

**ABANDONED SHIPS AND WHAT THEY CAN
TEACH US ABOUT CLEANING UP SPACE
JUNK**

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INTRODUCTION

Orbital debris, or “space junk,” is not a new problem. The laws governing the liability for damage to spacecraft or harm to astronauts from debris are well established.¹ Objects in orbit are registered and extensively tracked by spacefaring nations in accordance with several international treaties.² But as time passes, space becomes more crowded, and the problem is getting worse every day.³ Low Earth orbit (LEO), the area that is closest to Earth and most convenient for use, is becoming especially difficult for spacecraft to navigate.⁴ Man-made space junk is a danger to astronauts and spacecraft in orbit because it moves at thousands of miles per hour and can crash into anything in its path.⁵ It is also a hazard to people and property on Earth because it can crash down anywhere onto the Earth’s surface.⁶

1. See generally G.A. Res. 2345 (XXII), Agreement on Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, at 5–7 (Dec. 19, 1967) [hereinafter Rescue Agreement] (noting the urgency in preparing an agreement regarding damage from objects launched into space); G.A. Res. 2777 (XXVI), Convention on International Liability for Damage Caused by Space Objects, at 25–28 (Nov. 29, 1971) [hereinafter Liability Convention].

2. See, e.g., G.A. Res. 3235 (XXIX), Convention on Registration of Objects Launched into Outer Space (Nov. 12, 1974) [hereinafter Registration Convention] (noting that there will be a “mandatory system of registering objects into outer space world” that will be “established and maintained” by the United Nations Secretary-General).

3. *The Current State of Space Debris*, EUR. SPACE AGENCY (Dec. 10, 2020), https://www.esa.int/Space_Safety/Space_Debris/The_current_state_of_space_debris [<https://perma.cc/C777-J4W9>].

4. *ESA’s Space Environment Report 2022*, EUR. SPACE AGENCY (Apr. 22, 2022), https://www.esa.int/Space_Safety/Space_Debris/ESA_s_Space_Environment_Report_2022 [<https://perma.cc/J3N6-T32M>].

5. *Space Debris*, NASA, <https://www.nasa.gov/headquarters/library/find/bibliographies/space-debris/> [<https://perma.cc/7RNV-D979>] (last updated Sept. 27, 2023).

6. *Id.*

Until recently, countries have made few efforts to mandate or incentivize private companies to clean up after themselves in space.⁷ In September 2022, the U.S. Federal Communications Commission (FCC) proposed a rule to require operators to take satellites out of orbit at the end of the satellites' operations.⁸ If enacted, this rule would be the first of its kind in the U.S., even though decades have passed since humanity first sent objects into Earth's orbit.⁹ It might be a surprise that it has taken so long to even think of passing such a law, but cleaning up space comes with many challenges. Removing spacecraft and debris is expensive, difficult to do, and takes up time that countries and companies could spend working on other projects.¹⁰ Space debris is also not the most pressing issue in most people's lives. Those who do not work in space-related fields are likely unaware of the concerns or think they are less pressing than the issues facing people on Earth.

Besides the problems of funding and awareness, space clean-up comes with an additional challenge—space is not solely controlled by one country or jurisdiction. A lot of the defunct spacecraft in orbit belong to countries that might not see a

7. See Sahana Parker, *How Private Companies Light Up Our Night Sky*, ATHENS SCI. OBSERVER (Dec. 29, 2020, 2:00 PM), <https://athensscienceobserver.com/2020/12/29/how-private-companies-light-up-our-night-sky/> [<https://perma.cc/XG9H-GXY4>] (noting that there is no international legislature governing private companies launching satellites into orbit); Alyssa Goessler, *The Private Sector's Assessment of U.S. Space Policy and Law*, AEROSPACE SEC. (July 25, 2022), <https://aerospace.csis.org/the-private-sectors-assessment-of-u-s-space-policy-and-law/> [<https://perma.cc/JZ5C-Q333>] (“[S]pace activities are increasingly impacted by the growing role of the private sector.”).

8. Jon Brodtkin, *FCC to Fight Space Debris by Requiring Satellite Disposal in 5 Years or Less*, ARS TECHNICA (Sept. 9, 2022, 12:47 PM), <https://arstechnica.com/tech-policy/2022/09/fcc-aims-to-minimize-space-junk-by-requiring-faster-deorbiting-of-satellites/> [<https://perma.cc/8STV-RYU4>].

9. *Id.*

10. See Leonard David, *Space Junk Removal is not Going Smoothly*, SCI. AM. (Apr. 14, 2021), <https://www.scientificamerican.com/article/space-junk-removal-is-not-going-smoothly/> [<https://perma.cc/C5R2-GTS6>] (indicating that orbital dynamics with growing debris “can be unpredictable” and “technically challenging” while policy makers remain “sluggish in their reactions” to do something about it); Rich Smith, *Cleaning Up Space Trash: A Billion-Dollar Opportunity?*, MOTLEY FOOL (Sept. 3, 2023, 7:07 AM), <https://www.fool.com/investing/2023/09/03/cleaning-up-space-trash-billion-dollar-opportunity/> [<https://perma.cc/L2ES-S5US>].

mission to clean up space as entirely altruistic. Anyone who removes their objects from orbit could risk facing liability for infringing on another country's physical or intellectual property rights. Even the attempt to do so could lead to an incident that could disrupt global relations. Given all these factors, it is a small wonder that people would be unable or unwilling to clean up man-made space junk. But this problem needs to be addressed, and soon, because we are running out of space.

This comment will attempt to address the issues outlined above using international maritime law. Maritime law has often been used to guide the formation of space law.¹¹ No single country can have or maintain jurisdiction over outer space or the oceans, so space is treated like "international waters" of sorts.¹² Both the oceans and space are mainly governed by international treaties.¹³ This comment will focus on the laws around abandoned ships and how they can be applied to space to create a new legal regime for cleaning up orbital debris. The first section will provide the background information necessary for understanding the extent of the space junk issue and how it affects us both in orbit and on Earth. The background section will go into the laws and treaties governing space junk. The following section will address the current problems in incentivizing space clean-up. The analysis section will go beyond the maritime law of salvage to look at how different countries deal with abandoned ships and regulate and reward their clean-up. These laws can be analogized to space to try to solve overcrowding issues. Lastly, the conclusion will provide a summary of the issues discussed in this comment.

11. Rachel Rogers, *The Sea of the Universe: How Maritime Law's Limitation on Liability Gets it Right, and Why Space Law Should Follow by Example*, 26 IND. J. GLOB. LEGAL STUD. 741, 741–43, 748 (2019).

12. See Gabrielle Hollingsworth, *Space Junk: Why the United Nations Must Step in to Save Access to Space*, 53 SANTA CLARA L. REV. 239, 249–50 (2013); Elizabeth Borneman, *Who Owns the Oceans?*, GEOGRAPHY REALM (Oct. 21, 2014), <https://www.geographyrealm.com/owns-oceans/> [<https://perma.cc/24W7-HWV3>]; *International Space Law*, SPACE FOUND., https://www.spacefoundation.org/space_brief/international-space-law/ [<https://perma.cc/APG5-DKW4>] (last visited Oct. 31, 2023).

13. William C. Pannell, *Pirate Battles in Outer Space: Preventing Patent Infringement on the 8th Sea*, 46 UNIV. MEM. L. REV. 733, 740 (2016).

II. BACKGROUND

A. *What Is Space Junk?*

NASA defines man-made space junk as nonfunctional debris that is composed of either natural particles, like meteors, or artificial man-made particles.¹⁴ Man-made space junk is referred to as orbital debris when it is orbiting the Earth.¹⁵ By definition, orbital debris has no function and only takes up space in low Earth orbit.¹⁶ Besides not serving any purpose, space debris poses an active and increasing threat to spacecraft and human life.¹⁷

B. *The Danger of Space Junk to People and Property in Orbit*

As of last year, NASA is tracking more than 27,000 pieces of orbital debris.¹⁸ There are hundreds of thousands more pieces that are statistically estimated to be in orbit but are too small to individually track,¹⁹ and the total number of pieces of space junk now exceeds 100 trillion.²⁰ According to NASA, collision avoidance maneuvers are used for objects larger than ten centimeters.²¹ However, because of the high velocities of space debris and the difficulty in tracking them, even flecks of paint smaller than a millimeter pose a major threat to spacecraft.²² These objects

14. See *Space Debris and Human Spacecraft*, NASA (May 26, 2021), https://www.nasa.gov/mission_pages/station/news/orbital_debris.html [https://web.archive.org/web/20220710130215/https://www.nasa.gov/mission_pages/station/news/orbital_debris.html] (last visited Oct. 30, 2023) [hereinafter NASA, *Space Debris and Human Spacecraft*].

15. *Id.*

16. See *id.* (noting that there are “approximately 100 million pieces of debris about .04 inches”—or one millimeter—and larger taking up space in low Earth orbit).

17. *Id.*

18. *Id.*

19. *Id.*

20. Jamie Carter, *There Are Now 100 Trillion Bits of ‘Space Junk’ Circling Our Planet—And It’s About To Get A Lot Worse*, FORBES (May 9, 2023, 2:00 PM), <https://www.forbes.com/sites/jamiecartereurope/2023/03/09/do-we-need-an-orbital-treaty-there-are-now-100-trillion-bits-of-space-junk-circling-our-planet-and-its-about-to-get-a-lot-worse/?sh=7144acbb34a5> [<https://perma.cc/V83E-UX5V>].

21. NASA, *Space Debris and Human Spacecraft*, *supra* note 14.

22. *Id.*

in low Earth orbit are moving at thousands of miles per hour, so any impact can create large problems and present mission-ending risks.²³

Overcrowding in space also increases the danger of crashes between functional spacecraft, some of which may be carrying astronauts.²⁴ In 2021, there were two separate incidents where China had to move the Chinese space station, Tiangong, to avoid an imminent collision with one of SpaceX's Starlink satellites.²⁵ China has since complained to the United Nations that this incident amounts to a U.S. violation of the Outer Space Treaty,²⁶ which raises the question of whether the U.S. should be held liable for the unlicensed actions of private companies. These kinds of incidents are not unusual and are increasing in frequency as low Earth orbit becomes more crowded.²⁷ SpaceX's Starlink satellites alone are involved in about 1,600 close encounters in orbit per week, which amounts to around fifty percent of all such incidents.²⁸

As the detection of debris improves and low Earth orbit becomes more crowded, the number of near misses in space will increase.²⁹ Each avoidance maneuver is manually controlled, and operators on the ground have to make careful decisions about whether to spend the fuel, time, and effort needed to make emergency evasions.³⁰ As the number of close encounters

23. *Id.*

24. See *Space Congestion: An Increasingly Contested and Crowded Frontier*, ZURICH (July 5, 2022), <https://www.zurich.com/en/media/magazine/2022/from-moonshot-to-musk-how-the-rules-of-the-game-are-changing-in-space> [<https://perma.cc/6BKM-DMYA>].

25. *China Slams US Over Space Station Near Misses*, DEUTSCHE WELLE (Dec. 28, 2021), <https://www.dw.com/en/china-slams-us-over-space-station-near-misses-with-musk-satellites/a-60276241> [<https://perma.cc/QD79-RPRW>].

26. Zhao Jia, *Near Miss in Outer Space Prompts Call for US Respect*, CHINA DAILY (Dec. 29, 2021), <https://epaper.chinadaily.com.cn/a/202112/29/WS61cb88b9a31019b029ba2d79.html> [<https://perma.cc/NSH6-LLLL>].

27. See NASA, *Space Debris and Human Spacecraft*, *supra* note 14 (explaining that rising amounts of space debris increases the potential danger to all space objects).

28. Tereza Pultarova, *SpaceX Starlink Satellites Responsible for Over Half of Close Encounters in Orbit, Scientist Says*, SPACE.COM (Aug. 20, 2021), <https://www.space.com/spacex-starlink-satellite-collision-alerts-on-the-rise> [<https://perma.cc/YD4R-Y7D6>].

29. *Id.*

30. *Id.*

increases, the likelihood of an operator making an incorrect decision that leads to a crash increases too.³¹ These crashes have long-lasting, cascading effects which can clutter low Earth orbit for years or even decades.³² There is a considerable level of uncertainty in the positions of objects in space, which makes crash avoidance even more complicated.³³ For space debris, the uncertainty in its position can be a mile or more, which creates a range of several kilometers where the debris might be.³⁴

C. *The Danger of Space Junk on Earth*

Space debris is not just a danger to objects in orbit.³⁵ Debris can re-enter the Earth's atmosphere and present a danger to people and property on Earth.³⁶ Many countries and companies try to deorbit their spacecraft in a controlled way by predicting their flight paths and attempting to have parts land in the ocean or on uninhabited land.³⁷ However, not all parties carry out a successful attempt or any attempt at all, and not all deorbiting missions go to plan; to date, China has launched three Long March 5B rockets and intentionally left them in an uncontrolled orbit, meaning that there was no way of knowing where they would land.³⁸

31. *Id.*

32. *Id.*; see also Charlotte Luke, *What is Space Junk and How Does it Affect the Environment?*, Earth.org (Sep. 6, 2021), <https://earth.org/space-junk-what-is-it-what-can-we-do-about-it/> [<https://perma.cc/M6TE-TTSA>] (discussing the debris created from the worst space satellite crash in history and how they are expected to remain in orbit for at least a century).

33. Pultarova, *supra* note 28.

34. *Id.*

35. See generally Fabian Zander, *What's the Risk of Being Hit by Falling Space Debris?*, BBC FUTURE (Sept. 26, 2022), <https://www.bbc.com/future/article/20220912-what-happens-to-space-debris-when-it-returns-to-earth> [<https://perma.cc/C9FM-WJNZ>].

36. *Id.*

37. See *id.*; see also Paul Marks, *Dodging debris*, AEROSPACE AM. (July/Aug. 2021), <https://aerospaceamerica.aiaa.org/features/dodging-debris/> [<https://perma.cc/H7MD-DPQY>].

38. Zander, *supra* note 35.

In 2022 alone, there were two separate instances of space junk landing in unexpected places.³⁹ China launched the third of its Long March 5B rockets which reentered Earth's atmosphere over Indonesia and Malaysia, with debris landing in different parts of the two countries.⁴⁰ SpaceX, which generally tries to deorbit its satellites in a controlled fashion, had multiple pieces of its space debris land in Australia's Snowy Mountains.⁴¹ Current estimates about the risk of being hit by space debris vary, but most are negligible.⁴² However, a study published in *Nature Astronomy* estimates the risks posed by debris reentering the atmosphere over the next ten years are small but significant.⁴³ Even on Earth, the danger of space junk cannot be ignored.

D. Current Laws Governing Space and Debris

Since the early days of space exploration, only five international United Nations treaties governing space law have been put into effect.⁴⁴ The three that are most important to the issue in this comment are generally referred to as the Outer Space Treaty, the Liability Convention, and the Registration Convention.⁴⁵ Each of these treaties helped establish or further develop international law on damage caused by objects in space.⁴⁶

39. See *id.* (discussing the uncontrolled re-entry of a "Chinese Long March 5B rocket over Malaysia" and the discovery of SpaceX spacecraft parts in New South Wales, Australia).

40. *Id.*

41. Adriane Reardon, *United Nations Weighs in After Another Piece of Space Junk in Snowy Mountains is Confirmed to be SpaceX's*, ABC S. E. NEW S. WALES (Sep. 11, 2022, 3:16 PM), <https://www.abc.net.au/news/2022-09-12/space-debris-spacex-united-nations-snowy-mountains/101417242> [<https://perma.cc/DBB2-TKL4>].

42. See Zander, *supra* note 35.

43. See Michael Byers et.al., *Unnecessary Risks Created by Uncontrolled Rocket Entries*, 6 *NATURE ASTRONOMY* 1093, 1093–1097 (2022).

44. See *Space Law Treaties and Principles*, UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS, <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html> [<https://perma.cc/2ZZZ-25Z9>] (last visited Nov. 19, 2022).

45. *Id.*

46. See *id.*

The Outer Space Treaty⁴⁷ (OST) was the first of its kind as an international treaty that regulated the use of space.⁴⁸ The OST allows for the exploration and research of outer space as long as any studies and travels are for the benefit of all countries party to the treaty and of humankind as a whole.⁴⁹ It also begins to formulate a standard of liability for countries whose objects cause damage in outer space or on Earth and allows compensation for damages to spacecraft.⁵⁰ Under this Treaty, the launching State of a spacecraft is “internationally liable for damage to another State . . . by such object or its component parts[.]”⁵¹ Therefore, launching States are liable for damage caused by their space objects even if they have broken off or fractured into debris. Moreover, under the OST, launching an object into space requires a member State to register the object with the United Nations—expanded later in the Registration Convention—although it is difficult to identify many pieces of space debris once they have broken off from their main structures.⁵²

The Liability Convention was enacted in 1972 and focuses on establishing a country’s liability for any damage caused by accidents in outer space.⁵³ Although it was put into effect later than the previous two treaties, it was debated for almost a decade, from the time it was first proposed in 1963 to the time it was

47. 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, 610 U.N.T.S. 205 [hereinafter *Outer Space Treaty*].

48. See generally *Domestic Space Law*, Space Policy Online, <https://spacepolicyonline.com/topics/space-law/> [https://perma.cc/6DFU-NABH] (last updated Dec. 17, 2022) (giving a timeline and general overview of the space laws and treaties that followed the creation of NASA in 1958).

49. See G.A. Res. 2222 (XXI), Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, at art. I (Jan. 27, 1967).

50. *Id.* at art. VII.

51. *Id.*

52. See *id.* at art. VIII (describing some requirements of parties to the treaty and mentioning registration, but not yet laying out the exact registration policies); see Registration Convention, *supra* note 2.

53. Liability Convention, *supra* note 1, at 25.

finally put into force.⁵⁴ The Liability Convention has only been used to bring a claim once, almost fifty years ago.⁵⁵ In September of 1977, the Russian Cosmos 954 collided with a defunct satellite in space and parts of Cosmos 954 crash-landed on Canadian soil.⁵⁶ An investigation team recovered several large pieces of the satellite, ten of which were radioactive.⁵⁷ Canada brought a claim against Russia for \$6 million in damages and clean-up costs, but the countries eventually settled out of court in 1981.⁵⁸ So the Liability Convention has never been used to fully prosecute a claim in court.

The last treaty is commonly known as the Registration Convention, which was enacted in 1976.⁵⁹ This Treaty expanded on the three previous treaties to create a mechanism for nations to be able to identify and keep track of objects launched into space by expanding the UN register.⁶⁰

More recently, the U.S. Federal Communications Commission (FCC) adopted a rule to require satellites in low Earth orbit to be disposed of in the five years following their end of service.⁶¹ This new rule will be legally binding, unlike the previous NASA recommendation—suggesting that satellites be removed up to twenty-five years after the end of operations—which allowed satellites to decompose in space.⁶² There are also additional

54. *Convention on International Liability for Damage Caused by Space Objects*, UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS, <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html> [https://perma.cc/42M8-EGAB] (last visited Oct. 31, 2023).

55. Benjamin L. S. Ritz, *Splash and Crash: Satellite Liability and Insurance*, THE HOUSTON LAWYER (Jan. 20, 2022), <https://www.thompsoncoe.com/resources/publications/splash-and-crash-satellite-liability-and-insurance/> [https://perma.cc/9KFC-HFWG].

56. *Id.*

57. *Id.*

58. *Id.*

59. See Registration Convention, *supra* note 2.

60. See *id.*

61. Jon Brodtkin, *FCC to Fight Space Debris by Requiring Satellite Disposal in 5 Years or Less*, ARS TECHNICA (Sept. 9, 2022), <https://arstechnica.com/tech-policy/2022/09/fcc-aims-to-minimize-space-junk-by-requiring-faster-deorbiting-of-satellites/> [https://perma.cc/RD4M-X2C4].

62. *Id.*

measures built into the rule to allow satellites to obtain exemptions as needed.⁶³ Although the FCC rule was made in an attempt to help minimize space junk, current satellites will be grandfathered in under the previous standard and will not be required to adhere to the new rule.⁶⁴ While this will be useful moving forward, it does not mitigate the extant space junk issue.

III. PROBLEMS WITH INCENTIVIZING SPACE CLEAN-UP

A. *Privatization and Liability Issues*

Previously, private companies' role in space had mostly been restricted to building and supplying vessels for national space agencies like NASA.⁶⁵ In recent years, more private actors are venturing forth into space on their own behalf, and the number is expected to increase in the future.⁶⁶ The Biden administration has worked with private companies to develop an executive order to simplify the launching procedures and bring legal clarity to issues facing private companies in space.⁶⁷ These recent pushes, however, do not extend to changes to international liability for private companies' actions in space, which is still determined by the Outer Space Treaty and the Liability Convention.⁶⁸ Article VI of the Outer Space Treaty provides, "State Parties to the treaty shall bear international responsibility for national activities in

63. *Id.*

64. *Id.*

65. See, e.g., Alex Knapp, *Apollo 11's 50th Anniversary: The Facts And Figures Behind The \$152 Billion Moon Landing*, FORBES (July 20, 2019), <https://www.forbes.com/sites/alexknapp/2019/07/20/apollo-11-facts-figures-business/?sh=6b12ea0e3377> [<https://perma.cc/HP53-TSRX>] (stating that a number of private companies worked on the construction of vessels used in the Apollo missions).

66. *Biden Administration Drafting Executive Order to Simplify Space Rules*, CNBC (Dec. 9, 2022), <https://www.cnbc.com/2022/12/09/biden-administration-drafting-executive-order-to-simplify-space-rules.html> [<https://perma.cc/4DKA-CLS5>].

67. *Id.*

68. Outer Space Treaty, *supra* note 47; Liability Convention, *supra* note 1 (establishing that non-government entities are still bound to follow the treaties because State Parties to the treaties are responsible for the actions of their private citizens in space, even though private actors engaging in space to the current extent were not fully contemplated at the time of writing).

outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities.”⁶⁹ Article VII in the Outer Space Treaty and Article I of the Liability Convention, hold a State liable for damage caused by a space object if the launch occurred in, or was procured by, the launching state.⁷⁰ Article II of the Liability Convention provides that the launching State is “absolutely” liable for damage caused by space objects on Earth or to aircraft in flight.⁷¹

The U.S. requires a license for all commercial launches and re-entries within its borders and for launches by U.S. entities abroad.⁷² The U.S. also lays out guidelines for when companies need to get third-party space liability insurance.⁷³ However, the government can pay up to \$1.5 billion over the amount of a licensee’s insurance towards successful third-party claims.⁷⁴ The risk of exposure to third-party claims is low and few claims are brought successfully, so insurance rates are much lower than most other liability insurances.⁷⁵ This probably reduces companies’ incentive to work to clean up space as they know collisions caused by their space objects are unlikely to have many legal or financial ramifications, especially collisions caused by debris or spacecraft that are no longer of any use. Additionally, smaller pieces of debris can be difficult or impossible to track,⁷⁶ so even with the current registration and extensive tracking systems in place, no one can enforce an absolute scheme of liability.

69. Outer Space Treaty, *supra* note 47, art. VI.

70. *Id.* at art. VII (holding the launching state liable for loss of or damage to property); Liability Convention, *supra* note 1, art. I.

71. Liability Convention, *supra* note 1, art. II.

72. See The Commercial Space Launch Act, 51 U.S.C. § 50904 (establishing the licensing requirements for launches and re-entries).

73. 14 C.F.R. § 400.7.

74. *Id.* at § 400.19.

75. AON RISK SOLUTIONS, INSURING SPACE ACTIVITIES 11 (2016), https://www.aon.com/russia/files/insuring_space_activities_whitepaper.pdf.

76. See NASA, *Space Debris and Human Spacecraft*, *supra* note 14.

B. Costs and Awareness

In 2017, an Italian space company, D-Orbit, had to resort to crowdfunding on Kickstarter for their satellite D-Sat, which was designed to remove itself from orbit in a quick and controlled way at the end of its mission.⁷⁷ The company only managed to get 166 backers and raise about half of its goal of \$25,913, and eventually D-Orbit funded the project itself.⁷⁸ Their failed attempt at crowdfunding is indicative of some of the challenges faced by people trying to solve the space debris problem. There is a lack of funding and general awareness of the issue,⁷⁹ which led to D-Orbit needing a Kickstarter campaign for D-Sat to begin with and eventually led to the campaign's failure. D-Orbit is just one example of a company struggling to find support to help clean up space. Space clean-up is expensive, underfunded, and might cause actors who try to clean up space to face liability for infringing on others' physical and intellectual property rights.

C. Property Rights

While space treaties recognize ownership of resources and objects taken to space, there is a lack of law covering intellectual property rights in space.⁸⁰ Despite this legal void, actors who remove another country's or company's property from space may be liable for infringing on another's physical and intellectual

77. D-Orbit, *D-Sat*, KICKSTARTER, <https://www.kickstarter.com/projects/433487168/d-sat> (last accessed Oct. 31, 2023).

78. *Id.*; see *D-Sat Space Debris Mitigation Mission Successfully Launched by D-Orbit*, SPACEREF (June 27, 2017), <https://spaceref.com/press-release/d-sat-space-debris-mitigation-mission-successfully-launched-by-d-orbit/> [<https://perma.cc/Z8H7-CDF7>].

79. See, e.g., John Csiszar, *How Space Junk is Going To Cost Us—Big Time*, YAHOO FINANCE (Apr. 6, 2021), <https://finance.yahoo.com/news/space-junk-going-cost-us-110052034.html> [<https://perma.cc/Q7VF-AQ7C>] (stating that the first autonomous mission ever developed to clean up space debris will not even launch until 2025 and cost \$118 million, a stark contrast to the \$10 million budget of the U.S. Office of Space Commerce).

80. Clark W. Lackert & Jonathan Goodwill, *Time to Address the Real-World IP Issues*, AM. BAR ASS'N (June 30, 2021), https://www.americanbar.org/groups/intellectual_property_law/publications/landslide-extra/outer-space.

property rights.⁸¹ This acts as an additional deterrent to cleaning up space debris. There is an increasing amount of collaboration and joint projects in space between the public and private sectors, which further complicates ownership issues.⁸² Even if actors in space were to begin cleaning up defunct spacecraft, other countries and companies may see it as infringing on both their physical and intellectual property rights. A country might lay claim to the physical materials used to build a spacecraft, and some aspect of the design of a spacecraft may be a closely held trade or state secret. Until there is a clear understanding of intellectual and physical property rights in space, such as when a space object is considered to be abandoned, actors who want to clean up space might be deterred from doing so due to a concern of opening themselves up to claims of property infringement.

IV. ANALYSIS

It is nearly impossible to enforce the compensation provisions of the Liability Convention because it is both difficult to identify the origin of space debris and challenging to prove a party's fault in a collision. Alongside this problem are several others that deter both countries and corporations from making efforts to clean up space junk, both in orbit and on Earth's surface. Under the current system, each state or private actor in space must bear the burden of their losses in most situations, no matter the actual fault.

It is important to create a legal framework that allocates responsibility and creates a duty or incentive for spacefaring actors to manage defunct spacecraft and other man-made space junk. When space junk crashes down into the earth, it can land in locations that are in regular use. Having large pieces of metal lying around that cannot or will not be removed until the owner authorizes clean-up is an inconvenience for many people all over the world. It is important to create a framework of liability that still allows governments and people enough flexibility to be able

81. *Id.* (noting the need for new space legal schemes because the existing space agreements are inadequate to govern some modern issues in space).

82. *Id.*

to resolve these issues on Earth. Without such a framework, both people and governments are hindered; they cannot clean away space junk without incurring large costs or potentially risking legal liability for infringing on someone else's property rights.

The Outer Space Treaty was initially designed to prevent the possibility of space militarization and appropriation of celestial bodies, both concerns that loomed large in the Space Race during the Cold War.⁸³ While it is a thorough piece of legislation that has been ratified by every major spacefaring nation on Earth, it did not envision or encompass in its terms the diversification of actors that would one day venture forth into space. Both the Outer Space Treaty and the subsequent Liability Convention are mostly limited in scope to the actions of States themselves. Space has long been treated similarly to international waters or shared lands like Antarctica, resulting in a legal framework to govern space that is analogous to many maritime laws.⁸⁴ There are many problems with space crowding due to space junk and defunct spacecraft being left to deteriorate in space. Looking to different approaches to how abandoned ships are treated in international maritime law could assist in building a framework for how space clean-up can be allocated or incentivized. Any proposed solutions need to consider the costs of decluttering space, ways to incentivize both governments and private actors to engage, and ways to minimize actors' liability when engaging in space clean-up.

A. *The Maritime Law of Salvage*

No one country can have full control over either seas or space, so both are mainly governed by international treaties.⁸⁵ The maritime law of salvage governs the successful recovery of

83. Samuel Stockwell, *Legal 'Black Holes' in Outer Space: The Regulation of Private Space Companies*, E-INT'L RELATIONS (July 12, 2020), <https://www.e-ir.info/2020/07/20/legal-black-holes-in-outer-space-the-regulation-of-private-space-companies/> [https://perma.cc/L7DE-5R2W].

84. Rachel Rogers, *The Sea of the Universe: How Maritime Law's Limitation on Liability Gets It Right, and Why Space Law Should Follow by Example*, 26 IND. J. GLOB. LEGAL STUD. 741, 751, 759 (2019).

85. See Pannell, *supra* note 13, at 743–44.

property lost at sea or of property and ships in peril at sea.⁸⁶ Under this law, a person or entity who rescues property or ships (a "salvor") is entitled to a reward for the rescue.⁸⁷ Since its inception, the law of salvage has been expanded to reward salvors who successfully act to prevent or reduce harm to the environment from a ship or its cargo; for example, minimizing the damage from oil spills.⁸⁸ This is referred to as environmental salvage.⁸⁹

Space law similarly expresses concerns about the impact of space activity on the environment. Article IX of the Outer Space Treaty requires State signatories to the treaty to pursue outer space activities in a manner that avoids any harmful contamination or adverse environmental changes on Earth.⁹⁰ This may be one reason why many scholars have attempted to analogize the law of salvage to space to advocate for the creation of a similar framework for cleaning up orbital debris.⁹¹ However, a comparison of maritime salvage and space junk shows that they are not entirely analogous. Cleaning up space is not something that should be done only when a specific spacecraft is in peril. In a perilous situation in space, it is unlikely that a second party would be able to act to prevent harm. Space debris is often difficult to trace back to a specific country or company, which removes the salvor's incentive to clean up because they are unlikely to be able to recover any reward. It is also difficult to define when an object is a danger to others in space because it has been noted that every object in orbit is a threat to others in orbit, regardless of its intended function.⁹² Although the two

86. International Convention on Salvage, Apr. 28, 1989, 1953 U.N.T.S. 165.

87. Sandra Drago, *No Man's Sky: Utilizing Maritime Law to Address the Need for Space Debris Removal Technology*, 59 SANTA CLARA L. REV. 389, 418 (2019).

88. *Id.* at 419.

89. *Id.* at 418–19 (noting that salvage actions done to minimize harmful environmental impacts are taken into account for reward purposes).

90. Outer Space Treaty, *supra* note 47, art. IX.

91. See, e.g., Drago, *supra* note 87, at 418 (noting the influence maritime law has had on space law due to their similarities); Hamilton DeSaussure, *Maritime and Space Law - Comparisons and Contrasts (An Oceanic View of Space Transport)*, 9 J. SPACE L. 93, 102–03 (1981).

92. Stockwell, *supra* note 83.

environments seem similar at first glance, the law of salvage does not provide enough guidance on how to create a framework for managing space debris.⁹³ Simply adding provisions similar to the law of salvage to the current laws on space debris would be inadequate to solve the problem.

B. Abandoned Ships

While the law of salvage covers ships and cargo that are in peril or posing a danger to the environment, it does not address vessels that have been sunk or abandoned entirely.⁹⁴ Many countries around the world have tried to fill this gap by using unique approaches to address what to do with abandoned ships. When some of these approaches are applied to space, they provide a potential framework for how to deal with the problem of space debris.

1. Holding States Responsible for Preserving Historically Important Space Objects

The Abandoned Shipwrecks Act of 1987 (ASA) is a U.S. law that Congress passed to recognize the historical significance of shipwrecks found at sea.⁹⁵ Under this Act, the U.S. claims ownership over certain abandoned shipwrecks and then transfers the title to the state whose waters the shipwreck is in.⁹⁶ One of the purposes of the ASA was to make states responsible for protecting these shipwrecks and maintaining public access to them.⁹⁷ The ASA was also meant to make states “develop appropriate and consistent policies so as to . . . allow for appropriate public and private sector recovery of shipwrecks

93. National Space Society, *Space Debris Removal, Salvage, and Use: Maritime Lessons*, 1–2, 5 (Oct. 2019), <https://space.nss.org/wp-content/uploads/NSS-Position-Paper-Space-Debris-Removal-2019>.

94. International Convention on Salvage, *supra* note 86, at art. I (defining salvage operations, vessels, and property, all of which do not discuss completely abandoned vessels).

95. Abandoned Shipwrecks Act of 1987, 43 U.S.C. §§ 2101–2106.

96. *Id.* at § 2105(a).

97. *Id.* at § 2103(a).

consistent with the protection of historical values and environmental integrity of the shipwrecks and the sites.”⁹⁸ This recovery provision could be useful when applied to countries with objects in space because it could create a duty for them to recover their historic or important objects, for the preservation of both the objects themselves and orbits around Earth. However, such a law would be limited only to those spacecraft with some “historic” significance,⁹⁹ and so would require a definition of what would qualify. Additionally, because of the narrow scope of this law, it could exclude many deteriorating objects in space that are not considered to have “historic” significance and hundreds of thousands of pieces of debris. A law based on the ASA would be too limited to be effective in space because the duty to remove space objects would not extend far enough to mitigate or correct the increasing space junk problem.

2. Giving States Absolute Ownership Over Abandoned Vessels

Spain has a law that allows its government to gain ownership over abandoned or sunken Spanish vessels after a set amount of time, even if they are not located in Spanish waters.¹⁰⁰ This law has gotten some criticism for conflicting with other countries’ laws about ships sunk in their waters.¹⁰¹ Nevertheless, Spain’s absolute ownership approach presents an interesting framework for space. The Spanish approach would give ownership over all spacecraft to the launching country’s government. This would put the responsibility for all space junk and crashes on individual governments, whether the original owner was a national or a private entity. Liabilities in crashes would become completely

98. *Id.*

99. *See, e.g., id.* at § 2104(a) (noting the encouragement of managing underwater resources related to historic shipwrecks).

100. Maritime Navigation Act of 2014, art. 374 (Spain).

101. *See, e.g.,* José Manuel Martín Osante, *Spanish Maritime Navigation Law: Some Territorial Questions*, 9 J. OF TERRITORIAL AND MAR. STUD. 1, 34, 41 (2022), <https://www.jstor.org/stable/48684178>; Victor L. Gutiérrez Castillo & Juan J. García Blesa, *Critical Analysis of the Law 14/2014 on Maritime Navigation*, 18 SPANISH Y.B. OF INT’L L. 293, 293 (2013–14), <https://sybil.tirant.com/sybil/article/view/1511/1517>.

clear regarding who should bear responsibility and who should recover. It would also be clear which country's responsibility it would be to clean up debris that is large enough to be tracked, both in space and when it crashes on Earth. This would increase nations' liability for private actors and incentivize governments to either pass laws requiring private entities to clean up defunct spacecraft or engage in broad clean-up themselves. This would also incentivize countries to pass laws to require private actors to have clean-up plans before they are allowed to launch space vessels because each country would be liable for all crashes caused by privately owned and operated spacecraft.

Nevertheless, this approach does have its disadvantages. First, it may disincentivize private actors from going into space because they would want to retain ownership over their spacecraft, and it could be unclear when ownership would switch from a private actor to the country of launch. It would also create ownership issues in situations where multiple countries or companies want to work together on a space project. This would not be an entirely new situation, because ownership and liability in the International Space Station is divided up by which module astronauts happen to be in. For example, when astronauts are in American modules, American law applies; when in Russian modules, Russian law controls, and so forth.¹⁰² Countries are already using this kind of divided liability approach in space,¹⁰³ and this approach would extend each country's responsibility to all spacecraft launched from their land. However, countries might hesitate to allow international projects to launch from their soil because they would have to bear sole responsibility for any eventual clean-up or deorbiting regardless of any international partners participating in the launch. A more flexible approach might be necessary in the interests of not chilling interest and collaboration in space exploration and development.

102. *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/M94G-KMYC] (last visited March 5, 2023).

103. *Id.*

3. A Holistic Approach to When a Vessel Becomes “Abandoned”

Courts in Norway and Australia have held that shipwrecks and their cargo could be considered abandoned if no attempt is made to salvage them after a certain amount of time, while other factors were also relevant in the determination.¹⁰⁴ These cases represent a more holistic approach to determining whether a ship should be considered abandoned, also taking into account the length of time and the status of the original owner. If the Norwegian and Australian approach to abandoned ships was applied to space, spacecraft that are left to deteriorate for a similar amount of time could be considered to be abandoned. Once this happens, any actor—governmental or private—would be free to remove these spacecraft and reuse or repurpose any physical materials or technological aspects of the design. This would increase the incentive for third parties to remove materials from space without fear of facing liability for trespasses to physical or intellectual property. This might not serve as enough of an incentive, however, because there are still considerable costs that need to be borne when removing any object from space,¹⁰⁵ and potential actors might not consider the reward worth the investment.

There is also the chance that spacefaring companies and nations might be opposed to this idea. Companies and countries put a lot of time, effort, and investment into creating the technology that goes into space and maintaining it while it is in use.¹⁰⁶ If anyone were able to take the materials and ideas that went into a company or country’s technology, that could act as a

104. Sarah Dromgoole, *Law and the Underwater Cultural Heritage: A Legal Framework for the Protection of the Underwater Cultural Heritage of the United Kingdom*, 15–16 (Apr. 1993) (Ph.D. thesis, University of Southampton Law School); see also *Robinson v. Western Australian Museum* (1977) 138 CLR 283, 289–90 (Austl.).

105. See, e.g., Csiszar, *supra* note 79 (noting the costs associated with space launches and satellites).

106. See, e.g., Gene Gregory, *Is the Space Effort a Waste of Money?*, UNESCO (Apr. 20, 2023), <https://courier.unesco.org/en/articles/space-effort-waste-money> [<https://perma.cc/Q2VY-2U62>] (noting the millions of dollars that have been spent for space activities and how this investment continues to positively impact people on earth).

deterrent to investing in space because people would be able to benefit from others' investments without contributing anything to the development of these technologies. This could also be a hindrance to smaller companies or actors who want to go into space but are unable to afford the maintenance costs or a deorbiting plan for their spacecraft. People might think twice about venturing into space when there is a very real possibility of losing the rights to their materials and intellectual property through abandonment. Furthermore, without concrete guidelines for when a vessel is considered abandoned, a rule based on these lines might lead to considerable litigation from companies or governments arguing that they had not relinquished ownership over their vessels. The flexibility of a holistic approach could lead to such problems because of the indefiniteness of the law and might still fail to address the space junk issue.

4. When Vessels Obstruct Navigable Channels

U.S. federal law does not allow anyone to sink vessels or other craft in navigable channels under the Federal Rivers and Harbors Act.¹⁰⁷ This rule applies whether the sinking is on purpose or not.¹⁰⁸ Once a vessel is sunk in navigable waters, an owner having knowledge of the sinking has a duty of reasonable care to avoid injury to others from a collision with that vessel.¹⁰⁹ Reasonableness is determined based on the imminence of the danger and the means available to the owner and its employees.¹¹⁰

If the owner fails to remove the vessel, it is considered abandoned and subject to removal by the U.S.¹¹¹ That does not mean that an owner has no further responsibility or liability; they may face criminal penalties¹¹² or civil liability for the unrecovered

107. 33 U.S.C. § 409.

108. *Id.*

109. *In re Berwind-White Coal Min. Co.*, 80 F. Supp. 125, 131-32 (S.D. N.Y. 1948) (noting a reasonableness standard to avoid harming others in the event of maritime collisions and potential recourse for not taking action to assist the situation).

110. *Id.* at 130.

111. 33 U.S.C. § 409.

112. 33 U.S.C. § 411.

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benevolent actors, and it becomes clear who is liable in cases where the proper procedures are not followed.

The abandoned ship doctrines, covered in the analysis section, each present a unique approach to solving the problem of orbital debris and space cluttering. While Spain's approach of absolute national ownership creates a framework that would be clear to follow, it would probably face backlash from private entities and discourage innovation in the space industry. The more tailored Norwegian and Australian approaches allow for each situation to be considered on a case-by-case basis. However, there is a lack of clarity on when ownership is relinquished, and it therefore becomes permissible to remove someone else's property from space. This creates a potential for litigation and therefore discourages the actual act of clean-up until there is no danger of facing a lawsuit, during which time objects in space will continue to deteriorate and create more debris. This solution does not create the kind of urgency that is necessary when dealing with space junk.

The maritime law that is best applied to space is the U.S. law on the obstruction of navigable waters. This law would create a duty for private actors and governments to clean up their messes, and they would not be absolved of responsibility in the case where they fail to act. If someone does fail to act, another can step in without the worry of being unable to recoup their losses against the original owner. Also, the knowledge of the duty to remove one's own space objects would motivate actors to create deorbiting solutions preemptively and not have to be financially liable to another in the future. The only flaw is that this does not provide a financial reason to clean up smaller pieces of debris that cannot be traced to a single source, but it can be hoped that many space clean-up activities will capture pieces of smaller debris incidentally.

The application of maritime law to space is something that has been done successfully in many instances in the past, and different countries' approaches offer solutions that have been tried and tested in a real-world context already. Applying the U.S. law on the obstruction of navigable waters to space creates a feasible legal framework that addresses all the major issues preventing countries and private actors from engaging in

clean-up efforts. As such, it provides a logical foundation for an international agreement on the management of orbital debris.

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By Rida J. Sarwar

James W. Skelton, Jr. Award: Outstanding Comment in International Human Rights Law

POSTPARTUM CLUES IN DEVELOPING COUNTRIES: HOW
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GOES BEYOND THE WORLD HEALTH ORGANIZATION'S
RECOMMENDATIONS TO COMBAT POSTNATAL DEPRESSION

By Victoria Porter

Stephen T. Zamora Award: Outstanding Comment in International Trade

NEARSHORING TO MEXICO: HOW THE NEARSHORING TREND
MIGHT SHAPE THE FUTURE OF THE U.S.M.C.A.

By Ashanty De Luna