multinational deep space facilities that were not launched from Earth, such as space stations, starships, and space settlements, their strong legitimate interest in onboard activities might be inconsistent with a jurisdictional mélange under the active personality principle. Third, the active personality principle might generate uncertainty and arbitrariness, leading to inefficiency and unfairness, as similar cases occurring in the same multinational facility will be subject to different jurisdictions and different laws. Fourth, any nationality-based principle might be ineffective in future cases involving individuals or organizations with no Earth nationality.

An alternative nationality-based model, known in international criminal law as the passive personality principle, bases jurisdiction on the victim's nationality rather than the perpetrator's.[319] Applied to civil wrongs, it would grant jurisdiction to the country whose nationals were wronged or harmed in space.[320] Even though victims' nationality has been considered by scholars, it has not been regularly used as a basis for jurisdiction in *criminal* contexts and is considered a highly controversial basis for *criminal* jurisdiction.[321] This seems understandable. As indicated above, criminal law focuses on the perpetrator and the misconduct, so jurisdiction is most naturally granted to the perpetrator's country. But in private law, the victim is equally relevant and significant, so the passive personality principle is equally defensible.

However, it might be rejected for similar reasons. First, if the wrongdoer and the victim are nationals of different countries, the passive personality principle does not treat them as equals. The victim's nationality prevails in resolving the jurisdictional question and injurers are systematically subjected to "foreign" jurisdictions. Second, the legitimate interest of the country that operates a multinational outer space facility in overseeing onboard activities might be inconsistent with a nationality-based jurisdictional mixture. Third, any nationality-based model might generate uncertainty and arbitrariness in multinational space ventures. Fourth, it may become lacking when individuals and organizations with no Earth nationality are involved.

318. *See* ERNEST J. WEINRIB, THE IDEA OF PRIVATE LAW 212 (1995) ("[T]he form of corrective justice postulates that each party has an equal standing and that neither is subordinate to the other or superfluous to their relationship.").

319. *See* GALLANT, *supra* note 303, at 441–60 (discussing the passive personality principle).

320. *See* Johnson, *supra* note 315, at 191.

321. *See* Chatham, *supra* note 303, at 345; Johnson, *supra* note 315, at 191–92.

C. Registration-Based Models

1. Wrongs and Harms on Board Space Objects

A simple, though partial solution to the problem of wrongdoing and causation of harm on non-Earth-launched space objects would be a reform in the international registration system, requiring registration of space objects not launched from Earth, including those constructed outside Earth from non-Earth materials. Under a modest version, the existing *State-based registration* model can be extended to non-Earth-launched objects. If the entities involved in the construction and operation of a space object are from a single State, that state would naturally be the State of registry. If entities from more than one State are involved, the principle currently applicable to Earth-launched objects, whereby the States involved must jointly determine which one will be the State of registry, can be applied *mutatis mutandis*.[322] Wrongs and harms occurring on a registered object will then be subject to the jurisdiction and laws of the State of registry.

However, in the era of private space activities, the need for intergovernmental negotiations and accord might hinder private initiative. Assume, for example, that company P from State X, company Q from State Y, and company R from State Z plan to construct and operate a space station using space-manufactured components and space-mined materials. They will be unable to do so until States X, Y, and Z can reach an agreement on the registration issue, overcoming political tensions and conflicts of interest. Moreover, such a model denies participants in a joint venture the power to include jurisdiction and choice of law clauses in their contracts with each other and with third parties in accordance with their business vision and interests.

A more robust reform would oblige entities involved in the construction and operation of a space object to register the object in a single country ("the flag State"), which will then have jurisdiction over civil disputes arising from onboard conduct and harm, in a way similar to that applied to merchant ships today.[323] To register an object, its operators will have to comply with applicable laws and regulations of the designated State. This model does not entail intergovernmental negotiations and enables participants to pursue their business goals under the most accommodating laws. One may also consider a more flexible regime, requiring each contract related to the operation of a space object to incorporate jurisdiction and choice of law clauses without a prior commitment to a single system, allowing diversification. In theory, each contract would fit a more efficient arrangement to the respective relationship than a one-size-fits-all rule; but the totality of the operation, involving

322. *Registration Convention*, *supra* note 3, at 17.

323. UNCLOS, *supra* note 243, at 433–35.

numerous contracts subject to different jurisdictions and laws, would generate unimaginable complexities and uncertainties.

All registration-based solutions are problematic because they tie deep space torts to terrestrial jurisdictions and law. This may become challenging in a universe full of distant space ventures, such as deep space stations, space settlements, or even staffed starships on long missions away from Earth. Subjecting distant locations to terrestrial jurisdictions may prove ineffective given insurmountable physical constraints. For example, communication between these locations and Earth could become increasingly difficult due to weaker signals and longer one-way light times,[324] making it impractical for terrestrial legal systems to adjudicate cases and enforce judgments (or settlements). More importantly, in the nearer future, Earth-bound models might be inconsistent with the will of the people living in remote communities and therefore lack legitimacy and stability.[325]

2. Harms Caused by Space Objects

Under the existing international regime, a launching State is liable for harms caused by the launched object and, because a launching State must register the object, it has jurisdiction over wrongs and harms occurring on the object.[326] However, while reforming the registration system offers a reasonable framework for handling onboard wrongs and harms, the question of harms caused *by* space objects not launched from Earth entails further discussion. Assuming the above reform in the registration system, the term "launching State" in the Liability Convention can be amended to include the State of registry when the space object is not launched from Earth.[327] Thus, the costs of accidents caused by the object will be channeled to the State of registry.

The proposed amendment replicates most of the flaws of the Liability Convention enumerated above.[328] Particularly, with an increasingly privatized space industry, imposing liability on the State of registry regardless of its lack of control and limited regulatory power over the respective space object seems anachronistic, unfair, and inefficient. This problem can be solved in two ways. First, States of registry can transfer the burden to responsible entities through

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324. For example, it takes a radio signal almost an entire day to reach Voyager 1 (and another day for a signal to come back to Earth). *See* Calla Cofield, *NASA's Voyager 1 Resumes Sending Engineering Updates to Earth*, NASA JET PROPULSION LAB'Y (Apr. 22, 2024), https://www.jpl.nasa.gov/news/nasas-voyager-1-resumes-sending-engineering- updates-to-earth/ [https://perma.cc/B5HH-DWUT]. Space activities may go much deeper into space, though not in the near future.

325. *See infra* Part III.D.1 (discussing other Earth-bound models).

326. *See OST*, *supra* note 3, at 209.

327. Redefining a launching state as the (single) state of registry can provide more certainty, even for accidents involving Earth-launched objects.

328. *See supra* Parts I.A.3.a, I.B.2. With only one state of registry per object, there is less uncertainty than in cases of Earth-launched objects with several launching states.

domestic legislation, as some "launching States" already do with respect to Earth-launched objects,[329] or through contractual obligations assumed by private operators as part of the registration process. Second, the international regime can be amended differently, imposing liability on those responsible for the harm rather than the State of registry. To simplify the model and facilitate dispute resolution, the Registration Convention can be amended to require an additional registration of a single *operator* for each space object (in joint ventures—participants will decide whom to select), and the Liability Convention can then impose liability on the registered operator. The registered operator and other participants can contractually allocate expected liability among themselves. Such a model may include liability caps and mandatory insurance, if necessary, to promote the space industry while ensuring well-structured deterrence and adequate compensation to its victims. Of course, this model is still Earth-bound, with all that it entails.[330]

3. Wrongs and Harms Outside Space Objects

Registration-based (which are more fundamentally object-based) models cannot straightforwardly resolve disputes arising from wrongs or harms occurring outside space objects, such as incidents on the surface of celestial bodies with temporary or permanent human presence. Under Article II of the OST, outer space, including celestial bodies, is not subject to "national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[331] No State can extend its sovereignty to the surface of celestial bodies and the void outside objects in outer space, so no State can have territorial or quasi-territorial jurisdiction over these loci.[332]

Three solutions may be considered. The first is to give up territorial jurisdiction (extended through registration) and apply a different model to incidents occurring outside any space object. In other words, use a registration-based system for incidents *on board* space objects and for harms caused *by* space objects, and resolve the remaining cases through a different model. The most intuitive alternative would be a nationality-based regime. However, Part III.B discussed the weaknesses of these options. Most of all, they may lead to simultaneous jurisdictional claims, uncertainties, and complexity, especially in cases involving multiple nationalities.

The second and most drastic solution is to repeal Article II of the OST and allow States to claim sovereignty over outer space regions or territories on celestial bodies. This will undermine the fundamental goals of the original

329. *See supra* note 135 and accompanying text.

330. *See supra* note 325 and accompanying text.

331. *See OST*, *supra* note 3, at 208.

332. *See* Kaplan, *supra* note 292, at 1152; *see also* Moenter, *supra* note 250, at 1039 (discussing Article II of the OST's ban on claims of sovereignty in outer space).

international regime and result in an aggressive space race, reminiscent of the colonial competition in the nineteenth century. Furthermore, it will not provide a comprehensive solution because it will only cover legitimately claimed regions, a minuscule fragment of the universe.

The third and fairly appealing option may be to extend a State of registry's jurisdiction, as proposed in Part III.C.1 for incidents on board non-Earth launched objects, to people and nonregistered equipment that leave the registered space object. For example, if A and B live in a space city registered in State X, and A wrongs B, the case will be subject to State X's jurisdiction even if the wrong was committed when A and B were outside the city, on the surface of the hosting planet. This model is relatively simple to craft and implement. It might generate jurisdictional and choice of law complexities when the injurer and victim come from space objects registered by different countries, but these are akin to contemporary problems surrounding transnational torts on Earth.

D. New Legal Systems

1. A Noncentralized Non-Earth-Bound Model

The most radical solution to the problem of the lawless expanse involves the construction of new, ultimately independent legal systems for non-Earth-launched domains. The idea of establishing a *centralized Earth-bound* court system, possibly with the power to generate its own common law, to adjudicate space-related claims was proposed with respect to incidents that existing law already covers, though imperfectly.[333] In theory, this model can be used to resolve the more challenging cases of space wrongdoing and harm that are unrelated to Earth-launched objects and therefore not covered by existing international and domestic laws.[334] A centralized Earth-bound system seems to have several advantages. It generates uniformity and a higher level of certainty, arguably reducing the costs of space activities and facilitating entrepreneurship and exploration. It offers some level of fairness in the sense that similar cases are treated similarly. It provides highly professional oversight at the appellate level, reducing the risk of biases, abuse of power, undue influence, conflicts of interest, lack of fact-finding resources, and other problems more likely to affect decision-making in remote and small communities.[335]

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333. *See* Abrams, *supra* note 14, at 820–21; Logterman, *supra* note 16, at 194–95; Reinert, *supra* note 14, at 353. *Cf.* Chatham, *supra* note 303, at 352 (proposing to grant exclusive jurisdiction over criminal activity in Antarctica to a multinational tribunal applying a uniform criminal code).

334. Of course, the proposed model can be extended to incidents covered by existing law, particularly those occurring in outer space (replacing the law described in Part I.B).

335. *See, e.g.*, Nikki Hawkins, *Perspectives on Civil Protective Orders in Domestic Violence Cases: The Rural and Urban Divide*, NAT'L INST. JUST. J. (May 25, 2010), https://nij.ojp.gov/topics/articles/perspectives-civil-

Still, a *centralized* system has five major weaknesses. First, it might be plagued by international or intercommunal politics, tensions, and intrigues (or at least accused or suspected of being politicized) and hence lack legitimacy among potential and actual litigants. Existing international tribunals, such as the ICC, already suffer from this problem.[336] It will be more acute when space—with its unimaginable potential of utilization and much greater stakes—is on the line. Second, as increasingly independent space communities develop, peoples' understandable desire to control their destinies by forging their own local dispute resolution mechanisms will undermine any legitimacy of an external overarching system.[337] Third, a centralized system may be less in tune with the culture and social dynamics of distinct space communities, generating not only legitimacy issues but also undesirable case outcomes. Fourth, a centralized system does not offer aspiring space actors a variety of options. A reasonable range of alternatives, not only in terms of the available activities, sceneries, and socioeconomic structures, but also in terms of the legal environment, is a precondition for both liberty[338] and efficiency.[339] Fifth, once humanity extends its reach to the vast realm of space, the physical distance between human communities is likely to make any interaction, or even communication between communities, much more challenging, undermining any attempt to implement a centralized legal system.[340] A decentralized model may therefore be more appealing, particularly in areas "where no law has gone before."

Moreover, while space legal systems at the nascent stage are likely to have a strong connection to *Earth-based* institutions, jurisdictions, and laws, this connection will gradually loosen (and in the more distant future become obsolete). Understandably, the first steps in human space expansion will be taken by terrestrial governments, corporations, and individuals, who will want to replicate dispute resolution mechanisms they are familiar with. They may

protective-orders-domestic-violence-cases-rural-and-urban-divide [https://perma.cc/4XS5-NW7U] (discussing judicial constraints in remote and small communities).

336. *See, e.g.*, Kate Cronin-Furman, *'States of Justice' Asks Tough Questions About the International Criminal Court*, WASH. POST (Sept. 8, 2020), https://www.washingtonpost.com/politics/2020/09/08/states-justice-asks-tough-questions-about-international-criminal-court/ [https://perma.cc/XJG5-GC4C] (discussing allegations about the ICC); Rick Noack, *Why Does the Trump Administration Hate the International Criminal Court So Much?*, WASH. POST (Apr. 5, 2019), https://www.washingtonpost.com/world/2019/04/05/why-does-trump-administration-hate-international-criminal-court-so-much/ [https://perma.cc/WU9N-XJND] (same).

337. The gradual separation of the American colonies from Great Britain may serve as an illustrative analogy. *See* GORDON S. WOOD, THE CREATION OF THE AMERICAN REPUBLIC 1776-1787 *passim* (1969).

338. *See* HANOCH DAGAN, A LIBERAL THEORY OF PROPERTY 79–113 (2021) (explaining that a liberal property law must include a structurally pluralistic inventory of property types—which opens up options for real choices); JOSEPH RAZ, THE MORALITY OF FREEDOM 372 (1986) (explaining that autonomy entails an adequate range of options).

339. *See* Perry, *supra* note 263, at 863–64 (explaining that "regulatory competition" facilitates economic activity and growth).

340. *See supra* note 324 and accompanying text.

allow appeals from their new space tribunals to a terrestrial appellate court (in a way reminiscent of but not fully analogous to the historical example of the Privy Council in London, which heard appeals from common law courts around the world[341]). They may also adopt the substantive laws and procedures of their countries of origin. Presumably, however, activities in space will develop and proliferate, permanent presence in distant locations will become prevalent, and space communities with multiple nationalities and subsequently even members with no terrestrial nationality will evolve. These people will legitimately demand community-tailored institutions and laws. This Article does not reject any model on the Earth-connection spectrum. It merely envisages and supports a natural evolution of independent institutions and laws in accordance with the legitimate preferences of the relevant subjects. This Part offers some guidelines for the establishment of new, decentralized, decreasingly Earth-bound space legal systems.

2. One System Per Space Venture

The first guideline for resolving civil disputes concerning outer space wrongs and harms unrelated to Earth-launched objects is that each physical space venture must be governed by a single legal system (analogous to territorial jurisdiction on Earth). Put differently, all wrongdoing within or in the practical vicinity of a single starship, space station, or celestial community, should be subject to a single jurisdiction with its own laws. At this point one need not determine which legal system should reign—an issue to be discussed below.[342] The first guideline merely insists on exclusivity. As a practical matter, a starship or another space object traveling among permanent space ventures (such as space stations or space settlements) will be treated like a vessel in maritime law—being subject to local jurisdiction and laws while docking at or in the vicinity of an independent space polity, and to its own jurisdiction and laws while traveling in space outside the jurisdiction of other space communities.[343]

Avoiding conflicting jurisdictional claims and choice-of-law conundrums can foster efficiency and fairness. On the efficiency level, the single system principle reduces ex post uncertainty. When a person wrongs or harms another within a particular space venture or in its practical vicinity, the competent court, the applicable law, and the expected outcome can be more easily discerned. This encourages settlement, simplifies the legal process, and saves administrative costs for litigants and courts. Similarly, the single-system principle reduces ex

341. *See* Rohit De, *"Peripatetic World Court" Cosmopolitan Courts, Nationalist Judges and the Indian Appeal to the Privy Council*, 32 L. & HIST. REV. 821, 821–22 (2014) ("The right to appeal from the colonial courts to the Judicial Council of the Privy Council . . . was a major legal sinew that tied the common law world together . . . .").

342. *See infra* Part III.D.3.

343. *See infra* Part II.B.2.

ante uncertainties. Potential wrongdoers and victims can determine in advance how potential disputes will be resolved and adjust their conduct accordingly. By facilitating accurate compliance, certainty makes substantive law more effective. If liability rules are structured in an efficiency-oriented manner, as per the decades-long project of law and economics theorists of torts,[344] certainty will also lead to efficient outcomes.[345] Lastly, localized independent dispute resolution mechanisms provide much faster and more enforceable results, given the impracticability of reliance on external tribunals and enforcement agencies that cannot efficiently communicate with and impose order on remote space communities.

On the fairness level, the single-system principle will ensure that similar cases occurring within the same community or polity are treated equally. When specific conduct causes a particular consequence in a given domain, the legal process and outcome will not hinge on fortuities, such as the parties' nationality, origin, or specific ties to different communities, and any variance among legal systems that might otherwise have an interest in resolving the dispute.

This model requires some form of international agreement. Firstly, a single-system principle might undermine Earth-bound claims of jurisdiction over nationals, habitual residents, specific objects, and so on. An international agreement may include a waiver of such claims and facilitate the establishment and viability of independent space legal systems. Secondly, an agreement is required to minimize jurisdictional disputes, by clearly defining the boundaries of a space venture's spatial jurisdiction, in a way similar to the definition of territorial sea in the U.N. Convention on the Law of the Sea.[346]

3. System Building: From a Contractual to a Political Choice

Once the international community endorses the single-system principle, it must establish a method for determining which courts will have exclusive jurisdiction over tort disputes arising in a particular space venture and which law will apply. The second proposed guideline is that jurisdiction over and applicable law within a specific space venture should generally follow the will of its founders and participants, not some terrestrial mandate. An international agreement can outline suggested institutional designs that space communities may use in developing their legal systems, but none should be imposed. This guideline derives primarily from the need for legitimacy and legal variety.

Starting with legitimacy, each space venture will be granted self-governance, namely the power to develop institutions, laws, and regulations suited to its

344. *See, e.g.*, Ronen Perry, *Harmful Precautions*, 99 NOTRE DAME L. REV. 153, 173–88 (2023) (discussing efficiency-oriented adjustments of tort law).

345. Certainty reduces mistakes in the understanding and application of rules by courts and in compliance by relevant parties and increases the probability of effective enforcement.

346. UNCLOS, *supra* note 243, at 400.

unique circumstances. Those may include the size and nature of the community (civil, commercial, scientific, mixed); members' backgrounds and level of diversity and cooperation; local economic, social, and cultural preferences; the type of activities carried out on or in the particular space venture; unique problems, challenges, and risks related to the specific celestial environment; the venture's location and distance from other space communities; and so on. By allowing self-governance, the system will be accepted by the respective population. Legitimacy is always important, but it becomes crucial in secluded communities whose members do not wish to be (and, in fact, cannot be) effectively controlled by foreign powers, which are aloof from the intricacies of life on or in distant space ventures.

Additionally, assuming space communities will vary in size, nature, members' backgrounds, economic, social, and cultural preferences, etc., venture-specific legal system building will reflect that variety. It will therefore offer potential and aspiring participants in space activities a diverse range of legal environments to choose from, promoting both liberty and efficiency.[347]

The founders' choice will usually be expressed in the fundamental contracts underlying the operation of the specific venture. These will be drafted by the founders-operators when inviting participation and accepted by those who choose to participate as staff members, inhabitants, suppliers, clients, and so forth. Contracts can establish dispute resolution mechanisms or rely on external courts. They can lay down concrete loss allocation rules or endorse the laws of an external system (such as a terrestrial country). The participants' choice will, at first, be represented by their voluntary entry into the contractual framework underlying the operation of the space venture. Following the consolidation of a cohesive space community, participants may demand and should ultimately be empowered to develop the community's institutions and laws through a political process.

In space ventures carried out by a single terrestrial country or entities from a single country, the founders and many of the participants will often prefer dispute resolution by the courts of the same country and under its law or by "local" courts following that country's judicial design, with which they are familiar. However, operators of space ventures may also opt for business-friendly systems, like many U.S. corporations choosing to incorporate in Delaware.[348] Operators may also choose a legal system based on ideological affinity. New members of space communities will then be subject to predetermined law. Calls for a legal system consistent with the will of the locals are likely to emerge over time and will need to be properly addressed.

In space ventures involving multiple Earth nationalities or, in the more distant future, people with no terrestrial nationality, founders and participants

347. *See supra* notes 338–39 and accompanying text.

348. *See* HAL WEITZMAN, WHAT'S THE MATTER WITH DELAWARE? 17 (2022).

are likely, at the initial stages, to opt for (1) the institutions and laws of a specific terrestrial country or state (based on familiarity, business-friendliness, ideological affinity, etc.), (2) universal or transnational models, such as the Principles of European Tort Law, which harmonize and integrate the law of torts in common law and civil law systems and have the advantage of respecting contemporary diversity,[349] or (3) the institutions and laws of an existing comparable space community (for example, an emerging scientific space community may adopt the laws of an established scientific space community). Either way, the legislatures and courts of each space community will subsequently "hew [their] own way"[350]—develop their institutions and law from the contractual starting point in accordance with the unique cultural, social, economic, and political setting.

4. Harms Caused by Non-Earth-Launched Objects in Outer Space

Incidents in which non-Earth-launched space objects cause harm to other space objects outside any recognized space jurisdiction are the remaining challenge in a universe of independent space legal systems. Suppose that a starship constructed at a space station leaves that station on its way to an inhabited planet and collides with another starship midway. This incident is not governed by the existing international regime (the OST and the Liability Convention) because the harm was not caused by an Earth-launched object. In addition, it occurred outside the proposed spatial jurisdiction of the origin and destination communities (the space station and the space settlement, respectively). Finally, it did not occur in or on any of the two starships, hence, does not neatly fit the proposed spatial jurisdiction of either. Such incidents seem to require a special arrangement.

A possible response, within the proposed model, may be that a collision in space is comparable to a crash into a space community, which is subject to that community's jurisdiction and law, just like any other materialization of risk in or on a space venture. This solution may be acceptable with respect to harm caused to payload or passengers on the "victim" starship. Payload owners and passengers can argue that they were wronged or harmed on that starship while in travel, so their claims are under its jurisdiction. Such an argument, however, seems less compelling with respect to harm to the starship itself which was not caused on or in but to that vessel.

A contractual choice of jurisdiction, dispute resolution method, applicable law, or loss allocation by the parties, which could be fair and efficient,[351] is often

349. *See* EUROPEAN GROUP ON TORT LAW, PRINCIPLES OF EUROPEAN TORT LAW TEXT AND COMMENTARY 12–18 (2005).

350. Borrowing the language of President Cooke in *Christchurch Drainage Board v. Brown* [1986] NZCA 451, [1986] 1 NZLR 76 at [80] (N.Z.).

351. *See supra* notes 263–64.

impractical. The parties to a deep-space collision may be complete strangers before the accident and therefore cannot negotiate a contract with dispute resolution provisions ex ante. Some repeat players in space may negotiate general contractual arrangements for common contingencies, as contemporary business practices demonstrate,[352] but these arrangements will not cover unexpected or rare contingencies and will not apply to non-parties. An ex post agreement might also be hard to achieve due to the conflict between the injurer and the victims.

A general international treaty, which is required anyway to facilitate the space-legal-systems model, can lay down clear rules for deep-space collisions among non-Earth-launched objects. A treaty can mandate the establishment of a special dispute resolution mechanism for each incident, such as an ad hoc tribunal, judicial committee, or arbitration, and specify practical rules for its efficient operation. It can also include choice-of-law provisions or even concrete liability rules, like the Liability Convention. Other creative solutions may also be considered. For example, the treaty can grant jurisdiction to the nearest permanent space community, with the understanding that it may still be very remote from the incident's locus. Proximity-based jurisdiction requires some deliberation because it has not been employed in other contexts before and might seem arbitrary.

Note further that in the case of deep-space collisions, uniformity of applicable law is more important than in the case of onboard wrongdoing and harm because the harm will often occur at an unpredicted location and involve unpredicted parties.[353] If the laws of a specific space legal system rather than universally accepted rules govern such a case, applicable law and the likely outcomes of its application cannot be determined in advance, causing uncertainty and hindering space travel. Any solution to the deep-space collision problem should take this into account.

CONCLUSION

This Article mapped, evaluated, and offered practical guidelines for resolving the main problems with existing (and non-existing) space tort law considering recent and foreseeable economic and technological developments. Part I discussed injuries caused by Earth-launched space objects. The law concerning injuries on Earth, though complex and somewhat uncertain, is relatively well-developed and does not present unique challenges. Nationals of a launching State may sue that State under relatively restrictive domestic rules.

352. *Cf.* Jeff Foust, *Updated Space Safety Document Outlines Rules of the Road for Avoiding Collisions*, SPACE NEWS (Apr. 5, 2023), https://spacenews.com/updated-space-safety-document-outlines-rules-of-the-road-for-avoiding-collisions/ [https://perma.cc/EX7H-REMM] (discussing the Best Practices for the Sustainability of Space Operations, voluntarily crafted and endorsed by major stakeholders).

353. *See* Perry, *supra* note 263, at 856–63 (discussing the importance of uniformity).

The limits are not exclusive to space activities, so any modification must be considered and made at a much higher level of abstraction, which transcends the boundaries of this Article. Domestic law on private entities' liability for injuries on Earth or in airspace is also well-developed and does not require an overhaul.

Non-nationals of the launching State may benefit from the international liability scheme. Alas, some of its main weaknesses, namely the limited and uncertain scope of liability, the non-judicial process, and the unenforceability of outcomes, cannot be easily overcome due to the political impracticability of amending the Liability Convention. In contrast, the most important imperfection of this scheme—the misalignment between the ends (deterrence, corrective justice, empowerment, etc.) and the means (state-to-state liability)—can be and often is ameliorated on the national level. Non-nationals can also sue under national laws, either in the launching State or in their domestic courts. Claims in a foreign country might be costly and stressful while claims in the victims' jurisdiction might be barred by the foreign sovereign immunity. Yet these problems must also be addressed at a more general level because they are characteristic of all kinds of cross-border torts and not limited to space activities.

When a space object causes injury in outer space, national laws might not provide any cause of action against States (taking into consideration different immunities and evidentiary challenges) or private entities (for lack of jurisdiction). International law does not protect nationals of the launching State at all, while non-nationals face the same obstacles discussed with respect to injuries on Earth, in addition to the often-insurmountable hurdle of having to prove fault and causation in cases of unidentifiability.

Part II examined wrongs and harms occurring on board Earth-launched space objects. The international liability scheme does not currently cover such torts unless the injury *on* the space object was also caused *by* a space object. However, the Registration Convention provides that every State launching an object to space must register the object domestically, and the OST stipulates that each State retains jurisdiction and control over launched objects recorded on its registry and their personnel. The extension of sovereignty through registration enables terrestrial courts to resolve onboard tort disputes, applying their own laws. Alternatively, the parties involved can consensually fashion a more nuanced regime before embarking on the joint venture. Contractual choice of jurisdiction, applicable law, dispute resolution method, or even the ultimate allocation of harm is common in many contexts on Earth and generally respected by the courts.

Part III considered the more futuristic tort incidents that do not involve Earth-launched space objects. The existing legal framework is not completely silent on such cases, but it addresses them by coincidence rather than by design and remains patently incomprehensive. The Article discussed three possible

methods for handling the unhandled. Nationality-based models are not only inconsistent with the bilateral nature of tort litigation but also likely to result in incoherence and subsequent unfairness within space ventures. Registration-based models that build on existing ideas of jurisdictional extension are problematic because they tie deep space torts indefinitely to terrestrial jurisdictions and law. This gives rise to both physical-technological and sociopolitical challenges. Thus, in the long run, the most appealing method seems to be the establishment of independent legal systems for deep space incidents.

The Article predicts and supports the establishment of decentralized, decreasingly Earth-bound space legal systems and proposes two guidelines. First, each physical space venture must be governed by a single legal system (analogous to territorial jurisdiction on Earth). Second, legal system building within each space venture should normally follow the will of the founders or current members of the community and not a terrestrial mandate. In the foundational stages, the essential choices will be made through the underlying contractual arrangement, and in evolved space communities—through political decision-making processes.

The Article intended to commence and facilitate but not to conclude a long-awaited debate. The general ideas presented here, as well as any specifics that could not be explored, are left for future analysis and research. Nevertheless, the need for legal adaptation should be undisputed. Admittedly, as more States are joining the space club, and given the high stakes involved, international conflicts and tensions might hinder necessary reforms. However, major developments in other highly divisive areas of international law leave room for hope.[354]

354. Agreement under the UNCLOS on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction, June 19, 2023, https://treaties.un.org/doc/Treaties/2023/06/20230620%2004-28%20PM/Ch_XXI_10.pdf [https://perma.cc/9DVX-FUSB]**;** Paris Agreement, Dec. 12, 2015, T.I.A.S. No. 16-1104 (UN framework convention on climate change).