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Governing Mass Harm in the Space Commons: the Role of Collective Redress

RESEARCH ARTICLES

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ABSTRACT

Having been described as the province of humankind, outer space is regarded by many as one of the global commons, making its use a subject of the collective interests of all States and humanity at large. Scholars have examined various aspects of space commons governance, such as non-appropriation, freedom of access, and resource extraction and utilization. Yet commons scholarship has paid relatively little attention to the governance of mass harm risk from space activities. As space activities become more frequent and increasingly complex, there is a growing likelihood that a single launch failure, reentry incident, or other irresponsible conducts may generate numerous related claims across multiple parties. The authors argue that the existing legal framework governing space disputes neither help to mitigate the risk of such mass harm incidents, nor provide accessible dispute settlement to private litigants. The authors then examine the potential for collective redress to complement existing space commons regulatory and judicial frameworks by reducing barriers to recovery, addressing power imbalances between private parties and dominant space actors, and creating incentives for space enterprises to adopt responsible practices and higher safety standards. In doing so, the authors argue that collective redress may provide both an ex ante preventative function and an ex post remedial function in the governance of mass harm in the space commons. Finally, the authors also consider the practical challenges of implementing collective redress in the space context and identify corresponding policy recommendations.

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1. INTRODUCTION

The 21st-century space sector has undergone a NewSpace transition, characterized by soaring private investments and ventures (Stotler, 2017, pp. 2–3). This paradigm shift has transformed outer space from a domain traditionally organized by States into an open arena for diverse participants. While it opens exciting economic opportunities (WEF, 2024), the proliferation of private space activities pushes an already crowded orbit closer to a tipping point for potentially disastrous accidents (Nomura et al., 2024), making space safety a legitimate concern.

Among the most serious consequences is the heightened risk of mass harm events. These are instances when a single incident such as collision between space objects or uncontrolled reentry of debris affects a large number of parties, generating myriad claims against the wrongdoer (Tomas & Rijnhout, 2024, p. 4). In such cases, a single space participant's misconduct can quickly escalate into widespread harm against other participants in the now densely populated orbital environment, causing not just isolated losses but damage to the common interest in the use of space. Under this backdrop, developing frameworks capable of preventing and addressing space-related mass harm becomes an urgent agenda in the NewSpace era.

In their work, Janssen and Yap (2024, p. 33) conceptualized NewSpace development as humanity's shared project, as it involved both actors capable of shaping future global conditions and others vulnerable to the adverse consequences. Plenty of space commons scholarships have engaged with the first half of this dichotomy, noting the need for those actively conducting space activities to approach issues such as non-appropriation, free access, and resource sharing as a collective (Feen, 2026; Roe, 2023; Neto, 2021). Less attention was paid to the other half concerning how the mitigation of NewSpace's negative externalities, including mass harm risk, could proceed within a commons governance framework. While some legal scholars have called for a space dispute settlement reform (Zhang, 2025; Zielinski, 2022; Kim, 2021; Rojas García, 2019), their proposals are often tailored to bilateral commercial disputes or single-event damage cases, lacking both a collective focus and a solution to mass harm. Traditional dispute settlement regimes are also ex post centric, dealing primarily with the allocation of responsibility. These research do not consider the preventative function of dispute settlement regime. To fill this gap, the authors examine the potential for collective redress to form part of a broader collective governance agenda toward mass harm in the space commons.

This article proceeds in three parts. First, it demonstrates that existing space dispute settlement mechanisms fail to provide accessible dispute settlement for private parties. Then, it introduces collective redress as a governance tool for space-related mass harm and explains its function in terms of both ex ante regulation and ex post remedy. Finally, it examines the practical challenges of implementing collective redress mechanisms and offers corresponding policy recommendations.

2. THE ACESSIBILITY CRISIS

Effective governance of global commons requires mechanisms that enable participants to obtain effective remedies when they suffer from harm inflicted by others. Yet private parties continue to face substantial obstacles in pursuing space-related claims. As Zhang (2025) observed, an archaic, State-oriented dispute settlement regime continues to limit private parties' access to judicial recourse in space disputes. This Section evaluates the principal shortcomings of existing space dispute settlement frameworks under both international and domestic law to explain why they remain ill-equipped to address space-related mass harm.

2.1 THE STATE-ORIENTED INTERNATIONAL DISPUTE SETTLEMENT FRAMEWORK

The dispute settlement framework under international space law is governed by the 1967 Outer Space Treaty (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 610 UNTS 205, 1967, hereinafter referred to as OST) and the 1971 Liability Convention (Convention on the International Liability for Damage Caused by Space Objects, 961 UNTS 187, 1972, hereinafter referred to as LIAB). Specifically, OST makes States both responsible for their national and private space activities and liable for damage caused by their space objects (OST, Arts. VI–VII). LIAB operationalizes these provisions by setting out a set of inter-State dispute settlement procedures. Under these procedures, the claimant State must first pursue diplomatic negotiations and, failing resolution, may submit the dispute to a Claims Commission (LIAB, Arts. IX, XIV). States could also submit certain space disputes to the International Court of Justice when an obligation set out in the OST has been breached (OST, Art. III; Byers & Simon-Butler, 2023).

It is observed that OST sets out a 'State-oriented' system of responsibility by making States solely liable under international law (Masson-Zwaan & Freeland, 2010, p. 1604). Accordingly, the dispute settlement framework as an extension of this system is also State-oriented, allowing only States to participate in legal actions. As shown below, this

design is potentially prejudicial for two reasons. First, it pits private access to remedy against States' extrinsic political considerations. Second, it deprives from private parties meaningful control over the dispute settlement process.

2.1.1. State Espousal as a Political Prerogative

States have a right to exercise diplomatic protection. This can be done by espousing their nationals' claim against another State when the latter has committed a wrongful conduct (ILC, 2006). Yet States rarely exercise this right due to its political implications (Bettauer, 2019).

As Andrew Coleman (2003, p. 32) explains, 'all international disputes will inevitably be 'political' in nature; what varies is merely the degree of political volatility.' In his view, States' willingness to pursue any international claim depends on various extrinsic factors such as external economic pressures, domestic needs, and even national pride. In practice, diplomatic consideration is a significant factor. For example, the US Department of State would generally only espouse a claim when the perceived legitimacy of the injured party's interests outweighs the negative foreign policy implications of pursuing international legal action (Hill & Lucas, 1973, p. 103).

2.1.2. State Exclusivity in Espoused Claims

When a State has decided in favor of espousal, it immediately assumes exclusive control over the claim. This entails, first, that the private claim is subsumed into the State's claim and is extinguished for all practical purposes; second, that the State acts in its sovereign capacity as an independent claimant, rather than as a trustee or agent of its nationals; third, that the State enjoys full discretion to settle or withdraw at any time; and fourth, that the State bears no legal obligation to distribute any compensation received (Hill & Lucas, 1973, p. 105).

2.1.3. Consequence of State-oriented Dispute Settlement

The significant strategic and diplomatic sensitivity associated with space activities means that States may not consistently observe the OST and LIAB standards in disputes affecting private interests. As Kehrer (2019, pp. 214–215) noted, antagonistic States are likely reluctant to engage in good-faith negotiations, while allied States may prefer more conciliatory and diplomatic arrangements. In either scenarios, private parties are left with little assurance for full recovery.

The first scenario occurred in the aftermath of the Cosmos 954 incident. On 24 January 1978, the Soviet nuclear-powered satellite disintegrated and scattered radioactive debris along a 600-kilometer belt through the Canadian Northwest Territories (Dembling, 1978). Canada initially sought C$6,041,174.70 from the USSR under Article II of LIAB, representing less than half of its C$14 million clean up expenditure. Yet Canadian officials eventually agreed to settle for just C$3 million, having concluded that any demand higher would be rejected. The USSR's resistance toward full indemnification can be partly explained by Canada's refusal of its clean up offer. Driven by security and foreign-relations considerations, the latter instead turned to the US for debris recovery and clean up (Cohen, 1984). This settlement thus reflects Canada's willingness to compromise economic interests in order to appease its ally. Had private losses arisen from this incident, victims would likely have received only a fraction of their losses due to Canada's politics-first approach.

The second scenario is best illustrated by the large portion of space partnerships between States relying on cross-waiver clauses to attribute liability, rather than sticking to the OST formula (Ziemblicki & Oralova, 2021, p. 7). These clauses apply to compensation claims between cooperating parties for losses arising from activities conducted under the agreement and are often broadly framed to exclude claims made under the LIAB procedures (Zhao, 2016, p. 16). While some recent multilateral initiatives such as the Artemis Accords and the International Lunar Research Station project lack explicit cross-waiver provisions, the close diplomatic ties among partner States make it doubtful that they would closely observe the OST and LIAB standards should any dispute actually occur.

Taken together, the high political volatility of inter-State space dispute settlement and States' extensive control in this process render private access to dispute settlement under international law highly uncertain, if not nearly impossible.

2.2 THE INCONVENIENT DOMESTIC DISPUTE SETTLEMENT FRAMEWORK

LIAB expressly permits private parties to bring their space disputes to domestic courts or administrative tribunals (LIAB, Art. XI(2)). However, in doing so, they will likely confront a range of procedural and substantive impediments that render dispute settlement 'messy, expensive, and unpredictable' (Ziemblicki & Oralova, 2021, p. 7). The sub-sections below highlight procedural and substantive impediments in domestic space litigation.

2.2.1. Procedural Impediments

In international tort lawsuits, conventional choice of court rule generally adopts a plaintiff-oriented approach, granting victims the logistical benefit of litigating where the tort or injury occurred, which is often their home forum. However, the extraterritorial nature of space activities adds complexity to applying this principle. For example,

where a foreign third party causes injury in space, the plaintiff may struggle to establish domestic jurisdiction if they cannot sufficiently demonstrate continuous and systematic contacts between their own jurisdiction and the defendant's space activity (Abrams, 2014, p. 818). The absence of clear and universally accepted choice of court rules also means that courts may ultimately weigh factors such as the location of the harm, the nationality of the parties, and registration of the space object to decide where the case should be litigated (Li, 2021, p. 731). This case-specific and potentially arbitrary approach unduly burdens the plaintiff, who must establish jurisdiction before the merit of the case is heard.

In cases involving ground-based injury, conventional choice of court rules would almost invariably direct the matter to the plaintiff's home court. Yet a defendant could contest its application by invoking Article XI(2) of LIAB:

> A State shall not . . . be entitled to present a claim under this Convention in respect of the same damage for which a claim is being pursued ***in the courts or administrative tribunals or agencies of a launching State*** . . . .

By expressly referring to 'the courts … of the launching States,' States appear to agree that private claims must be pursued exclusively in launching States. This was a logical approach when LIAB was signed, since it was inconceivable for national space agencies to attend a foreign hearing. Yet in the NewSpace era, this outdated rule could allow private enterprises to force victims to litigate in a foreign court.

Another consequential procedural impediment stems from the unreliable space object registration regime. Under the 1976 Registration Convention (The Convention on Registration of Objects Launched into Outer Space, 1023 UNTS 15, 1974, hereinafter referred to as RC), launching States are required to register space objects both domestically at its own registry and internationally with the UN Office for Outer Space Affairs (UNOOSA). These practices, in theory, make ownership tracing fairly straightforward for space objects. Though in practice, significant deficiencies persist.

To start, some objects were never registered, as some States simply never complied with their RC obligation to establish a national registry (Lyall & Larsen, 2017, p. 79). This problem is further exacerbated by the increasing practice of in-orbit ownership transfers, which are often not notified to national space agencies or UNOOSA in a timely manner (von der Dunk, 2017). Consequently, the registries frequently fail to reflect current ownership, undermining their primary function of attributing control and responsibility (Lyall & Larsen, 2017, p. 89).

This situation is particularly problematic in the context of space torts, since no infringement claim can be brought if the alleged wrongdoer cannot be identified (Limperis, 1998, p. 331). If identification through the registries fails, plaintiff may end up being forced to expend considerable time and resources tracing real ownership through alternative means; failing which, meaningful legal recourse could become unattainable. These monetary and evidentiary burdens are further compounded in cases involving space debris, where attribution of responsibility may necessitate the use of advanced situational awareness technology (Nelson, 2015–2016, p. 123; Limperis, 1998, pp. 330–331).

2.2.2. Substantive Impediments

A prime example of substantive impediments in domestic space litigation is private law's lack of clear liability standard for space-related harm. LIAB makes launching States liable for ground-based and air-based damage arising from their space activities regardless of whether they are at fault, while making States liable for damage in space only if they are at fault (LIAB, Arts. II–III). Yet, as elaborated below, these standards may not be directly applicable to private parties, leaving open the question of how private liability should be assessed.

First, since Article II of LIAB addresses only State liability, private plaintiffs cannot directly benefit from its favorable standard. Instead, they must rely on analogous provisions in domestic space law, should they exist, or argue that the defendant's conduct falls within an existing category of torts holding defendants liable regardless of fault, such as those governing ultrahazardous activities. Many legal scholars favor the idea of characterizing all space activities as ultrahazardous to reflect their technological complexity and potentially catastrophic consequences (Hobe, 2019, pp. 82–83). Yet this position lacks firm support in the written law. And as space activities become increasingly routine, lawmakers and courts may be reluctant to take a categorical approach across the entire sector.

Second, the fault-based liability standard under Article III of LIAB is also unworkable in private disputes, as scholars have yet to reach consensus on what it precisely entails (Lampertius, 1992; Dennerley, 2018). One view suggests that international soft law could help refine the parameters of responsible practice in space, thereby providing some clarity to the requisite level of fault in holding the defendant liable (Dennerley, 2018, pp. 299–301). However, like LIAB, international soft law is predominantly State-oriented and can only become effective in domestic settings through subsequent

implementation. The reality is that space-related soft laws often achieve very limited levels of implementation among States (Burger, 2025, p. 7584), making it difficult to see a world where their intended best practices become binding domestic standards in short terms.

As it stands, though private parties could technically resolve space disputes in domestic courts, private litigation is likely a complex and drawn-out process in which plaintiffs must work their way through both procedural and substantive legal ambiguities. These barriers are especially concerning in the context of mass harms in space, risking to leave affected parties without a clear path to pursue their claims and widespread losses unremedied.

3. RATIONALIZING COLLECTIVE REDRESS

This Section explores the implementation of collective redress as a potential tool to manage space-related mass harm risks. It begins with a brief introduction of the concept, then considers the archetypal scenarios where collective redress can be useful, before evaluating the benefits of collective redress implementation.

3.1 WHAT IS COLLECTIVE REDRESS?

In different jurisdictions, collective redress has been termed class action, group action, or mass litigation. Labeling aside, it generally refers to the aggregate adjudication of multiple individual claims. For example, it may allow the judgment and reasoning in a lead case to apply in subsequent related claims (Hodges, 2021, p. 30). Alternatively, it may authorize a representative to litigate on behalf of a defined class (Molavi 2021, pp. 10–11). At present, at least 38 jurisdictions worldwide have adopted some form of collective redress, including 21 of the 25 largest economies (Hensler, 2017, pp. 966–967).

The popularization of collective redress is underpinned by a commitment to democratize access to justice. In mass harm cases, pursuing individual claims against well-resourced corporate opponents often feels 'impractical or irrational' due to financial burden and mental stress, even when the claims are otherwise well-founded (Molavi, 2021, p. 2). Collective redress levels the playing field by both reducing individual litigation costs and alleviating the sense of isolation and intimidation inherent in facing powerful defendants (Galanter, 1974, pp. 97–98).

3.2 ARCHETYPAL COLLECTIVE REDRESS SCENARIOS

On the afternoon of 16 January 2025, residents across the Caribbean looked up only to witness fiery streaks crossing the sky as debris from SpaceX's failed Starship test flight reentered the atmosphere. For those on the ground and across the internet, this was perhaps what Elon Musk described as 'guaranteed entertainment.' Yet for those caught in the airspace, there was nothing entertaining about the ordeal. The incident prompted 20+ commercial flights to make sharp turns to avoid the fulling debris. Subsequent airspace restriction led to further diversions and operational disruption, making hundreds of pilots and passengers unwitting participants in SpaceX's test (Propublica, 2026). Less than two months later, another Starship rocket exploded during launch, this time disrupting about 240 flights (Reuters, 2025). Similar disruptions have followed other re-entry incidents, including the often discussed Long March 5B incident in 2022. When the Chinese rocket reentered over the Pacific, it caused more than 600 flight delays, imposing heavy involuntary logistical costs on airlines and passengers (Wright et al., 2025). Although failed launches have yet to cause direct physical damage, the increasing launch frequency will drive up the likelihood of a catastrophic collision between an aircraft and reentering space debris (Hook et al., 2024). Even without a direct collision, disruption from forced airspace restrictions can impose substantial costs on airlines, passengers, airports, and insurers due to delays, rerouting, and missed connections (Emanuelli & Lips, 2015). These circumstances justify collective redress, as affected passengers and airlines share a common cause for their claims while often suffering losses too modest to motivate individual litigation (Hook et al., 2024).

A similar category of mass harm risk arises from the proliferation of satellite mega-constellations. Since 2019, the number of satellites operating at the low Earth orbit (LEO) has dramatically increased as mega-constellation operators like SpaceX and Amazon began launching in batches. Most of these LEO satellites were designed to de-orbit at the end of their five to six-year operational lives (Boley & Byers, 2021). Since these reentries are often uncontrolled and difficult to track with accuracy, they pose significant casualty risk and other risks such as property damage by scattering surviving debris over a random area along the satellite's orbit (Wright et al., 2026; Pardini & Anselmo, 2025). Historically, the above-mentioned Cosmos 954 incident demonstrated that uncontrolled reentries can affect extensive geographical areas. While that particular incident left nobody injured, having affected only sparsely populated territory, a similar incident could affect densely populated areas in the future and generate widespread personal injury, property damage, and disruption to businesses (FAA, 2023, p. 8). This alternative scenario transforms what was otherwise an isolated claim into numerous related claims arising from a common cause.

Another foreseeable category of claims could emerge as commercial spaceflight and space tourism continue to expand (Lindbergh, 2025). Unlike civil aviation, operator liability in space flights are not governed by any existing regime like the Montreal Convention. LIAB may not be applicable either, since passengers could be considered participants of the space operation who are not protected by LIAB (McCue, 2022, p. 1100). Therefore, passengers may have to resort to class action lawsuit after an accident for claims involving physical injury, emotional distress, loss of enjoyment, or other forms of pecuniary losses during flight. In the conventional tourism sector, such claims have been filed in collective proceedings to address harms suffered by passengers in cruise trips (Davies, 2020).

Finally, collective redress may also play an important role in addressing harm to common resources both on Earth and in outer space. Such community-based interests are not easily addressed through traditional bilateral litigation, calling instead for some form of representative action. For example, debris-generating operations and microbiological testing in space are widely regarded as abnormally dangerous activities putting the everyone's future use of space at risk (Baker, 1989, p. 85; McGarrigle, 1985, pp. 129–131). Concerns have also been raised regarding mega-constellations' adverse impact on astronomical observation and upper atmospheric composition (Koplow, 2024, pp. 267–268; Barker et al., 2026).

3.3 THE BENEFITS OF OUTER SPACE COLLECTIVE REDRESS

3.3.1. Enhancing Legal Certainty in Space

The legal uncertainty surrounding space disputes not only restricts judicial access by inflating the perceived costs and complexity of litigation, but also risk creating legal fragmentation by forcing similarly situated plaintiffs to pursue their claims in disparate forums.

The OST affirms in its Preamble that international cooperation and the rule of law are essential to humanity's endeavors in space. Consistent with this spirit, legal capacity-building and harmonization have long been identified as priorities for inclusive and sustainable governance of the space sector (Masson-Zwaan, 2019; von der Dunk, 2006; Jakhu, 2009). This equitable and cooperative vision is undermined when similarly situated parties are treated differently by inconsistent domestic space law across jurisdictions.

Collective redress enables courts to resolve common factual and legal issues in a centralized manner, reducing incidence of parallel proceedings and minimizing the risk of inconsistent rulings (Boster, 2017, pp. 162–163). Moreover, while decisions in one jurisdiction are not automatically binding elsewhere, high-profile collective actions can attract international attention. Well-reasoned judgments in such cases can thus promote private space law harmonization by influencing academic commentary, judicial reasoning, and policy development beyond their home jurisdictions.

3.3.2. Leveraging the Strength in Number

Defendants in mass-harm cases can invest resources far exceeding the value of any single claim, taking advantage of economies of scale by reusing the same arguments and supporting evidence. This makes litigation economically viable even in low-stakes disputes. In contrasts, plaintiffs must build their cases independently, making it much more difficult to justify the cost of litigation when potential recovery is insignificant. This structural asymmetry gives the defendant greater bargaining leverage in the dispute settlement process (Molavi, 2021, pp. 92–95; Bone, 2021, pp. 8–9), an imbalance that becomes especially acute when the parties' financial capacities are vastly disproportionate to begin with. When the outcomes of space disputes are dictated by the starkly asymmetric positions between plaintiffs and defendants, they eroding public confidence in the fairness and legitimacy of space jurisprudence.

Collective redress can play a corrective role by distributing the costs and risk of litigation across the plaintiff group, thereby allowing them to benefit from economies of scale comparable to the defendant (Molavi, 2021, p. 96; Bone, 2021, p. 9). Aggregation may also produce high-volume claims more attractive to litigation funders (Molavi, 2021, pp. 105–117). These advantages are particularly relevant in inherently complex space disputes that require substantial expenditures on the procurement of evidence and expert opinion. Through aggregation, collective redress makes dispute settlement in space-related cases more affordable.

3.3.3. Preventing Risk through Collective Redress

While collective redress is more commonly understood as an enabler of ex post remedy, its role in commons governance goes beyond conflict resolution, providing risk prevention function where formal regulation is ineffective or insufficient. Collective redress becomes an ex ante regulatory tool when it enables effective public oversight in two key ways. First, it empowers the public to impose tangible pecuniary consequences on harmful conduct. Second, it allows the public to address statutory and regulatory gaps that risk future harm.

Regarding the first point, the mere availability of collective redress can compel corporate actors to exercise greater precaution when conducting activities that carry the risk of widespread harm. The prospect of substantial financial liability and reputational fallout from high-value, high-profile collective actions can steer corporations toward responsible operation and proactive assumption

of accountability (Bone, 2021, p. 12; Sugerman, 2023, pp. 988–991). The aggregation of individual claims operates, in the words of the US Supreme Court (1980, p. 339), as 'an evolutionary response to the existence of injuries unremedied by the regulatory action of government.'

Regarding the second point, collective actions were sometimes strategically pursued to correct certain practices or deficient rules that could lead to mass infringement in the future. In the US, for example, class actions have long been brought to address issues such as malpractices in detention facilities and structural inequities in public education. These actions were less about seeking for redress or compensation and more about the implementation of updated standards and policies to ensure the institutions' greater compliance with legal and constitutional requirements (Marcus, 2022, pp. 620–622).

The risk prevention function of collective redress may become valuable in the governance of space commons, as NewSpace remains under-regulated despite a growing private presence. International space law has by design left the task of formulating specific rules and exercising continuing supervision to State regulators. Yet this top-down approach is plagued by uneven commitment and discrepancies in regulatory standards across jurisdictions (Burger, 2025; de Zwart et al., 2023; De Man, 2017). Also, monitoring space is inherently difficult. State regulators must design and enforce rules for a rapidly evolving orbital environment while remaining physically confined to Earth, a practical limitation that renders governance reactive to technological and commercial developments (Danilenko, 2016, p. 181). As a result, critical issues such safety standards for space tourism and space labor rights remain largely neglected as the market itself is not yet fully developed (Freeland, 2010, pp. 16–18; Nesvold, 2023, pp. 247–249). In this context, collective redress introduces an additional layer of oversight that operates alongside formal regulation. Where regulatory gaps persist, collective proceedings may draw attention to deficient industry practices and create incentives to adopt higher safety standards. In this sense, collective redress contributes not only to the settlement of disputes post accident, but also to the promotion of due diligence and best practices in the space commons.

4. IMPLEMENTION OF OUTER SPACE COLLECTIVE REDRESS

Collective redress' function in mass harm governance ultimately hinges on its implementation. In this Section, the authors discuss the principal implementation challenges and offer corresponding implementation recommendations in private dispute and inter-State claim settings.

4.1 PRIVATE DISPUTE IMPLEMENTATION

The procedural rules concerning collective redress differ significantly across major jurisdictions (Hensler, 2017). Lawmakers have also at times intentionally distanced designs of later-generation collective redress frameworks from earlier examples (Mullenix, 2021, p. 46). In jurisdictions applying trans-substantive procedural rules, such as the US and China, collective redress is available when the prescribed criteria is satisfied, regardless of the substantive nature of the claim. In contrast, most European States, England and Japan restrict collective redress to specific areas such as consumer protection, anti-competition practices, and product liability (Hensler, 2017). Compared to the trans-substantive model, this model is less adaptable to novel circumstances such as space disputes. The lack of uniformity makes access to space-related collective redress jurisdiction-specific, an uncertainty that calls for more synchronized space-related collective redress rules across jurisdictions.

Even in jurisdictions applying trans-substantive procedural rules, it is unclear whether the archetypal space-related mass harm cases would easily meet the threshold. Class actions in the US, for example, must meet four prerequisites: numerosity, commonality, typicality, and adequacy. In terms of numerosity, the general rule is that there must at least be 20 victims making the claim (Berman, 2018, p. 261; Johnson, 2024, p. 522). This limitation would preclude certain space-related mass harm claims, such as those arising from space tourism due to limited passenger capacity. Commonality may prove just as difficult to satisfy. Historically regarded as a low threshold, the requirement was significantly heightened in *Wal-Mart Stores, Inc. v. Dukes*, where the US Supreme Court (2011, p. 349) asked the victims to demonstrate 'the same injury' as opposed to merely a violation of the same legal provision by the defendant. In falling debris cases, injured parties may suffer from loss of life, bodily injury, property damage or other indirect losses. An overly restrictive approach to commonality would bar these parties from suing collectively, even though the underlying cause of their loss is identical. Moreover, in cases where debris from a single origin causes damage across an extended period or wide geographic area, the temporal and spatial dispersion of harm could discourage courts from finding commonality. An analogous challenge have arisen in asbestos litigation, where courts often struggled to find a shared factual basis from the victims' broad spectrum of asbestos-related injures over a prolonged period of exposure (Gallegos, 2000, pp. 71–72). These legal hurdles suggest that an

effective outer space collective redress regime must tailor to the distinctive features of space-related mass harm.

Other deficiencies in existing collective redress procedures will remain problematic if unattended. For example, studies suggest that collective redress is typically only economically viable when the claim is larger than £3-6 million (Molavi, 2021, p. 107). This makes socially significant yet lower-valued claims unattractive to class action lawyers or funders. A further concern arises in lawyer-initiated proceedings, where the representative plaintiff often functions as a mere 'figurehead' with little economic stake and limited supervisory capacity (Klement, 2002, pp. 27–28). This dynamic risks incentivizing lawyers to prioritize their interests over the victims'. Additional difficulties emerge in the distribution process, which frequently suffers from a black box problem due to inadequate oversight of settlement implementation, resulting in delays or inequitable allocations of settlement funds (Van der Elst & Waterings, 2021, p. 293).

In view of these challenges, the authors offer several recommendations below, acknowledging that they may not address every issue.

Space-specific collective redress rules. The procedural certainty of outer space collective redress can be enhanced by adopting model rules for collective actions. These model rules shall identify the types of space collective actions and incorporate safeguards against existing flaws. For example, they could enable appointment of public interest plaintiffs or independent monitors to strengthen plaintiffs' ability to hold their representatives accountable (Molavi, 2021, pp. 99–100; Klement, 2002, pp. 60–79). Likewise, they could introduce reporting obligations in the post-settlement phase to ensure fair and transparent fund distribution (Van der Elst & Waterings, 2021, pp. 293–294). International organizations such as the United Nations Committee on the Peaceful Uses of Outer Space and the International Law Association are in a position to design such rules, drawing upon their combined expertise in space governance and international lawmaking. Both bodies have previously undertaken initiatives to promote national space law harmonization by drafting model provisions and non-binding recommendations (von der Dunk, 2023, p. 29).

International mass arbitration forum. An alternative option to promote procedural certainty is to establish an international mass arbitration center for space-related disputes under a multilateral agreement. This would ensure that collective claims are adjudicated under a uniform set of rules, irrespective of the nationality of the parties. Building upon the rationale behind the Permanent Court of Arbitration's Optional Rules for Arbitration of Disputes Relating to Outer Space Activities, the forum could convene a specialized panel of arbitrators and technical experts in space law and technology to handle highly technical disputes (Rosenberg & Vivasvat, 2021).

Public litigation funds. Public litigation funds play an important role in promoting collective justice by financing socially significant claims with lower value or higher risk (Molavi, 2021, p. 113). These funds have achieved varying degrees of success in Canadian provinces and Israel, facilitating collective access to justice in cases that would otherwise be financially excluded (Molavi, 2021, pp. 114–117; Bukspan, 2021). The financial role of public litigation funds is essential in keeping space-related legal actions affordable. But even beyond this role, public litigation funds may promote space governance in two ways: first, by acting as an initial screening process to weed out potentially frivolous claims; and second, by endorsing certain cases to signal unacceptable conducts and practices, thereby informally shaping the standard of corporate behaviour in space.

4.2 INTER-STATE DISPUTE IMPLEMENTATION

Collective redress procedures are generally not applicable when mass harm is caused by States, since States generally cannot be sued in a domestic court. Consequently, the LIAB dispute settlement regime becomes the only path to recovery when private groups are harmed by States' space activities, even as the impediments highlighted earlier persist.

A potential solution here is for States to establish a quasi-collective redress scheme that allows private parties to petition their States to bring LIAB claims on their behalf. A similar mechanism was already implemented in several jurisdictions for WTO dispute settlement (WTO Secretariat, 2017, p. 23). This scheme shall also prescribe clear and specific rules regarding the types of damage parties may claim, the evidentiary requirements, and procedures governing the distribution of compensation. The scheme shall be implemented and administered by a special working group with expertise in the legal and technical dimensions of space-related disputes.

Moreover, States could encourage private participation in the LIAB procedures by permitting the parties to submit their position and arguments to the Claims Commission. Nothing in LIAB precludes this practice, which has also been a prominent feature of WTO dispute settlement (WTO Secretariat, 2017, p. 23).

Ultimately, while inter-State space dispute settlement will always retain a State-oriented design, States can capitalize on the flexible nature of the LIAB procedures to accommodate the private voices. This, to some extent, depoliticizes claims by shifting the focus away from

space politics, which could ultimately reduce extra-legal influence. Equally important, it inserts a collective element to the traditional State-oriented dispute settlement process, which is an imperfect yet progressive step toward governing space as a global commons.

5. CONCLUSION

Scholars have occasionally mentioned the potential use of class action in resolving certain space-related disputes (O'Donnell et al., 1997, pp. 189–190; Hook et al., 2024, p. 73; Smith, 2015, p. 617). Yet these references are often made only in passing, without in-depth analysis of the role collective redress could play in addressing mass harm risk in space or how collective redress mechanisms might be implemented in practice. This article represents an effort to initiate this conversation. Given the novelty of the proposal and the limited scope of this article, its analysis seeks not to paint a definitive path but to invite further legal and policy research on space-specific collective redress mechanisms.

As the commercial use of outer space accelerates, the risk that corporate activities will replicate patterns of exploitation and inequality familiar from other commons becomes more acute. It seems inevitable that dominant space enterprises will obtain both the leverage to influence industry practices and regulatory standards in ways that externalize risk onto others, and the financial resources to resist accountability when that risk materialize into mass harm. This article positions outer space collective redress as a safeguard for the common interest in space in that context, highlighting its role in both mitigating mass harm risk and improving remedial access in future accidents. By serving these functions, collective redress becomes an important building block in NewSpace development that preserves the communal ideals of outer space enshrined in the OST's description of outer space as the province of all mankind, a description that qualifies any right to use and explore outer space by the collective right of other States and of humanity at large (Tan, 2000, p. 164).

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The authors have no competing interests to declare.

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