Legal aspects of Active Debris Removal (ADR): regulation of ADR under international space law and the way forward for legal development

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5 Further Development of International Space Law for ADR Activities

The previous discussion assesses the two pillars of space law – the hard law pillar in Chapter 3 and the soft law pillar in Chapter 4 – in order to understand to what extent the four issues identified in Chapter 2 are addressed in these two pillars. In general, these two pillars have provided, to varying degrees, answers to all these four issues, but some gaps remain for the regulation of these issues. Therefore, the main question of Chapter 5 is how international space law should move forward to fill these gaps and better regulate the four issues relating to the governance of ADR.

The *first* gap is that there is no clear legal obligation upon States to mitigate and remove space debris. While the UN space treaties and international law provide some general requirements relevant to the protection of the space environment, they do not specifically address the issue of space debris. Soft law partly fills this gap by providing some guidelines on debris mitigation and space sustainability, but these guidelines are not legally enforceable due to their non-binding character. In view of the continuous growth of space debris, more efforts are needed from the international community to tackle the space debris problem. Section 5.1 will discuss how the lack of an explicit obligation can be filled through the shaping of unilateral, multilateral and global commitments of States, as well as commitments made by all stakeholders of the space industry from over the world.

The *second* gap is that the concept of "fault" for the establishment of liability for damage caused in outer space is not clearly defined in the space treaties. This may create legal uncertainty and disincentivise operators from engaging in ADR activities. The development of non-legally binding instruments such as the space debris mitigation guidelines can contribute to the specification of this concept, but more specific guidelines for the safety of ADR operations are needed due to the complexity and inherent risk of these operations. CONFERS and ISO have both published standards and practices applicable to ADR operations, but it would be beneficial for States to adopt commonly accepted guidelines regarding how ADR activities are to be conducted in a safe and sustainable manner, which could provide a more authoritative yardstick for the determination of "fault" when an ADR operation causes damage to other space objects. Section 5.2 will discuss the development of ADR guidelines in the context of space sustainability, assess some recent developments in national legal order specifically addressing ADR, and analyse the way forward for the development of safety guidelines for ADR activities.

The *third* gap is that the jurisdiction and control retained by the State of registry over its space object may constitute a legal hurdle to the removal of space debris under foreign jurisdiction. Circumventing this obstacle does not appear a viable option, for this may be perceived by the State of registry as threatening or even hostile actions, which could undermine international peace and security in outer space. Hence, the feasible path forward is to establish international mechanisms that could facilitate consensual ADR operations. Section 5.3 will provide several recommendations that could be incorporated into a UN General Assembly resolution to promote the implementation of ADR missions on a consensual basis.

The *fourth* gap arises from the fact that the inherent dual-use nature of ADR technologies may raise security concerns. The space treaties and general international law impose restrictions on the use of ADR systems for forcible actions, but the hard law pillar does not specifically address how peaceful ADR activities should be carried out in a way to reduce the risks of misperceptions and misunderstandings. The GGE Report of 2013 provides some general recommendations that could be helpful in mitigating such risks, but more specific norms are needed to ensure that ADR activities are carried out in a transparent and responsible manner in order to alleviate potential security concerns. This will be discussed in Section 5.4.

5.1 *Issue 1*: Commitments to Tackle the Space Debris Problem

One possible way to overcome the legal gap regarding the lack of a clear obligation to mitigate and remove debris is for those more forward-looking States to make commitments and lead international efforts to solve the space debris problem. As to the form of commitments, reference can be made to the GGE Report of 2013, which states that:

> "The Group endorses efforts to pursue political commitments, for example, in the form of unilateral declarations, bilateral commitments or a multilateral code of conduct, to encourage responsible actions in, and the peaceful use of, outer space. The Group concludes that voluntary political measures can form the basis for consideration of concepts and proposals for legally binding obligations."[1]

In other words, political commitments can take a variety of forms, and these commitments may contribute to the further development of international law for the governance of space activities. Accordingly, States could make unilateral, multilateral and global commitments to address the space debris problem. These three forms of commitments will be discussed in Sections 5.1.1 to 5.1.3 below. Besides the State-oriented commitments addressed in

1 UN Doc. A/68/189 (29 July 2013). Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, para. 69.

these three sections, Section 5.1.4 will discuss the "Net Zero Space" initiative launched in November 2021 at the Paris Peace Forum which calls upon all stakeholders over the world, ranging from governmental agencies to private actors, to make commitments to debris mitigation and remediation.[2]

5.1.1 Unilateral Commitment to Debris Mitigation and Remediation

At the unilateral level, States could issue unilateral statements to express their determination and commitment to mitigate and remove space debris. In fact, some States have explicitly expressed in their national space policies their political will to promote the development and implementation of ADR programs. For instance, the UK National Space Strategy states that the UK aims to "[l]ead the global effort to make space more sustainable".[3] More specifically, the UK "will explore advanced *in-orbit debris removal*, servicing, refuelling and assembly technologies, bringing together industry, academia, and government to ensure the UK is ready to grasp the opportunities of the future space economy".[4]

With regard to the US, the Orbital Sustainability Act ("ORBITS Act") passed unanimously by the Senate on 31 October 2023 finds that an increasing amount of space debris endangers the safety and sustainability of operations in LEO and nearby orbits.[5] To respond to this growing problem, the Act provides that the US should develop and carry out programs to minimise space debris, including initiatives to demonstrate active remediation of space debris generated by the US government.[6] Moreover, the Act would direct the US to lead international efforts to encourage other spacefaring nations to mitigate and remediate space debris under their jurisdiction and control.[7] Therefore, political will is taking shape that could serve as a basis

2 Net Zero Space initiative. (November 2022). <https://parispeaceforum.org/en/initiatives/net-zero-space/>.

3 UK National Space Strategy, published on 27 September 2021, last updated 1 February 2022, p. 42. <https://www.gov.uk/government/publications/national-space-strategy>.

4 Ibid, emphasis added.

5 US Senate Committee on Commerce, Science & Transportation. (1 November 2023). Cantwell, Hickenlooper Bill to Clean Up Space Junk Passes Senate Unanimously. <https://www.commerce.senate.gov/2023/11/cantwell-hickenlooper-bill-to-clean-up-space-junk-passes-senate-unanimously>. The ORBITS Act was first introduced in September 2022 and it passed the Senate by unanimous consent in December 2022, but was not taken up by the US House of Representatives. After the unanimous pass of the bill by the Senate in October 2023, the ORBITS Act now heads to the House for the second time. For more details see Foust, J. (1 November 2023). Senate Passes Orbital Debris Bill. *SpaceNews*. <https://spacenews.com/senate-passes-orbital-debris-bill/>. See also US National Space Society (NSS). (14 September 2022). NSS Statement on the Orbital Sustainability Act of 2022 (ORBITS Act). <https://space.nss.org/nss-statement-on-the-orbital-sustainability-act-of-2022-orbits-act/>.

6 Sec. 2(b)(1), ibid.

7 Sec. 2(b)(2), ibid.

for forward-looking States to lead by example through the declaration of commitments to mitigate and remediate space debris.

The following two examples indicate that some States are pioneering efforts in developing new rules for the governance of outer space activities beyond the current requirements towards a safer and more sustainable space environment. The first example is the ban on destructive direct-ascent anti-satellite missile testing and the second example is the shortening of the FCC post-mission disposal rule for satellites in LEO from 25 years to 5 years. These two examples will be addressed respectively in Sections 5.1.1.1 and 5.1.1.2. They illustrate the feasibility of the unilateral approach for space law to move forward. Section 5.1.1.3 will discuss the substance of the potential unilateral commitment to mitigate and remove space debris.

5.1.1.1 Moratorium on Destructive Direct-Ascent Anti-Satellite Missile Testing

On 18 April 2022, US Vice President Kamala Harris announced in a speech at Vandenberg Space Force Base in California:

> "[T]he United States commits not to conduct destructive direct-ascent anti-satellite missile testing.
> Simply put: These tests are dangerous, and we will not conduct them.
> We are the first nation to make such a commitment. And today, on behalf of the United States of America, I call on all nations to join us."[8]

Despite being a unilateral commitment, it is intended as a starting point for further international norm-setting to ban direct-ascent ASAT tests. As Harris stated, "we will lead by example. […] We are the first nation to make such a commitment. And today, on behalf of the United States of America, I call on all nations to join us. In the days and months ahead, we will work with other nations to establish this as a new international norm for responsible behavior in space".[9] In other words, unilateral commitment may be intended to serve as a means towards the shaping of broader commitments within the international community. According to *SpaceNews*, the timing of the commitment was not accidental, as it was made just a few weeks before the first meeting of the OEWG on Reducing Space Threats established by the UN General Assembly in 2021.[10] As pointed out by US official Eric

8 US White House. Remarks by Vice President Harris on the Ongoing Work to Establish Norms in Space. 18 April 2022. <https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/04/18/remarks-by-vice-president-harris-on-the-ongoing-work-to-establish-norms-in-space/>.

9 Ibid.

10 Foust J. (25 April 2022). A Small Ban of ASATs, A Giant Leap for Space Security? *The Space Review*. <https://www.thespacereview.com/article/4374/1>. UN Doc. A/RES/76/231 (30 December 2021), Reducing space threats through norms, rules and principles of responsible behaviours, para. 5.

Desautels, this timing "is meant to spur a meaningful discussion in the Open-Ended Working Group, as we view this as an important tool in our efforts to multilateralize this commitment".[11]

The US-initiated moratorium on destructive direct-ascent anti-satellite missile tests has been joined by a considerable number of other States.[12] According to a US statement, while many States "do not intend to develop direct-ascent anti-satellite missile capabilities", their supports "contribute their voices to identifying this in the international community as an emerging norm of responsible behavior".[13] In September 2022, the US announced that it would propose a UNGA resolution banning the conduct of such tests.[14] On 1 November 2022, the First Committee of the UN General Assembly approved the US-proposed draft resolution entitled "Destructive direct-ascent anti-satellite missile testing" (A/C.1/77/L.62).[15] On 7 December 2022, the UN General Assembly adopted this draft resolution (A/RES/77/41), calling upon all States to commit not to conduct destructive direct-ascent anti-satellite missile tests.[16]

As Chen points out, the US-initiated moratorium is limited in scope as it addresses only the testing but not the use of direct-ascent ASAT missiles, and it does not address weapons other than direct-ascent ASAT weapons.[17] According to a Working Paper submitted by Germany and the Philippines at the OEWG in September 2022, on top of direct-ascent anti-satellite mis-

11 Ibid.

12 These include Canada, New Zealand, Japan, *Germany*, the UK, South Korea, Switzerland, Australia, and *France*, *The Netherlands*, *Austria*, and *Italy*, as well as the 27 Member States of the EU which made their commitments in a joint statement. It should be noted that before the EU joint commitment, 5 EU members had already made their commitments earlier, which are emphasised in italics. See Foust, J. (24 August 2023). European Union nations join ASAT testing ban. *SpaceNews*. <https://spacenews.com/european-union-nations-join-asat-testing-ban/>.

13 US Mission Geneva. (13 September 2022). U.S. Statement to the Open-Ended Working Group on Reducing Space Threats. <https://geneva.usmission.gov/2022/09/13/u-s-statement-to-the-open-ended-working-group-on-reducing-space-threats-2/>.

14 U.S. Mission Geneva. (21 September 2022). Aide-Memoire on Proposed UN General Assembly Resolution on Destructive Direct-Ascent Anti-Satellite Missile Testing Submitted by the United States of America. <https://geneva.usmission.gov/2022/09/21/proposed-un-general-assembly-resolution-on-destructive-direct-ascent-anti-satellite-missile-testing/>.

15 UN. (1 November 2022). Approving 21 Drafts, First Committee Asks General Assembly to Halt Destructive Direct-Ascent Anti-Satellite Missile Tests in Outer Space. <https://press.un.org/en/2022/gadis3703.doc.htm>.

16 UN. (7 December 2022). General Assembly Adopts over 100 Texts of First, Sixth Committees Tackling Threats from Nuclear Weapons, International Security, Global Law, Transitional Justice. <https://press.un.org/en/2022/ga12478.doc.htm>.

17 Chen, K.-W. (21 April 2022). Commentary on the US Commitment Not to Conduct Direct-Ascent Anti-Satellite Testing. <https://www.mcgill.ca/iasl/US%20commitment%20not%20to%20conduct%20ASAT%20testing>.

siles, co-orbital anti-satellite capabilities are equally concerning in terms of space security, i.e., the kinetic destruction of satellites via other satellites that can close in on the target.[18] In its statement to the OEWG, the US describes the moratorium as an important first step "to rein in the destructive testing of direct-ascent anti-satellite missiles" and states that ongoing collective work in bodies like the OEWG "will make progress on developing further solutions to address other challenges resulting from State behavior that threaten the security of space systems".[19] Therefore, while limited in scope, the moratorium may serve as a starting point for a progressive approach towards further development.

This progressive approach is reflected in the aforementioned UN General Assembly resolution 77/41.[20] The preamble of the resolution not only expresses concerns over the impact of destructive direct-ascent anti-satellite missiles on the space environment but also recognises the similar negative impact that other types of anti-satellite systems might have. Therefore, besides calling for a halt to destructive direct-ascent anti-satellite missile testing, the resolution also calls upon all States to continue discussions to develop further practical steps and contribute to legally binding instruments on the prevention of an arms race in outer space.[21]

The above moratorium illustrates how a unliteral commitment could attract support from other States and provoke international discussions. Similarly, a unilateral commitment made by one State to mitigate and remove space debris may gain momentum towards a more sustainable and stable space environment, with other like-minded and interested States joining the initiative. In addition, a commitment need not be comprehensive from the outset but could focus on one specific problem and broaden its scope at a later stage. A similar path can be followed for States to make their commitments to debris mitigation and remediation.

5.1.1.2 Shortening the Post-Mission Disposal Rule to 5 Years

On 29 September 2022, the US FCC adopted the Report and Order (FCC 22-74) which sets out new rules requiring satellites ending their mission in or passing through LEO to de-orbit as soon as practicable but no more than five years following mission completion.[22] The new rule, which will apply

18 UN Doc. A/AC.294/2022/WP.17 (6 September 2022). Security risks, threats, and irresponsible behaviors undermining stability in outer space: Submitted by the Federal Republic of Germany and the Republic of the Philippines, para. 9(b).

19 US Mission Geneva. (2022), *supra* note 13.

20 UN Doc. A/RES/77/41 (7 December 2022). Destructive direct-ascent anti-satellite missile testing.

21 Ibid, paras. 1&3.

22 FCC. (29 September 2022). FCC Adopts New '5-Year Rule' for Deorbiting Satellites. <https://www.fcc.gov/document/fcc-adopts-new-5-year-rule-deorbiting-satellites>.

to US-licensed satellites as well as foreign-licensed satellites seeking access to the US market, is largely shorter than the 25-year post-mission disposal rule as generally contained in international instruments on space debris mitigation, such as the IADC Space Debris Mitigation Guidelines.[23]

As explained by Jessica Rosenworcel, chairwoman of the FCC, the proliferation of defunct satellites in orbit raises the risk of collisions to operational satellites, making it harder to launch new objects into higher orbits.[24] Therefore, the shortening of post-mission disposal period for satellites in LEO from 25 years to 5 years "will mean more accountability and less risk of collisions that increase orbital debris and the likelihood of space communication failures".[25] FCC commissioner Geoffrey Starks adds that compliance with the new five-year rule will help to bend the curve of space debris proliferation.[26] The study of the CNES also supports the view that the 25-year rule can no longer accommodate the current need for a sustainable orbital environment. Based on the analysis performed by the French space debris evolutionary models, the CNES concludes that "existing post-mission disposal guidelines (e.g. 90% post-mission disposal success rate as well as the 25-year rule) are not sufficient to guarantee the sustainable use of space in the presence of large constellations."[27]

As the population of space debris grows continuously, the current international guidelines and standards addressing this issue might not be sufficiently effective for ensuring the safety and the long-term sustainability of space operations, and more ambitious efforts would be needed. The update made by the FCC illustrates that it is possible for national initiatives to move ahead of international efforts to tackle the space debris problem and preserve the orbital environment. In a similar vein, with the development of ADR technologies and the growing need for ADR operations to stabilise the orbital environment, one could expect that some States may lead international efforts to remediate space debris.

5.1.1.3 Substance of Unilateral Commitments

With regard to the substance of unilateral commitments to tackle the space debris problem, reference can be first made to the IADC ADR Statement which puts forward three recommendations for space operators:

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23 FCC. (September 2022). Mitigation of Orbital Debris in the New Space Age. FCC 22-74, p. 8, para. 18.

24 Ibid, p. 23.

25 Ibid.

26 Ibid, p. 24.

27 UN Doc. A/AC.105/C.1/2022/CRP.20 (7 February 2022). General presentation of French activities and views concerning the long-term sustainability of outer space activities, in relation with the implementation of the 21 Guidelines, para. 81.

i. Adhere to the existing space debris mitigation guidelines with a post-mission reliability as high as practicable but no less than 90%;
ii. Conduct further research and cost-benefit analysis on ADR and develop concepts and technologies that can satisfy technical, economic and safety considerations for the stabilisation of debris population;
iii. Newly launched spacecraft and upper stages are encouraged to be ADR ready.[28]

Further reference can be made to the two white papers developed within the Net Zero Space initiative which provide, respectively, legal and technical recommendations for the achievement of the sustainable use of outer space. The Net Zero Space WG1 White Paper aims to enhance regulations and public policies with regard to debris mitigation and remediation.[29] Specific to debris remediation, it provides two recommendations. One recommendation is that States should adopt stricter regulations concerning debris remediation, including requiring LEO satellite operators to engage with credible on-orbit servicing providers to perform viable ADR and end-of-life services to de-orbit their inactive satellites.[30] This issue is also addressed in the 2018 US *Space Policy Directive-3* ("SPD-3"), which enumerates a number of factors that should be considered by satellite and constellation owners in their pre-launch certification process.[31] These factors include, *inter alia*: "Self-disposal upon the conclusion of operational lifetime, or owner-operator provision for disposal using active debris removal methods."[32] If ADR can be included as a disposal strategy in the licensing process, this may create more commercial opportunities for the ADR market. Another recommendation proposed in the WG1 White Paper is that States should collaborate towards ADR solutions.[33] This could start from the discussion and development of a list of the most concerning derelict objects in space, followed by the establishment and maintenance of international dialogue to pursue opportunities for the collaborative de-orbiting of these objects.[34] The Net Zero Space initiative Working Group 2 White Paper provides recommendations "focusing on advancing international efforts towards a more interoperable way of stipulating the existence of a risk of collision in orbit".[35] The recommendations contained in these two White Papers can be incorporated by States into their commitments to debris mitigation and remediation.

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28 IADC. (2022). IADC ADR Statement, IADC-22-02, p. 1.
29 Net Zero Space WG1. (November 2022). White Paper on "*Fostering Better and More Interoperable Norms: Comparing Existing Binding National Requirements Relating to Space Debris*".
30 Ibid, p. 17.
31 US. (18 June 2018). *Space Policy Directive-3, National Space Traffic Management Policy*. <https://trumpwhitehouse.archives.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/>.
32 Ibid.
33 WG1 White Paper 2022, *supra* note 29, pp. 17-18.
34 Ibid.
35 Net Zero Space Working Group 2 (WG2). (November 2022). White Paper on "*Developing Reference Modelling to Assess Risks of Collision in Orbit*" ("WG2 White Paper"), p. 2. <https://www.netzerospaceinitiative.org/activities/2022-working-group-2>.

In addition, regulatory certainty is key for investors to be willing to invest in expensive ventures, including the development of ADR technologies and the execution of ADR missions.[36] Therefore, States should, where appropriate, adopt and revise their national regulations to provide legal assurance to space operators. This issue is addressed in the *United States Space Priority Framework* released by the White House in December 2021, which states that US regulations "must provide clarity and certainty for the authorization and continuing supervision of non-governmental space activities, including for novel activities such as on-orbit servicing, orbital debris removal…".[37] In particular, States may consider whether specific licensing conditions should be made for ADR operations due to their higher risks than conventional space activities, while also ensuring that this fledgling industry would not be overburdened by the additional regulatory requirements. In this regard, the US and Japan have already adopted some national rules and standards specifically addressing ADR operations, which will be discussed in more detail later.

In the future, when ADR technologies become more mature and economically viable, States could make commitments that they will execute ADR missions in a responsible and transparent manner to ensure mission safety and avoid generating additional space debris during mission operations. States with strong willingness can even commit to actively removing large defunct objects at a certain rate, i.e., on average one object per year, which would likely be plausible when technologies allowing the removal of multiple debris objects in a single mission become applicable. States could also coordinate their efforts by setting a common goal for ADR and allocating among them the responsibilities to achieve this goal.

In sum, at the current stage, the commitments could be to enhance the compliance with space debris mitigation guidelines, advance ADR technologies, and develop national law to provide legal certainty to ADR operators and promote the development of the commercial ADR sector. When ADR technologies become more mature and reliable in the future, States could commit to removing a certain number of their debris objects per year. As stressed by Mazlan Othman, "the prompt implementation of appropriate space debris mitigation measures is in humanity's common interest, particularly if we are to preserve the outer space environment for future generations".[38] Specifically, the implication of increased debris

36 Blount P. J. (2019). On-Orbit Servicing and Active Debris Removal: Legal Aspects. In Nakarada Pecujlic, A., & Tugnoli, M. (Eds.). (2019). *Promoting Productive Cooperation Between Space Lawyers and Engineers*. IGI Global, p. 186.

37 US. (December 2021). *United States Space Priorities Framework*. <https://www.whitehouse.gov/wp-content/uploads/2021/12/United-States-Space-Priorities-Framework-_-December-1-2021.pdf>.

38 UN. (13 February 2009). UN Reiterates the Importance of the Implementation of the Space Debris Guidelines to Curtail Space Debris in Future. UNIS/OS/376. <https://unis.unvienna.org/unis/en/pressrels/2009/unisos376.html>.

population in space will be more severe for those States and international organisations that rely heavily on their space assets and infrastructure for economic and strategic purposes.[39] As such, these States and organisations may have a strong motivation to tackle the space debris problem. Moreover, they are usually more technologically capable of developing viable methods to actively remove space debris. Initiatives taken by them could pave the way for broader international efforts within the international community to collectively solve the space debris problem.

5.1.2 Multilateral Commitment to Debris Mitigation and Remediation

While a unilateral commitment could potentially be 'multilateralised' at a later stage, States sharing common goals could also make joint commitments straightforwardly. One example of this approach is the joint statement of the Group of Seven (G7) nations on the safe and sustainable use of space, which was made in June 2021 at the G7 Leader's Summit in Cornwall, the UK ("G7 Statement of 2021").[40] The statement, recognising the growing hazard of space debris and increasing congestion in Earth's orbit, aims to support humanity's ambitions to use space now and in the future.[41] Considering that the orbit around the Earth is "a fragile and valuable environment", the G7 nations agree to strengthen their efforts to "ensure the sustainable use of space for the benefit and in the interests of all countries".[42] In particular, the statement makes explicit reference to ADR:

> "We welcome all efforts, public and commercial, in debris removal and on-orbit servicing activities and undertake to encourage further institutional or industrial research and development of these services."[43]

Similar to a unilateral commitment, a multilateral commitment could also be further multilateralised and globalised. The G7 Statement calls upon all nations to work together, through international bodies like COPUOS, the IADC and the ISO, to preserve the space environment for future generations.[44] Simonetta Di Pippo, then Director of UNOOSA, welcomed this joint commitment and commented that "[o]nly through such leadership, with all nations working together, will we preserve the space environment for future generations".[45] In other words, multilateral commitment can be used

39 Jakhu, R. S. & Ahmad, M. T. (13 November 2017). The Outer Space Treaty and States' Obligation to Remove Space Debris: A US Perspective. *The Space Review*. <https://thespacereview.com/article/3370/1>.

40 UK Space Agency. (June 2021). G7 Nations Commit to the Safe and Sustainable Use of Space. <https://www.gov.uk/government/news/g7-nations-commit-to-the-safe-and-sustainable-use-of-space>.

41 Ibid.

42 Ibid.

43 Ibid.

44 Ibid.

45 Ibid.

as a step-wise approach towards a global effort to solve the space debris problem.

The *G7 Science and Technology Ministers' Communiqué* published in May 2023 in Sendai, Japan ("Sendai Communiqué of 2023") addresses the space debris problem in more detail in its section titled "Promoting Safe and Sustainable Use of Outer Space".[46] In this section, the G7 nations recall the G7 Statement of 2021 and share the view that space debris constitutes an urgent issue.[47] To promote space debris mitigation efforts, the G7 nations commit to:[48]

- Follow the relevant guidelines adopted by international bodies such as COPUOS and the IADC.
- Share experiences and best practices on space debris mitigation.
- When appropriate, support the development of new guidelines.

In addition, the Sendai Communiqué reiterates the respective commitments that have already been made by the G7 members on the ban of destructive direct-ascent anti-satellite missile tests and encourages other countries to follow suit.[49] This shows the interaction between unilateral and multilateral commitments and the intention of these commitments to be further globalised. The importance of addressing the issue of space debris is reiterated in the *G7 Hiroshima Leaders' Communiqué* published on 20 May 2023 ("Hiroshima Communiqué").[50] The Hiroshima Communiqué reaffirms the key commitments made in the Sendai Communiqué, including:[51]

- The implementation of international guidelines adopted at COPUOS;
- Further development of solutions and technologies for space debris mitigation and remediation;
- Commitment not to conducting destructive direct-ascent anti-satellite missile testing.

Another way to initiate multilateral commitment is to start at the regional level. During a panel session at the World Economic Forum in Switzerland in January 2023, ESA Director General Josef Aschbacher said he was in discussions with the ESA Member States about a "zero debris" policy that would require spacecraft to be de-orbited immediately after end-of-mission.[52] In June 2023, ESA, with the support of several European space

46 The text of the Sendai Communiqué is available on the website of the Cabinet Office of Japan: <https://www8.cao.go.jp/cstp/english/others/2023/g7_2023_en.html>.
47 Sendai Communiqué (2023), p. 5.
48 Ibid.
49 Ibid, p. 6.
50 The text of the Hiroshima Communiqué is available on the website of the Ministry of Foreign Affairs of Japan: <https://www.mofa.go.jp/ms/g7hs_s/page1e_000690.html>.
51 Hiroshima Communiqué (2023), para. 41.
52 Foust J. (20 January 2023). ESA Seeks Global Adoption of "Zero Debris" Policy. *SpaceNews*. <https://spacenews.com/esa-seeks-global-adoption-of-zero-debris-policy/>.

companies, announced the Zero Debris Charter initiative.[53] The Charter aims to bridge previous ESA initiatives aiming to shape global consensus on space sustainability and the Agency's technical work on the technologies and solutions enabling safe and sustainable space operations.[54] As Aschbacher said: "We are calling upon all stakeholders from across the European space ecosystem, including new space actors, to display a strong commitment towards achieving global leadership in space debris mitigation and remediation, through the Zero Debris Charter initiative".[55] In November 2023, the Zero Debris Charter was released at the European Space Summit in Seville, setting out both high-level guiding principles and specific, jointly defined targets towards a zero debris future.[56] The aim of the Charter is to shape consensus on space safety and sustainability at European and global levels.[57]

Multilateral commitments can also be program-oriented, i.e., States participating in cooperative space projects can incorporate commitments of space debris mitigation and remediation into their international agreements. For instance, the issue of space debris and spacecraft disposal is addressed in the Artemis Accords signed between NASA and the participating agencies to the Artemis Program.[58] According to Section 12 of the Artemis Accords, NASA and partner agencies commit to plan for the mitigation of orbital debris, including the safe, timely, and efficient passivation and disposal of spacecraft at the end of their missions.[59] They also commit to limit, to the extent practicable, the generation of new, long-lived harmful debris by taking appropriate measures to this end.[60] Similar commitments could be incorporated into other international agreements to mitigate the creation of space debris in cooperative space missions.

In sum, States can pursue multilateral dialogue and make joint commitments to preserve the long-term sustainability of the outer space environment. The substance of such commitments could be similar to those made in unilateral commitments, with appropriate adjustments made to reflect the common will of the endorsees or to accommodate the specific needs of

53 ESA. (22 June 2023). ESA Announces the Zero Debris Charter Initiative. <https://esoc.esa.int/esa-announces-zero-debris-charter-initiative>.
54 Ibid.
55 Ibid.
56 ESA. The Zero Debris Charter. <https://www.esa.int/Space_Safety/Clean_Space/The_Zero_Debris_Charter>.
57 ESA. (6 November 2023). World-First Zero Debris Charter Open for Registration. <https://esoc.esa.int/zero-debris-community-update>.
58 *Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes* ("Artemis Accords"), available at: <https://www.nasa.gov/specials/artemis-accords/index.html>.
59 Sec. 12(1), ibid.
60 Sec. 12(2), ibid.

a certain cooperative program. As a multilateral commitment represents a concerted voice of a group of States, it could be more politically powerful and influential than a unilateral one, and could also be used to reinforce unilateral commitments.

5.1.3 Global Commitment to Debris Mitigation and Remediation

As mentioned in the previous two sections, both unilateral and multilateral commitments may be oriented towards a global commitment. As stated by the UK, politically and legally binding approaches are not mutually exclusive but reinforcing.[61] When there is sufficiently strong political will in place, as a next step, the international community may consider establishing an international agreement to systemise the process of commitment-making. The 2015 Paris Agreement on climate change may provide a relevant model in this regard, which will be assessed in this section.[62]

The Paris Agreement is a legally binding international treaty on climate change adopted at the twenty-first session of the Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015. It has currently 195 parties (including 194 States plus the EU).[63] This universal acceptance is also needed for a future space debris agreement through which States can make and review their commitments to address this issue. Like the issue of climate change, the problem of space debris also constitutes a challenge of a global dimension, where the activities of a single State could affect the common interests of the whole international community. Under the Paris Agreement, the Parties aim to reach global peaking of greenhouse gas (GHG) emissions as soon as possible and to undertake rapid reductions thereafter in accordance with the best available science, "so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century".[64] Similarly, the stabilisation of the space debris population entails a balance of sources and sinks: the former focuses on mitigating the generation of new debris and the latter on removing existing debris from orbit.[65] In light of the comparability between the issue of climate change and that of space debris, lessons can be learned from the Paris Agreement to control the growth of space debris.

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61 The UK. (1 February 2023). Statement by the United Kingdom at the 3rd Session of the OEWG, pp. 1-2. <https://meetings.unoda.org/meeting/57866>.

62 United Nations Framework Convention on Climate Change (UNFCCC). Adoption of the Paris Agreement. Report No. FCCC/CP/2015/L.9/Rev.1, December 2015. <http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>

63 UN Climate Change. The Paris Agreement. <https://www.un.org/en/climatechange/paris-agreement>.

64 Art. 4(1), Paris Agreement, ibid.

65 Bonnal, C., & McKnight, D. S. (Eds.). (2017). *IAA Situation Report on Space Debris – 2016*. International Academy of Astronautics, p. 19.

The Paris Agreement sets a long-term goal to guide the global response to the threat of climate change:

> "Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change."[66]

In space, a widely shared long-term goal is to maintain outer space as an operationally stable and safe environment that is suitable for exploration and use by current and future generations.[67] For the quantification of this goal, reference can be made to the concept of "space environment capacity", also called "orbital capacity", which is understood as the full capacity of the orbital region that can be safely used by operators without leading to irreversible consequences for the space environment.[68] According to the Net Zero Space initiative WG2 White Paper, although there is currently no commonly accepted definition of what carrying capacity is, "the state of the art does allow a numerical approximation of the aggregate risk posed by each new system to the total [orbital] environment (based on elements like the reliability of satellites, the number of them, their lifetime or the debris background, to name a few)".[69] Knowing the maximum carrying capacity of an orbit would allow strategic decisions to be made accordingly on the efficient and sustainable use of such orbit.[70] As the IADC has already published some studies on the projected growth of space debris and its impact on the orbital environment, it appears as an appropriate forum to assess the full and remaining capacity of the orbital environment.

At the heart of the Paris Agreement are the nationally determined contributions (NDCs) which are the climate actions outlined by each State to reduce national emissions and adapt to the impacts of climate change.[71] Article 4(2) of the Paris Agreement requires each Party to prepare, communicate and maintain successive NDCs that it intends to achieve, and to pursue domestic mitigation measures with the aim of achieving the objectives contained in the NDCs. The NDCs are to be submitted every five years to the UNFCCC secretariat.[72] In order to enhance the ambition over time, the Paris

66 Art. 2(1)(a), Paris Agreement.
67 Preamble of the LTS Guidelines, para. 4.
68 European Space Policy Institute (ESPI). (April 2022). *ESPI Report 82 – Space Environment Capacity*, pp. 39-41. See also Palmroth, M., Tapio, J., Soucek, A., Perrels, A., Jah, M., Lönnqvist, M., Nikulainen, M., Piaulokaite, V., Seppälä, T., & Virtanen, J. (2021). Toward Sustainable Use of Space: Economic, Technological, and Legal Perspectives. *Space Policy*, *57*, 101428, p. 9.
69 Net Zero Space WG2 (2022), *supra* note 35, p. 22.
70 Ibid.
71 UN Climate Change. Nationally Determined Contributions (NDCs). <https://unfccc.int/ndc-information/nationally-determined-contributions-ndcs>.
72 Ibid.

Agreement provides that each Party's successive NDC will represent a progression beyond its current NDC and reflect its highest possible ambition.[73] Modelling after this mechanism, the future legal framework governing space debris should require States to periodically submit their self-defined space debris removal action plans.

As national actions set out in the NDCs are not legally binding under the Paris Agreement, the Agreement creates three different review mechanisms to ensure their effectiveness.[74] The first mechanism is the "enhanced transparency framework (ETF)" provided for in Article 13 of the Paris Agreement, which is designed to build trust and confidence that all countries are contributing their share to the global effort.[75] According to the ETF, starting in 2024, Parties will report transparently on their actions and progress in the implementation of their individual NDCs.[76] The submitted reports will be subject to a technical expert review and a multilateral consideration of progress.[77] As Dupuy and Viñuales note, the ETF functions as "a form of 'naming and shaming' mechanism designed to nudge States into complying with their NDCs".[78]

The information gathered through the ETF will feed into a global stocktake process, which is the second review mechanism in the Paris Agreement.[79] Starting in 2023 and then every five years thereafter, Parties will take stock of the implementation of the Paris Agreement with the aim to assess the world's collective progress towards achieving the purpose of the Agreement and its long-term goals and identify the gaps.[80] The outcome of the global stocktake will inform Parties in setting more ambitious goals in their subsequent NDCs and in enhancing international cooperation for climate action.[81]

The third mechanism is the Paris Agreement Implementation and Compliance Committee (PAICC) established pursuant to Article 15 of the Paris Agreement, which serves to facilitate implementation of and promote

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73 Art. 4(3), 2015 Paris Agreement.

74 Sands, P., Peel, J., Fabra, A., & MacKenzie, R. (2018). *Principles of International Environmental Law*. 4th ed., Cambridge University Press, p. 328.

75 UN Climate Change. Reporting and Review under the Paris Agreement. <https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-paris-agreement>.

76 UN Climate Change. The Paris Agreement. <https://unfccc.int/process-and-meetings/the-paris-agreement>.

77 Dupuy, P.-M., & Viñuales, J. E. (2018). *International Environmental Law.* 2nd ed., Cambridge University Press, p. 194. Art. 13(11), the Paris Agreement.

78 Ibid, p. 193.

79 UN Climate Change, *supra* note 76.

80 Art. 14, 2015 Paris Agreement. See also UN Climate Change. Global Stocktake | UNFCCC. <https://unfccc.int/topics/global-stocktake>.

81 Ibid.

compliance with the provisions of the Paris Agreement.[82] The PAICC is "expert-based and facilitative in nature" and it is to "function in a manner that is transparent, non-adversarial and non-punitive".[83] The Committee can take various measures to achieve its aim, such as "helping countries engage with relevant bodies or arrangements on finance, technology and capacity building or assist in the development of an action plan".[84] As such, the PAICC is designed to play a supportive role, helping parties figure out how to comply with the Agreement, and not enforcing compliance or sanctioning non-compliance.[85]

The future legal framework addressing debris mitigation and remediation could incorporate review mechanisms akin to those of the Paris Agreement to assess the individual and collective progress towards achieving the pre-defined long-term goal and inform future actions. Specifically, an ETF process may assess whether individual States have complied with their respective self-determined commitments, and the global stocktake could enable the global community to jointly evaluate the remaining orbital capacity that is able to host space activities in a sustainable manner. In addition, an expert-based committee with a facilitative role could be established to support implementation and promote compliance.

In brief, the Paris Agreement provides a model for the development of an international agreement to regulate the mitigation and remediation of space debris. The new treaty could be negotiated under the auspices of COPUOS, the place where the five UN space treaties were developed. This development of a legal regime is contingent upon the existence of political will, which could be built and shaped by unilateral and multilateral commitments made by States willing to take the lead in tackling the space debris problem. While currently only a few States have the technological potential to remove space debris, the development of the commercial ADR sector could, in the future, become a mature market that provides viable options for States to procure ADR services at a large scale. This is indeed happening, for space agencies such as ESA and JAXA are purchasing services from commercial space companies for their debris removal programs.

Admittedly, even with the wide ratification of the Paris Agreement, the situation of climate change is still concerning. The NDC Synthesis Report published on 26 October 2022 analyses 166 NDCs representing 193 Parties

82 UN Climate Change. Paris Agreement Implementation and Compliance Committee (PAICC). <https://unfccc.int/PAICC>.

83 Ibid. Art. 15(2), Paris Agreement.

84 UN Climate Change. (30 March 2022). Paris Agreement Implementation and Compliance Committee Meets to Assess Challenges. <https://unfccc.int/news/paris-agreement-implementation-and-compliance-committee-meets-to-assess-challenges>.

85 Owley, J., Ibrahim, I. A., & Maljean-Dubois, S. (2021). The Paris Agreement Compliance Mechanism: Beyond COP 26. *Wake Forest Law Review Online*, *11*, p. 153.

to the Paris Agreement recorded in the NDC registry as of 23 September 2022.[86] The Report "shows countries are bending the curve of global greenhouse gas emissions downward but underlines that these efforts remain insufficient to limit global temperature rise to 1.5 degrees Celsius by the end of the century".[87] Meanwhile, the report finds that "[m]ost of the Parties that submitted new or updated NDCs have strengthened their commitment to reducing or limiting greenhouse gas emissions by 2025 and/or 2030, demonstrating increased ambition in addressing climate change".[88] These findings indicate that the Paris Agreement is functioning, though more ambitious commitments and actions are urgently needed to achieve the goal set in the Agreement.

In the space context, it could be likewise questionable whether self-defined commitments would be able to effectively solve the space debris problem. This doubt is reasonable and the question cannot be answered until such a pledge and review system is established to test the effectiveness of these commitments. However, it should be noted that the COPUOS Space Debris Mitigation Guidelines remain voluntary even fifteen years after adoption and the development of LTS Guidelines took almost a decade of negotiation marked with political tensions. Therefore, it does not seem likely that States are ready to accept specific legal obligations on debris mitigation and remediation. Rather, allowing States the discretion to make their own commitments appears the most realistic way forward. As pointed out by Hobe, "[t]he best space law cannot help improve the situation if the spacefaring states do not want to help".[89] The shaping of political will would be the most challenging part, and a step-wise approach through unilateral and multilateral commitments could hopefully trigger a snowball effect and prompt the whole international community to follow suit. In any event, the increasing imminence of the space debris problem will likely propel States to contribute their efforts and make commitments to mitigate and remove space debris.

5.1.4 Involvement of All Stakeholders: The Net Zero Space Initiative

The proposals for unilateral, multilateral and global commitments as discussed in the previous sections are centred on States. State commitments can be transformed into national legal order as licensing requirements and

86 The text of the 2022 NDC Synthesis Report is available at: <https://unfccc.int/ndc-synthesis-report-2022>.

87 UN Climate Change. (26 October 2022). Climate Plans Remain Insufficient: More Ambitious Action Needed Now. *UN Climate Press Release*. <https://unfccc.int/news/climate-plans-remain-insufficient-more-ambitious-action-needed-now>.

88 Ibid.

89 Hobe, S. (2012). Environmental Protection in Outer Space: Where We Stand and What is Needed to Make Progress with regard to the Problem of Space Debris. *Indian Journal of Law and Technology*, *8*, p. 10.

become binding requirements for the regulation of private space activities at the domestic level. Meanwhile, private entities are not merely regulatees and they are playing an ever-increasing role in the promotion of responsible behaviour in outer space. The SSC and CONFERS are good examples showing that the commercial industry can also contribute to broadening the boundaries of space law.

In view of the growing importance of the private sector, a global commitment to space sustainability would not be complete without the active involvement of private entities. In this regard, the "Net Zero Space" initiative launched at the 4th edition of the Paris Peace Forum in November 2021 can complement State-centered commitments to debris mitigation and remediation as it is targeted at all stakeholders involved in space activities.[90] The overall goal of the Net Zero Space initiative is to "ensure safe space operations and the long-term sustainability of outer space activities".[91] To this end, it calls for "a global commitment to achieving sustainable use of outer space for the benefit of all humankind by 2030".[92] In addition, the initiative recommends "urgent action from 2021 onwards to rapidly contain and then reduce the ongoing pollution of Earth's orbital environment:

- by avoiding further generation of hazardous space debris, and
- by remediating existing hazardous space debris."[93]

The Net Zero Space initiative is "a global, multistakeholder platform gathering actors from across the space value chain and beyond the industry to raise awareness on the pressing need to better protect Earth's orbital environment."[94] Up to December 2023, the initiative has 65 supporters from 24 countries, which covers a wide range of stakeholders including OOS and SSA providers, satellite operators, civil society and academic actors, space agencies and public authorities, and other stakeholders in the space sector.[95] This all-inclusive approach can leverage the potential of the space community across the globe consisting of both public and private actors to contribute to space safety and sustainability.

With regard to the merits of the Net Zero Space initiative, reference can be further made to the concept of the "polycentric approach" proposed by Elinor Ostrom, 2009 Nobel Laureate in Economic Sciences, to address the cli-

90 Net Zero Space. (November 2022). The Launch of Net Zero Space Initiative. <https://parispeaceforum.org/en/initiatives/net-zero-space/>.
91 Net Zero Space. The Net Zero Space Declaration. <https://www.netzerospaceinitiative.org/declaration>.
92 Ibid.
93 Ibid.
94 Net Zero Space. Sustainable Use of Outer Space by 2030. <https://www.netzerospaceinitiative.org/>.
95 Net Zero Space. Key Facts & Figures. <https://www.netzerospaceinitiative.org/supporters>.

mate change problem.[96] As submitted by Ostrom, it would take a long time to resolve many of the conflicts at high-level international negotiations over "who caused global [climate] change in the first place and who is responsible for correcting [it]".[97] However, without sufficient action undertaken, the climate change problem can only get more serious.[98] Therefore, while States should endeavour to reach international agreements on the reduction of greenhouse gas emissions, "the capabilities of people to organize at a local level" should not be overlooked.[99] To leverage such capabilities, fostering mutual trust among individuals that "others are also going to contribute to their solution" is crucial, and therefore successful efforts at a local scale should be advertised and made well known on a larger scale.[100]

A similar bottom-up approach can be achieved through the Net Zero Space initiative, calling for commitments by all stakeholders instead of relying solely on the commitments of States. This allows forward-looking stakeholders to take the lead and like-minded ones to join the initiative. In addition, the initiators of the Net Zero Space initiative have asked the Paris Peace Forum to host the secretariat of the initiative, "to report annually on the status of the initiative and promote subsequent steps towards the realization of the 'Net Zero Space' goal".[101] This annual review approach could facilitate information exchange among supporters of the initiative and demonstrate to the international space community the positive results that have been achieved by these supporters. This could help enhance mutual trust among supporters and propel other space operators to follow suit by declaring their commitments to space sustainability.

5.2 *Issue 2*: Establishment of Safety Guidelines and Standards for ADR

As observed by Freeland, while the fundamental rules and principles contained in the UN space treaties and general international law remain relevant and applicable to new activities and challenges in outer space, "they do not necessarily provide the specific standards or direction to provide clarity as to every aspect of the conduct of many such activities".[102] ADR

96 The New Humanitarian. (25 April 2012). Interview with Nobel Prize Winner Elinor Ostrom on Climate Change. <https://www.thenewhumanitarian.org/feature/2012/04/25/interview-nobel-prize-winner-elinor-ostrom-climate-change>.
97 Ibid.
98 Ibid.
99 Ibid.
100 Ibid.
101 Net Zero Space (2022), *supra* note 90.
102 Freeland, S. (2012). The Role of 'Soft Law' in Public International Law and its Relevance to the International Legal Regulation of Outer Space. In Marboe, I. (Ed.), *Soft Law in Outer Space: The Function of Non-binding Norms in International Space Law*, Böhlau Verlag, p. 18.

is one such novel activity that is subject to the general requirements and limitations set forth in international space law, whereas more specific norms as to how ADR activities are to be carried out in a safe and sustainable manner are missing.

In particular, as discussed in Chapter 3, Article IX of the Outer Space Treaty requires States Parties to conduct all their activities in outer space with due regard to the corresponding rights and interests of other States and to adopt appropriate measures to avoid harmful contamination of outer space. Since the generation of space debris would adversely affect the safety and sustainability of space operations, it can be inferred from this principle a requirement that States engaging in ADR activities should enhance the safety of their operations and minimise the generation of space debris. As noted in Chapter 4, soft law instruments can contribute to the clarification of concepts such as "due regard" and "appropriate measures", and thus the adoption of UN General Assembly resolutions and sets of guidelines for the governance of space activities may specify the general requirements under the UN space treaties and provide guidance to States regarding the way to comply with these requirements.

Meanwhile, the lack of a standard of fault for the establishment of liability in outer space may create legal uncertainty for entities engaging in ADR activities. As suggested in the *Report of the International Interdisciplinary Congress on Space Debris Remediation and On-Orbit Satellite Servicing*, it may be useful to establish a rule that "if someone does the right thing (e.g., by removing a non-functional object from orbit), then fault could be mitigated in some way".[103] This suggestion can be read in conjunction with the aim to maintain the long-term sustainability of outer space activities, as expressed in the LTS Guidelines.[104] As mentioned in Chapter 4, LTS Guideline D.2 recommends the investigation of new measures to manage the space debris population in the long term, which can include the development of ADR technologies. Therefore, ADR operators may well argue that their efforts to maintain the long-term sustainability of outer space activities should be duly considered for the determination of fault. As ADR operations aim to remove hazardous debris objects from orbit and can thereby reduce collision risks in outer space, it can be regarded as the "right thing" to do for the benefit and in the interests of all countries.

Meanwhile, in view of the complexity of and risks involved in ADR operations, it is essential for such "right thing" to be done in the "right way",

103 UN Doc. A/AC.105/C.1/2012/CRP.16 (27 January 2012). Active Debris Removal – An Essential Mechanism for Ensuring the Safety and Sustainability of Outer Space: A Report of the International Interdisciplinary Congress on Space Debris Remediation and On-Orbit Satellite Servicing, p. 32.

104 Preamble of the LTS Guidelines, para. 5.

i.e., to avoid causing harmful interference with the space activities of other States. As discussed in Chapter 4, soft law instruments may be considered in assessing whether a launching State should be held at fault for damage caused in space. Hence, if an internationally recognised instrument setting out guidelines and standards for safe ADR operations can be established, ADR operators will have more certainty to assess their risks of liability exposure. The commercial space sector has already published some guiding principles and recommended practices in this regard, which were used as the foundation for the development of ISO Standard 24330. To enhance the authoritativeness of these guidelines and standards, it would be desirable for States to adopt international guidelines for ADR activities, which can reflect the general consensus of States on the way to conduct ADR operations and be implemented by them in the licensing process. As these guidelines would generally reflect best practices, compliance with these guidelines can provide a basis for States engaging in ADR activities to argue that they are acting diligently within the current legal framework. Moreover, as these guidelines are designed to enhance mission safety, compliance with them can reduce the likelihood and consequences of mishaps, which thereby reduces the risks of liability exposure.

This section will discuss the development of guidelines with regard to ADR activities by States and international bodies. Section 5.2.1 will examine the draft guideline on the measures of precaution for preparing and conducting ADR operations, which was proposed during the development of the LTS Guidelines. Sections 5.2.2 and 5.2.3 will discuss some recent regulatory developments in the US and Japan which specifically address the governance of ADR activities. National guidelines and standards on space debris mitigation served as the foundation for the development of international guidelines on this matter, such as those produced by the IADC and COPUOS. Therefore, the development of national guidelines and practices addressing ADR can not only provide legal certainty to operators at the domestic level, but they can also be used as a basis for the establishment of international guidelines. Section 5.2.4 will discuss the path forward for the development of international guidelines for ADR operations.

5.2.1 Draft ADR Guideline Proposed in the Development of the LTS Guidelines

As discussed in Chapter 4, at its sixty-second session in 2019, COPUOS decided to establish the LTS 2.0 Working Group under a five-year plan.[105] COPUOS also defined a guiding framework for the Working Group, including to identify and study challenges and consider possible new guidelines for the long-term sustainability of outer space activities.[106] This could be

105 UN Doc. A/74/20 (2019). Report of the COPUOS on its sixty-second session, para. 165.
106 Ibid, para. 167.

done by taking into consideration existing documents including, *inter alia*, document A/AC.105/C.1/L.367, which contains seven draft guidelines for space sustainability on which consensus could not be reached and were therefore not included in the set of twenty-one LTS Guidelines adopted by COPUOS in 2019. Among these seven guidelines, *Guideline 20+21+part of 22* ("draft ADR Guideline") is particularly relevant to ADR for it provides measures of precaution for preparing and conducting ADR.

At the sixty-fifth session of COPUOS in 2022, the view was expressed that the plans of the LTS 2.0 Working Group to identify challenges and consider possible new guidelines were of relevance due, among other things, to the interests of States and commercial entities in ADR projects.[107] In addition, Italy underlined some of the outstanding new challenges for the consideration of the LTS 2.0 Working Group including, *inter alia*, "the active debris removal missions and their implications for the long-term sustainability of outer space activities".[108] In fact, ADR activities could affect the long-term sustainability of the space environment in two aspects. On the one hand, the removal of existing space debris is indispensable to the stabilisation of the space debris in Earth's orbits. On the other hand, ADR activities are inherently risky in that a collision between the ADR spacecraft and the target debris object may generate more space debris that deteriorates the outer space environment. Therefore, ADR operators should enhance mission safety to ensure that their missions contribute to solving, instead of worsening, the space debris problem.

In a conference room paper submitted at the sixtieth session of COPUOS STSC, Canada expresses the view that in light of the increasing congestion in outer space, one area that the LTS 2.0 Working Group could consider is ADR.[109] This could include "the development of recommended procedures for effective communication and notification of active debris removal activities; means to conduct these activities in a transparent manner, and techniques for these operations that promote spaceflight safety".[110] As submitted by Canada, the publications of CONFERS and the ISO Standard 24330 could provide a starting point for international discussion, which would help ensure that ADR is conducted in a manner that contributes to the long-term sustainability of outer space activities.[111]

107 UN Doc. A/77/20 (2022). Report of the COPUOS on its sixty-fifth session, para. 155.
108 UN Doc. A/AC.105/C.1/L.409/Add.4 (1 December 2022). Information and views for consideration by the Working Group on the Long-term Sustainability of Outer Space Activities, p. 13.
109 UN Doc. A/AC.105/C.1/2023/CRP.17 (6 February 2023), Consideration of areas for possible new guidelines concerning the long-term sustainability of outer space activities: Conference room paper by Canada, para. 3(c).
110 Ibid.
111 Ibid.

Since the LTS 2.0 Working Group will be guided by UN Document A/AC.105/C.1/L.367, the draft ADR Guideline may be considered by the Working Group in the development of new guidelines for space sustainability. This draft Guideline has two alternative formulations for the consideration of delegations. The two formulations share many commonalities.[112] They both recommend that when considering and conducting ADR operations, States and international intergovernmental organisations should ensure that such operations are "carried out in a manner that is consistent with the aim of ensuring the long-term sustainability of outer space activities".[113] To this end, they should identify, evaluate and mitigate the risks involved in these operations, including the risks posed to space objects of other parties.[114]

Both alternatives also encourage States and international intergovernmental organisations contemplating ADR operations to provide information on such operations at the international level in advance, such as through UNOOSA or other appropriate channels.[115] The first alternative is more specific in this regard as it adds a recommendation that "the greater the probability of side effects from such an operation, the more detailed should be the information made available at different stages of the operation's preparation and implementation".[116] In addition, the first alternative encourages "the provision of information in an expeditious reactive mode or in a near-real-time mode" where practicable.[117] Since information sharing in a timely manner is essential for coordination among operators to avoid collision, such recommendations can help to enhance mission safety and reduce harmful interference.

Another issue that is addressed in both alternatives is the positive identification of the space object to be removed.[118] More specifically, they both underline the need to secure legitimate grounds for ADR operations, which depends on whether the specific space object planned for active removal, "and a specific physical object in orbit that is presumed to be or is associated with that space object, are in fact one and the same physical body".[119] In other words, entities engaging in ADR operations should ensure that no "wrong" space object, i.e., a space object that is not the intended removal target, will be mistakenly removed. This guideline could help avoid the

112 UN Doc. A/AC.105/C.1/L.367 (16 July 2018), Draft Guidelines for the Long-term Sustainability of Outer Space Activities: Working paper by the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities, pp. 4-5.
113 Ibid.
114 Ibid.
115 Ibid.
116 Ibid, p. 4.
117 Ibid.
118 Ibid, pp. 4-5.
119 Ibid.

provocation of potential tensions and conflicts resulting from the removal of an object under the jurisdiction of a third State, especially in light of the inherent dual-use capabilities of ADR technologies which could easily raise security concerns.

On top of the above common recommendations, each alternative addresses one additional issue. Alternative 1 addresses the issue of intentional destruction of space objects. It states that "States and international intergovernmental organizations should avoid any intentional destruction operations that could generate [long-lived] [long-term] debris, with the understanding that, under certain exceptional circumstances, such operations may need to be considered because the alternatives would have far more negative consequences".[120] Examples of these exceptional circumstances include "the need to avert an immediate or potential serious [threat] [risks] to human life, the environment or property in outer space or on the ground, in the air or at sea in the case of re-entry of the space object".[121] The topic of intentional destruction is also addressed in the aforementioned moratorium on direct-ascent anti-satellite testing, but this only bans one specific kind of intentional destruction. The exceptional circumstance may be discussed by States in the context of the circumstances precluding wrongfulness as discussed in Chapter 3, as the circumstances of distress and necessity also address situations where human life and other essential interests are at risk. In any event, it should be borne in mind that the intentional destruction of space objects may significantly deteriorate the orbital space environment and should in principle be prevented.

Alternative 2 addresses expressly the issue of prior consent. It provides that ADR operations "should be agreed to in advance by the authorities exercising jurisdiction and/or control over those space objects" to be removed, as well as in consultation with "the holders of proprietary or other legal rights with respect to those objects".[122] In other words, the non-consensual removal of space objects controlled, owned, or operated by other States or entities should be avoided.

In sum, the draft ADR Guideline provides a number of recommendations that should be considered by States and international organisations engaging in ADR activities. First, the Guideline sets forth a fundamental principle for ADR activities, namely that these activities should be carried out in a way that contributes to the long-term sustainability of outer space. In fact, as stated in another document that is also mentioned in the guiding framework for the LTS 2.0 Working Group, the safety issues related to ADR activities constitute the main concern of States, as such activities may in the

120 Ibid, p. 4.
121 Ibid.
122 Ibid, p. 5.

worst case lead to the production of new debris.[123] Hence, while ADR is necessary to stabilise the orbital environment, it should also be taken as a cautious move, so as not to let an activity with benign intent lead to a result worse than the *status quo* of the space debris situation.

To achieve the above aim, the Guideline provides more specific recommended measures. States and international organisations should assess and mitigate the risks involved in ADR activities. They are also encouraged to provide relevant information on such operations at the international level, which can facilitate consultation and coordination with the potentially affected entities and contribute to mission safety. In addition, States and international organisations should ensure that they do not mistakenly remove objects of other States, and obtain prior consent if they contemplate the removal of objects under foreign jurisdiction. This can help avoid provoking tensions and conflicts as a result of the non-consensual removal of space objects under the jurisdiction of other States. Finally, intentional destruction of space objects should be avoided unless in exceptional circumstances. These measures outline issues that should be considered by States and international organisations when engaging in ADR operations, but they are not sufficiently prescriptive about the way of implementation. From this perspective, they are more guiding principles for ADR activities than detailed design and operational standards specifying how ADR activities should be carried out. Therefore, while the adoption of the draft ADR Guideline in the future would be beneficial to enhance the safety of ADR activities, it is also advisable for the spacefaring nations to establish more specific guidelines for debris removal like the IADC Space Debris Mitigation Guidelines for debris mitigation. The recent regulatory development taking place in the US and Japan may inform future legal development in this regard.

5.2.2 Legal Developments in the US Relating to the Governance of ADR

The US has recently updated some of its national laws and standards to address the issue of ADR. The 2018 US Space Policy Directive-3 directed NASA to lead efforts to update the US *Orbital Debris Mitigation Standard Practices* (ODMSP) and establish new guidelines for satellite design and operation.[124] The revised ODMSP was published in November 2019, which is the first update to the ODMSP since its original publication in 2001.[125]

123 UN Doc. A/AC.105/2019/CRP.16 (18 June 2019). Meeting hosted by Switzerland on possible further work on the long-term sustainability of outer space activities: Background and Chair's Summary, p. 4.

124 Sec. 6(b)(i), US SPD-3, *supra* note 31.

125 U.S. Government Orbital Debris Mitigation Standard Practices, updated in November 2019 ("2019 ODMSP"). <https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf>. See also NASA Orbital Debris Program Office. *Orbital Debris Quarterly News*, *24*(1), January 2021, p. 1.

This 2019 update "incorporates new sections to clarify and address operating practices for" certain classes of space operations such as RPO, satellite servicing, and ADR.[126] The revised ODMSP focuses on the debris mitigation aspect of ADR by providing that ADR operations should follow the debris mitigation objectives like other space operations.

Also relevant to ADR is the reference to direct retrieval as one of the post-mission disposal methods. Objective 4-1.f of the 2019 ODMSP reads: "Direct retrieval: Retrieve the structure and remove it from orbit preferably at completion of mission, but no more than 5 years after completion of mission." As direct retrieval includes ADR activities, this means that ADR could be considered as a potential post-mission disposal measure.[127] To align its requirements with the 2019 ODMSP, NASA has updated its Standard 8719.14 in November 2021.[128] Reflecting the aforementioned Objective 4-1.f of the 2019 ODMSP, Requirement 4.6-1 of the NASA Standard lists direct retrieval as one of the options to accomplish post-mission disposal of space structures used for NASA space programs and projects.

Like NASA, the FCC has also updated in 2020 its rules regarding space debris mitigation to incorporate the technical guidance of the 2019 ODMSP and to address the developments in space technologies and activities. Among other issues, the FCC adopted in this update a requirement that in the licensing process of space stations, the applicant should disclose whether its spacecraft is capable of, or will be, performing proximity operations.[129] If so, the applicant should submit a statement "addressing debris generation that will or may result from the proposed operations, including any planned release of debris, the risk of accidental explosions, the risk of accidental collision, and measures taken to mitigate those risks".[130] According to the FCC, this disclosure requirement "follows the general approach in the revised ODMSP of analyzing such operations within the framework of standard debris mitigation objectives" and "provide[s] a vehicle for further review of those operations".[131] At the time, the FCC took note of the "evolving and developing nature" of RPO and considered it premature to adopt "more specific technical or operational requirements".[132]

In a *Notice of Proposed Rulemaking* (NPRM) published in 2018, the FCC observed that there are a number of specific technologies under development for direct spacecraft retrieval such as nets and harpoons, and sought

126 Preamble of the 2019 ODMSP.
127 FCC. (24 April 2020). *Mitigation of Orbital Debris in the New Space Age: Report and Order and Further Notice of Proposed Rulemaking*. FCC 20-54, para. 106.
128 NASA Standard 8719.14C, *Process for Limiting Orbital Debris*, approved 5 November 2021.
129 FCC 20-54 (2020), *supra* note 127, para. 123 & Appendix A.
130 Ibid, Appendix A.
131 Ibid, para. 123.
132 Ibid.

comments on "what weight, if any, the Commission should give to post-mission disposal proposals relying on direct spacecraft retrieval".[133] Similar to the case of RPO, the FCC concluded that "it would be premature to establish more detailed regulations in this area".[134] To the extent that applicants seek to rely on direct retrieval as a means of post-mission disposal, the plan may be considered by the FCC on a case-by-case basis.[135]

The issue of ADR is also addressed by the FCC in the context of in-space servicing, assembly, and manufacturing (ISAM) activities. As a first step towards the development of new rules to govern ISAM activities, the FCC issued in August 2022 a *Notice of Inquiry* (NOI) on ISAM.[136] The NOI stated that the FCC's orbital debris mitigation rules apply to all spacecraft operators seeking licenses from the FCC, including operators of ISAM missions.[137] Like the 2019 ODMSP, this affirms the application of space debris mitigation rules to ADR activities. The FCC is supportive of the continued advancement of technologies that would enable ADR and is interested in identifying how it can facilitate the advancement of these technologies.[138] To this end, the NOI sought comments on whether and how the FCC should consider ADR as a potential post-mission disposal strategy.[139]

In sum, current US space law specifically addresses two aspects of ADR activities. The first aspect is space debris mitigation. Both the 2019 ODMSP and the FCC affirm that ADR operations are subject to the relevant space debris mitigation requirements like other space activities. In addition, the 2019 ODMSP and NASA Standard 8719.14C provide that direct retrieval, which includes ADR, may be used as a means of post-mission disposal. The FCC is contemplating the weight it should give to direct retrieval as a debris mitigation strategy and how it may support the advancement of ADR technologies. The second aspect is the disclosure requirement. The FCC requires applicants to disclose the capability and plan of their spacecraft to perform proximity operations. As ADR involves proximity operations, the requirement applies *a priori* also to ADR operators. Meanwhile, the FCC finds that at the moment, more detailed technical and operational requirements for RPO and ADR operations would be premature due to the evolving and developing nature of these activities.

133 Ibid.
134 Ibid, para. 107.
135 Ibid.
136 FCC. (August 2022). Facilitating Capabilities for In-space Servicing, Assembly, and Manufacturing. FCC 22-66. <https://docs.fcc.gov/public/attachments/FCC-22-66A1.pdf>.
137 Ibid, para. 27.
138 Ibid, para. 29.
139 Ibid, para. 30.

5.2.3 The Japanese Guidelines and Standards Relevant to ADR

While the FCC considers it premature to develop specific rules for ADR, Japan has established two sets of guidelines applicable to the design and operations of ADR activities. The reason for the rapid steps taken by Japan to establish these guidelines may be explained by Japan's active engagement in ADR activities at both private and governmental levels. As mentioned in Chapter 2, the Japan-headquartered commercial company Astroscale is advancing and demonstrating key technologies for ADR operations. In addition, JAXA is in the process of developing its CRD2 program to remove a large debris object of Japanese origin in cooperation with private companies. In comparison, while the 2010 US National Space Policy directs NASA and the Department of Defense to "[p]ursue research and development of technologies and techniques […] to mitigate and remove on-orbit debris […]", no US governmental entity has currently been assigned the task of removing existing on-orbit debris.[140]

On 10 November 2021, the National Space Policy Secretariat (NSPS) of the Cabinet Office of Japan published the *Guidelines on a License to Operate a Spacecraft Performing On-Orbit Servicing* (Japanese OOS Guidelines).[141] This set of guidelines is applicable to the licensing of the operation of spacecraft designed to perform OOS missions.[142] Through the implementation of these guidelines, Japan aims to ensure that Japanese OOS missions are conducted in a safe and transparent manner and in compliance with international law.[143] The Japanese OOS Guidelines are designed to provide supplementary requirements for the licensing of OOS missions on top of the general licensing requirements for the operation of conventional spacecraft.[144] The instrument also provides some tips and sample measures on how to conform to these requirements.[145]

140 NASA Orbital Debris Program Office. Debris Remediation. <https://orbitaldebris.jsc.nasa.gov/remediation/>. The situation would likely change if the US ORBITS Act could be enacted as law, which would direct NASA to establish an Active Orbital Debris Remediation Demonstration Program to partner with industry in developing technology for remediating debris objects. The establishment of this program may motivate the US to develop more specific rules and regulations for ADR activities.

141 Japanese *Guidelines on a License to Operate a Spacecraft Performing On-Orbit Servicing*, published on 10 November 2021. A tentative English translation for reference purpose only is available on the website of the Cabinet Office of Japan. <https://www8.cao.go.jp/space/english/stm/index.html>.

142 Japan. (2022). *Japan Item 7 – "Report of the Scientific and Technical Subcommittee on its fifty-ninth session"*. <https://www.unoosa.org/documents/pdf/copuos/2022/Statements/7_Japan_r1.pdf>.

143 Ibid.

144 Sec. 1.1, Japanese OOS Guidelines.

145 Ibid.

The term "Active debris removal (ADR)" is defined in the Japanese OOS Guidelines as:

> "On-orbit servicing that removes either a spacecraft whose mission is terminating[146] or space debris from the current orbit to an orbit for disposal (including orbits for the Earth's atmospheric reentry)."[147]

According to the above definition, the Japanese OOS Guidelines categorise ADR as a subset of OOS and are therefore applicable to the licensing of ADR operations. As summarised by the NSPS, the guidelines contain the following four major requirements:[148]

1. Justifiability of purposes as a lawful business conduct
   The applicant for license should obtain consent from the entity which holds the proprietary and other legitimate rights to the client object.[149]

2. Reliability of subsystems of the servicer spacecraft to ensure mission safety
   Each subsystem of the servicer spacecraft must have the functions and capabilities to safely execute their associated operations.[150]

3. Establishment and enforcement of operations and management plan for the safe performance of OOS
   This includes a set of operational requirements for safe mission performance.[151] Specifically, for relocation or ADR missions, the client object should be transferred to an appropriate orbit in order not to interfere with the operation of third-party spacecraft.[152]

4. Information disclosure to enhance mission safety and transparency
   This concerns the disclosure of the main features of the mission and other associated information before the commencement of the mission as well as information on anomalies in the case of malfunction and other emergencies.[153]

As the SWF notes, a conundrum for the development of satellite servicing standards is "the interdependent nature of the government and industry efforts: industry is looking for regulatory certainty to be able to plan their

146 Thus, the definition of 'ADR' here includes end of life servicing. [Original footnote]
147 Sec. 3(4), Japanese OOS Guidelines.
148 NSPS. (November 2021). Japan's Guidelines on a License to Operate a Spacecraft Performing On-Orbit Servicing, p. 2. <https://qzss.go.jp/en/events/khp0mf000000l2j-att/0-2-2_CAO.pdf>.
149 Sec. 4.1, Japanese OOS Guidelines.
150 Sec. 5.2, ibid.
151 Sec. 5.3, ibid.
152 Sec. 4.2, ibid.
153 Sec. 4.3, ibid.

future missions, while governments need to know about future missions to establish regulatory frameworks".[154] In light of this conundrum, the Japanese OOS Guidelines represent a significant step forward, as the guidelines provide useful guidance for Japanese companies in the OOS and ADR industry to prepare and conduct their operations. In addition, regulatory uncertainty could affect private capital investment, for "investors are reluctant to invest in ventures that are mere 'not illegal' through silence in the law".[155] Therefore, the Japanese OOS Guidelines could help promote the development of the commercial OOS and ADR industry in Japan by providing certainty to these activities.

In addition to the Japanese OOS Guidelines, there is another Japanese document relevant to the safety of OOS missions, namely the *Safety Standard for On-Orbit Servicing Missions* ("JAXA OOS Standard") published by JAXA on 30 March 2020.[156] The Standard applies to "on-orbit servicing to be operated under liability" of JAXA.[157] Like the Japanese OOS Guidelines, the JAXA OOS Standard also includes ADR as a part of OOS.[158] Therefore, the document is applicable to JAXA's CRD2 program, which clarifies the safety and security requirements for the mission design and operations.[159]

The JAXA OOS Standard consists of basic requirements and specific requirements for OOS.[160] The basic requirements contain three measures:[161]

(1) Avoid unintended generation of space debris and loss of major functions that are required for the servicing spacecraft and client spacecraft to mitigate debris generation;
(2) Conduct a hazard analysis of the entire system involved in OOS and take appropriate safety measures to address the identified hazards;
(3) Consider adding fault tolerance or equivalent measures if due to the size, orbit or properties of the payload, a collision could lead to a catastrophic consequence.

The specific requirements are provided to deal with different categories of hazards such as collision caused by improper orbit and attitude control, structural failure, and failure caused by thermal incompatibility.[162]

154 SWF. (12 September 2022). Insight - Satellite Servicing Standards and Policy: A Progress Report. <https://swfound.org/news/all-news/2022/09/insight-satellite-servicing-standards-and-policy-a-progress-report>.
155 Blount (2019), *supra* note 36, p. 187.
156 JAXA. Safety Standard for On-Orbit Servicing Missions. JERG-2-026, 30 March 2020. <https://sma.jaxa.jp/en/TechDoc/index.html>.
157 Sec. 1, JAXA OOS Standard.
158 Sec. 3, ibid.
159 Yamamoto, T., Matsumoto, J., Okamoto, H., Yoshida, R., Hoshino, C., & Yamanaka, K. (2021). Pave the Way for Active Debris Removal Realization: JAXA Commercial Removal of Debris Demonstration (CRD2). *Proceedings of 8th European Conference on Space Debris*, p. 4.
160 Sec. 5, JAXA OOS Standards.
161 Sec. 5.1, ibid.
162 Sec. 5.2, ibid.

The guidelines and standards developed by Japan may serve as a basis for the development of international guidelines addressing ADR. In fact, the *Mid-to Long-term Policy on Efforts for Rule-Making on the Use of Earth Orbit* released by Japan in 2022 expresses the will of Japan to "take the initiative in making rules for the use of orbit ahead of other countries in order to promote discussions on STCM (space traffic coordination and management) and responsible behavior in outer space, and to help formulate rules and norms thereon".[163] Among other issues, this 2022 Policy states that Japan will study and develop mechanisms to promote the advancement of debris reduction and removal technologies by satellite manufacturers and operators, and then promote these mechanisms internationally so as to make them become international rules.[164]

5.2.4 The Way Forward for the Development of Safety Norms for ADR Activities

The above discussion on the national mechanisms of the US and Japan shows that some States are already taking initiatives to develop rules and guidelines for ADR operations. With the advancement of ADR technologies and the engagement of more States and private entities in ADR activities, it can be expected that more national regulations and standards will be developed to govern ADR. To enhance the harmonisation among the national mechanisms, it would be advisable for States to establish some internationally accepted guidelines and standards for ADR activities. Reference can be made to the aforementioned Sendai Communiqué of 2023, which expresses the commitment of the G7 nations to promote the technological and legal development for debris mitigation and remediation:

> "We strongly encourage further research and development of orbital debris mitigation and remediation technologies. We also strongly encourage development of national guidelines and regulatory frameworks for remediation that align with *guidelines developed within UN COPUOS*. We call for international cooperation, including through appropriate international bodies, that could encourage transparency and responsible remediation practices and foster the future development of international guidelines in this area."[165]

The above statement demonstrates the political will of the G7 nations to establish national and international guidelines for space debris remediation. In the Sendai Communiqué of 2023, the G7 nations commit to promoting debris mitigation efforts by continuing to act consistently with the COPUOS Space Debris Mitigation Guidelines and the LTS Guidelines.[166] The express

163 Sec. 1, *Mid- to Long-term Policy on Efforts for Rule-Making on the Use of Earth Orbit*, published on 28 March 2022. The English version of this policy is available on the website of the Cabinet Office of Japan: <https://www8.cao.go.jp/space/english/index-e.html>.

164 Sec. 3.3, ibid.

165 Sendai Communiqué of 2023, *supra* note 46, p. 5, emphasis added.

166 Ibid.

reference to "guidelines developed within UN COPUOS" in the above statement implies that future guidelines may be developed to provide design and operational guidance on how ADR activities should be conducted in accordance with the existing COPUOS guidelines, i.e., in a way to prevent the generation of space debris and contribute to the long-term sustainability of outer space activities.

As Japan has already developed national guidelines for ADR activities, the dissemination of these guidelines could "socialise" them and provide a basis for the development of technical standards and best practices at the international level.[167] As Martinez observes:

> "A number of soft law instruments are bottom-up technically-based instruments drawn from technical standards and best-practice guidelines based on the experiences of States in the safe conduct of space operations. Other States may use these soft law instruments as a basis for enhancing their own national regulatory frameworks and associated administrative procedures."[168]

An example of this bottom-up process is the development of international space debris mitigation guidelines and standards, which were formed on the basis of national guidelines and best practices in this area. In 1995, NASA published NASA Safety Standard (NSS) 1740.14 and became the first space agency in the world to issue a comprehensive set of space debris mitigation guidelines.[169] The NSS 1740.14 (1995) provided the baseline for the development of the 2001 ODMSP, which "served as one of the primary sources" for the development of the IADC Space Debris Mitigation Guidelines and later the COPUOS Space Debris Mitigation Guidelines".[170] Very soon after the publication of NSS 1740.14, other space agencies began to follow suit, including the NASDA (now JAXA), the CNES, ESA, and the RSA (now Roscosmos).[171] Like the NSS 1740.14, these space guidelines also informed the development of the IADC Space Debris Mitigation Guidelines,[172] which reflected "the fundamental mitigation elements of

167 Martinez, P. (2020). The Role of Soft Law in Promoting the Sustainability and Security of Space Activities. *Journal of Space Law*, *44*(2), p. 530.

168 Ibid.

169 Reynolds, R., Eichler, P., & Johnson, N. (1997). An Overview of Revised NASA Safety Standard 1740.14. *Proceedings of 2nd European Conference on Space Debris*, *393*, p. 721. See also NASA Orbital Debris Program Office. Debris Mitigation. <https://orbitaldebris.jsc.nasa.gov/mitigation/>.

170 Compendium of Space Debris Mitigation Standards Adopted by States and International Organizations (15 May 2023), p. 88. <https://www.unoosa.org/oosa/en/ourwork/topics/space-debris/compendium.html>.

171 Mudge, A. G. (2022). Incentivizing 'Active Debris Removal' Following the Failure of Mitigation Measures to Solve the Space Debris Problem: Current Challenges and Future Strategies. *Air Force Law Review*, *82*(1), p. 105.

172 See the original version of the IADC Space Debris Mitigation Guidelines published in 2002, as contained in UN Doc. A/AC.105/C.1/L.260 (29 November 2002), which listed a series of documents and study reports published by States and international organisations from which the IADC obtained information in the process of producing the IADC Guidelines.

a series of existing practices, standards, codes and handbooks developed by a number of national and international organizations".[173] The IADC Space Debris Mitigation Guidelines were then used as a foundation for the development of other international guidelines and standards on space debris mitigation. These international instruments could be implemented by States in their national regulatory frameworks for the licensing of private space activities. Hence, the development of national and international mechanisms can be regarded as a two-way traffic, i.e., the development of national and international guidelines is mutually supportive. As observed by Vedda, the current space debris mitigation guidelines and standards "are the results of a gradual evolution on both domestic and international fronts".[174]

As Japan and the US have developed some national guidelines and standards to govern ADR activities, these national initiatives could provide useful models for other interested States to develop their own national mechanisms in this area. Since the draft LTS ADR guideline for which consensus could not be reached is contained in a document that forms part of the guiding framework for the future work of the LTS 2.0 Working Group, it could be used as a basis for further negotiations. In the meantime, States, especially those with ADR capabilities, could contribute their insights and opinions for the consideration of the Working Group. In fact, according to the *Draft terms of reference, methods of work and workplan* of the LTS 2.0 Working Group, the Working Group will invite contributions from COPUOS States members for further discussion at its meetings.[175] Hence, some basic principles to ensure the safety of ADR activities can be developed in the context of space sustainability within COPUOS. These basic principles would be essential because although only a few spacefaring nations are technologically capable of conducting ADR activities, such activities could adversely affect all other States if carried out in a reckless and irresponsible manner. At the same time, as the issue of ADR is but one topic of space sustainability, the LTS 2.0 Working Group may not be an ideal forum to develop a comprehensive set of detailed ADR guidelines and standards. For instance, while the draft ADR Guideline recommends States to assess and mitigate risks in planning and conducting ADR activities, it does not provide specific implementation guidance. Considering the technical complexity of ADR activities, it would be useful to adopt an international instrument providing more detailed technical and operational guidelines for these activities.

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173 Sec. 2, COPUOS Space Debris Mitigation Guidelines.

174 Vedda, J. A. (March 2017). Orbital Debris Remediation Through International Engagement. *The Aerospace Corporation*, p. 2.

175 UN Doc. A/AC.105/C.1/2022/CRP.13 (7 February 2022). Draft terms of reference, methods of work and workplan of the Working Group on the Long-term Sustainability of Outer Space Activities: Conference room paper by the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities, para. 14.

As discussed in Chapter 4, there are already some principles, standards and best practices developed for OOS and RPO, including those published by the CONFERS and the ISO. These documents can provide a basis for spacefaring nations to develop and adopt a set of commonly accepted guidelines for ADR activities. The IADC could serve as a forum for the future negotiation and development of a set of guidelines for the design and operations of ADR, for two main reasons. Firstly, the technologies to enable ADR operations are mastered by only a few leading space agencies, and thus only these agencies have relevant experience and insights on how ADR operations should be planned and executed in a safe manner. Since the members of the IADC represent virtually all the leading space agencies in the world, the IADC can be seen as an appropriate international body with relevant expertise to develop ADR guidelines. It should be recalled that the primary purposes of the IADC include "to exchange information on space debris research activities between member space agencies" and "to facilitate opportunities for cooperation in space debris research".[176] As ADR activities are still at a nascent stage, it would be helpful for States actively engaging in ADR to share their experiences and safety concerns regarding these activities, which can inform the future development of guidelines for ADR.

Secondly, the IADC has already touched upon the issue of ADR. While the IADC Space Debris Mitigation Guidelines focus on debris mitigation, Section 5.3.2 of the instrument provides that "[r]etrieval is also a disposal option" for the post-mission disposal of objects passing through the LEO region. As mentioned earlier, ADR can be considered as a means of direct retrieval. More importantly, the IADC ADR Statement provides some useful recommendations on ADR activities including, *inter alia*: "Debris removal activities must be conducted in accordance with both, national and international law, and in a manner that does not unduly impose hazards to space systems in orbit or to people and property on Earth from reentering debris."[177] On the basis of this general principle for ADR activities, it would be helpful for the IADC to provide specific guidance on the measures that should be taken to implement this principle.

In short, since the IADC consists of all the major spacefaring agencies and has already started to address ADR, it appears as an appropriate international forum where the leading space agencies in the world could discuss and develop safety guidelines for ADR activities. This can be achieved by drawing upon the existing standards and practices as developed by national and international entities, like how the IADC did to develop and revise its space debris mitigation guidelines. Once established, these ADR guidelines should be kept as a living document to be periodically reviewed and updated so that they can keep in step with technological advances

176 IADC. About. <https://www.iadc-home.org/what_iadc>.
177 IADC ADR Statement (2022), *supra* note 28, p. 1.

and continue to ensure that ADR activities are conducted in a manner that contributes to the long-term sustainability of outer space activities and does not unduly pose hazards to others.

5.3 *Issue 3*: Recommendations to Promote Consensual ADR Operations

As discussed in Chapter 3, the jurisdiction and control retained by the State of registry over its space object is not affected by the functionality of such object. Therefore, an ADR operation targeting a debris object under foreign jurisdiction can only be conducted with the formal consent of its State of registry, otherwise this would constitute an infringement of Article VIII of the OST. Therefore, a debris object can only be removed either by the State of registry itself or with its explicit permission.[178]

Considering that non-consensual ADR may be regarded as a threatening and hostile act by the State of registry, which could potentially disturb international peace and security, this in principle does not appear a feasible option. Therefore, this section will discuss how the obstacle posed by Article VIII of the Outer Space Treaty could be tackled on a consensual basis. Section 5.3.1 will assess two key legal issues that may need to be addressed by States when entering into international arrangements or agreements for cooperative ADR projects. Section 5.3.2 will propose the provision of additional information about the removability of space objects to the UN to facilitate the seeking of approval for removal by other States. Section 5.3.3 will discuss the legal issues related to the removal of space debris of unknown origin and suggest States to conclude an agreement to generally consent to the removal of small debris fragments under their jurisdiction. Section 5.3.4 will propose the adoption of a UN General Assembly resolution to incorporate the recommendations made in this section.

5.3.1 Consultation and International Cooperation for ADR

Even though space debris is by definition non-functional, it might still serve some practical purposes and/or represent some real value to its owner and State of registry.[179] For instance, defunct satellites and rocket stages in orbit may contain materials that may be collected for re-utilisation.[180] Also, some

178 Popova, R., & Schaus, V. (2018). The Legal Framework for Space Debris Remediation as a Tool for Sustainability in Outer Space. *Aerospace*, *5*(2), p. 9.

179 Von der Dunk, F. G. (2010). Too-Close Encounters of the Third Party Kind: Will the Liability Convention Stand the Test of the Cosmos 2251-Iridium 33 Collision?. *Proceedings of International Institute of Space Law*, p. 203.

180 Koch, F. (2021). The Value of Space Debris. *Proceedings of 8th European Conference on Space Debris*, pp. 1-5.

defunct spacecraft of special status can represent a symbol of national prestige and thus have cultural and historical significance, such as the "Dong Fang Hong" satellite, China's first artificial satellite launched on 24 April 1970, which currently remains in orbit around the Earth.[181] Therefore, it is still for the State of registry of a space object to make a determination of its residual value after mission completion.[182]

As the removal target may contain sensitive data, to determine whether to grant or refuse approval, the State of registry would need to know the details of the planned ADR operations in order to assess whether there are risks of information divulgence that could threaten its national security interests. Therefore, the seeking of approval would likely start from information sharing. Reference can be made to a draft principle for responsible behaviour in space proposed by Germany titled "*Considerations in relation to rendezvous operations*":

> "States should not conduct or knowingly support rendezvous operations unless a State has reasonable grounds for the rendezvous operation and the affected other State has given consent. States should notify such rendezvous operations to affected States and should submit a request for consent to these States in advance of the manoeuvre. Notifications leading to consultations should include at least the planned timing, trajectory and objective of the manoeuvre".[183]

The above proposed principle addresses two categories of information, namely the rationale for removal and the basic information of the planned mission. As to the former, the State of registry may want to know the reasons for selecting its space object as a removal target. One possible reason could be that such debris object poses a significant threat to the operational safety of the State requesting approval. As to the latter, the sharing of information on the nature of the activity would enable the State of registry to estimate the relevant risks of such activity.

As an ADR operation may involve complex technical and legal issues, if the requesting State and the State of registry are interested in proceeding with the removal following the stage of information exchange, they may need to conclude a bilateral agreement to address these issues. There are two essential issues that would need to be considered by States in their cooperative arrangement, namely liability apportionment and export control. These issues will be discussed in the following two sub-sections.

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181 For more details see the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) of China. (Updated 24 April 2020). Dongfanghong 1, China's First Independently Developed Satellite, is Launched Successfully on April 24, 1970. <http://en.sasac.gov.cn/2020/04/24/c_1360.htm>.

182 Von der Dunk (2010), *supra* note 179, p. 203.

183 UN Doc. A/76/77 (13 July 2021). Report of the UN Secretary-General on Reducing space threats through norms, rules and principles of responsible behaviours, p. 49.

5.3.1.1 Apportionment of Liability for Damage Caused

The first issue is the apportionment of liability for damage caused to space objects of third parties. As ADR operations entail greater risks than conventional space activities, especially during the rendezvous, capture and relocation phases, there is accordingly a higher probability of liability exposure. Therefore, States involved in the ADR operations may enter into prior agreements to determine which State should bear what liability and to what extent.[184] The Liability Convention provides that the participants in a joint launching may conclude agreements regarding the apportioning among themselves of the financial obligation to compensate third parties for the damage caused.[185] When the State of registry of a debris object purchases removal services from another State, it can be regarded as the State which "procures" the launching of the removal spacecraft, and can thus be qualified as a "launching State" of such spacecraft.[186] Therefore, the Liability Convention can serve as a basis for the conclusion of an agreement to apportion liability among the States concerned.

Reference can further be made to UN General Assembly resolution 59/115 of 2004 which recommends States to "consider the conclusion of agreements in accordance with the Liability Convention with respect to joint launches or cooperation programmes".[187] The ADR program is beyond doubt also a "cooperation program" as States need to work closely, including in data sharing, to ensure the success and safety of the mission. Therefore, this resolution could also be seen as a basis for States to conclude agreements for the apportioning of liability for damage caused. In any event, each State possesses the capacity to conclude treaties, and there is no law prohibiting States involved in an ADR project from apportioning among themselves the ultimate burden of compensation through agreements.[188]

In an ADR operation, damage to a third party in outer space could be caused either by the removal spacecraft or the target debris object, and their respective launching States could be held liable if "fault" can be established. Obviously, before the removal spacecraft conducts any operation in relation to the target debris object that alters its trajectory, the launching State of the removal spacecraft should not be held liable for damage caused by the debris object. Meanwhile, since the capturing and detumbling phases when the removal spacecraft exerts some physical impacts on the target debris

184 Way, T. & Koller, J. (22 April 2021). Active Debris Removal: Policy and Legal Feasibility. *The Aerospace Corporation*, p. 4.

185 Art. V(2), Liability Convention.

186 Way & Koller (2021), *supra* note 184, p. 4.

187 UN Doc. A/RES/59/115 (10 December 2004), UNGA resolution on Application of the concept of the "launching State".

188 Art. 6, Vienna Convention on the Law of Treaties, adopted 22 May 1969, entered into force 27 January 1980, 1155 UNTS 331: "Every State possesses capacity to conclude treaties."

object which subsequently causes damage to a third party, a causal link can arguably be established between the removal spacecraft and the damage caused. For instance, this could be a scenario where a removal spacecraft accidentally "bumps" the debris object out of its original orbit which, as a consequence, causes damage to a third party's spacecraft.[189]

During the RPO when the removal spacecraft approaches the target debris object, there is a risk that these two objects may collide, and the debris fragments thereby generated cause damage to other spacecraft. Under the Liability Convention, the launching States of the former two spacecraft, if proven at fault, would be held jointly and severally liable for the damage caused. Following the grappling phase, the removal spacecraft and the target debris object might become one combined stack which moves towards a graveyard or re-entry orbit for the purpose of disposal. Damage may be caused by the combined stack to other space objects during the orbit transfer. In light of their involvement in the ADR operation, both the removal spacecraft and the target debris object seem to have some causal links with the damage.[190] However, the operator of the removal spacecraft appears more likely to be blamed as it is executing actual control over the combined stack.

Fault-based liability applies in the above scenarios, as damage is caused to objects in outer space. Meanwhile, damage may also be caused to the ground, e.g., the removal spacecraft accidentally causes the uncontrolled re-entry of the target debris object which survives the re-entering process and inflicts damage to persons or property on Earth. In this case, the launching States of the target debris object would be absolutely liable for compensation. The States involved in an ADR operation may conclude agreements to specify how the burden of compensation for the damage is to be apportioned among them if damage occurs.

For the harmonisation of practices on liability apportionment, an analogy could be drawn from the International Commercial Terms (Incoterms) rules published by the International Chamber of Commerce (ICC), which define a series of standardised trade terms for the sale of goods.[191] For example, the transaction parties may choose to agree that risks of loss of or damage to the goods transfer from the seller to the buyer from the point when the goods are loaded on the vessel nominated by the buyer at the named port of shipment. Similarly, for an ADR operation, the States involved may agree, for instance, that the State operating the removal spacecraft bears

189 Blount (2019), *supra* note 36, p. 184.

190 In spite of their combination into one "stack", these two spacecrafts should still be considered distinct space objects as they are registered by different States.

191 The latest edition of the Incoterms rules is Incoterms 2020. The previous edition, Incoterms 2010, remains in effect for those using them. See ICC. Incoterms 2020. <https://iccwbo.org/resources-for-business/incoterms-rules/incoterms-2020/>.

the ultimate burden of compensation for any third-party liability from the moment when the removal spacecraft or its components parts contact the target debris object.

5.3.1.2 Legal Arrangements for Export Control

A critical challenge for international cooperation in ADR programs is export control. To safely rendezvous with, grapple and remove a debris object, the State of registry may need to share potentially sensitive data of such object to the engaging State.[192] These data may involve essential interests such as national security and intellectual property rights.[193] Therefore, the removal by one State of an object under the jurisdiction of another State may trigger the application of export control laws and regulations of the latter State.[194] As a result, cooperative ADR missions are more likely to occur among mutually trusted or allied States.[195]

The export control restrictions do not necessarily rule out the possibility of the removal of objects under foreign jurisdiction. For instance, the US ORBITS Act expressly addresses international cooperation in ADR program.[196] The Act, which would direct NASA to establish an ADR demonstration program, provides that in carrying out such program, "it is critical that the Administrator [of NASA], in coordination with the Secretary of State and in consultation with the National Space Council, cooperate with one or more partner countries to enable the remediation of orbital debris that is under their respective jurisdictions".[197] Therefore, should this bill be passed as law, the US may consider removing space debris under the jurisdiction of other States through international cooperation.

To alleviate export control concerns, the State of registry could conclude an agreement with the engaging State to limit the use and dissemination of sensitive technical data. Reference can be made to the 1998 ISS Intergovernmental Agreement (IGA), which sets forth restrictions for the transfer of technical data and goods under the Agreement.[198] Under the ISS IGA, tech-

192 Way & Koller (2021), *supra* note 184, p. 10.

193 NRC. (2011). *Limiting Future Collision Risk to Spacecraft: An Assessment of NASA's Meteoroid and Orbital Debris Programs*. The National Academies Press, p. 84. <https://doi.org/10.17226/13244>.

194 Way & Koller (2021), *supra* note 184, p. 10.

195 Ibid.

196 Sec. 4(b)(7), US ORBITS Act, *supra* note 5.

197 Ibid.

198 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 ("ISS-IGA"), Washington, done 29 January 1998, entered into force 27 March 2001. The text of the ISS-IGA is available at: <https://www.state.gov/wp-content/uploads/2019/02/12927-Multilateral-Space-Space-Station-1.29.1998.pdf>.

nical data or goods that are to be protected for export control purposes shall be marked by the furnishing Cooperating Agency with a notice or specific identification, which shall indicate any specific conditions regarding the use of such technical data or goods.[199] The conditions include: (1) such technical data shall be used only for the purposes of fulfilling the responsibilities of the receiving Cooperating Agency under the IGA or relevant Memorandums of Understanding (MOUs), and (2) such technical data or goods shall not be used by any third parties or for any other purposes without the prior written permission of the furnishing Cooperating Agency.[200] Similar restrictions are made for technical data to be protected for proprietary rights purposes as well as for classified technical data and goods.[201] Modelling after these provisions, should the States involved in an ADR operation consider it necessary, they could make similar legal arrangements for data management and protection.

Due to the strategic sensitivity of ADR technologies, export control issues may also constitute a hurdle for States to pool their resources to jointly develop ADR technologies and programs.[202] Under US law, technologies involved in ADR operations can likely match several descriptions on the United States Munitions List (USML), a list identifying defence and space-related articles, services, and technical data subject to the US International Traffic in Arms Regulations (ITAR).[203] In particular, paragraph (a)(12) of Category XV of USML entitled "Spacecraft and Related Articles" applies to spacecraft that "[a]re specially designed to provide inspection or surveillance of another spacecraft, or service another spacecraft via grappling or docking". Therefore, the export of many ADR technologies is regulated under the ITAR, and a license has to be obtained from the US Directorate of Defense Trade Controls (DDTC). Besides ITAR, dual-use space products and technologies listed on the Commercial Control List (CCL) are subject to export control under the Export Administration Regulations (EAR), which may apply to some less-sensitive items and technologies used for ADR operations.[204]

In addition to export control regulations, there may be other legal and political restrictions that could hinder international cooperation. For instance, in

199 Art. 19(3)(a), ISS-IGA.
200 Ibid.
201 Art. 19(3)(b) & Art. 19(3)(c), ibid.
202 Popova & Schaus (2018), *supra* note 178, p. 10.
203 For a discussion on the application of US export control regulations to ADR and OOS technologies see Rivière, A. (2020). Potential Export Control Challenges and Constraints for Emerging Space Debris Detection and Removal Technologies: The Case of On-Orbit Collision. *Advances in Astronautics Science and Technology*, *3*(2), pp. 105-114.
204 US Department of Commerce and Federal Aviation Administration. (November 2017). *Introduction to U.S. Export Controls for the Commercial Space Industry*. 2nd ed., p. 5. <https://www.space.commerce.gov/regulations/satellite-export-control-regulations/>.

2011, the US Congress included a passage, known as the Wolf Amendment, in the annual Commerce, Justice, and Science (CJS) appropriations bill.[205] This bill restricts NASA, the Office of Science and Technology Policy (OSTP) and the NSC from cooperating with China and Chinese-owned companies.[206] The Wolf Amendment constitutes a hurdle for the US and China, the two major spacefaring nations in the world, to enter into cooperation in the space field.[207]

In light of these legal restrictions, together with the dual-use sensitivity of ADR technologies, although it would be desirable for the international space community to pool technical and financial resources into the advancement of ADR technologies and the execution of ADR programs, global-scale cooperation does not seem practicable at least in the near future. Meanwhile, States and international organisations, such as those that have established traditions of cooperation in the space field, may collaborate among themselves at a smaller scale through bilateral or multilateral agreements to jointly develop ADR technologies and perform ADR missions. ESA's Sunrise project, which has been financially backed by the UK Space Agency and includes the development of ADR technologies, illustrates the feasibility of international cooperation in ADR activities.[208]

5.3.2 Provision of Information on the Removability of Space Debris

As discussed in Chapter 4, although UNGA Resolution 62/101 recommends States to provide the UN Secretary-General with additional information regarding the change of operational status of their space objects, pursuant to Article VIII of the OST, the valid consent of the State of registry is still needed for the removal of its non-functional objects, i.e., space debris. Since even a defunct space object may still involve strategic and national security interests, States would need to determine the grant of permission for removal according to the sensitivity of the target concerned. The higher the sensitivity level, the more defensive the State of registry could be to avoid the divulgence of classified information entailed in the space object

205 The passage is commonly referred to as the "Wolf Amendment" because it was introduced by Representative Frank Wolf of Virginia. See e.g., Marshall, W., & Hadfield, C. (15 April 2021). Why the U.S. and China Should Collaborate in Space. *Time*. <https://time.com/5954941/u-s-china-should-collaborate-in-space/>

206 Ibid.

207 This hurdle is not unsurmountable. A recent instance is that NASA-funded researchers have been granted permission from the Congress, in an exception to the prohibition on bilateral activities according to the Wolf Amendment, to apply for access to portions of samples collected by China's Chang'e-5 mission. See Jones, A. (1 December 2023). NASA Researchers Get Permission to Apply for China's Moon Samples. *SpaceNews*. <https://spacenews.com/nasa-researchers-get-permission-to-apply-for-chinas-moon-samples/>.

208 ESA. (24 May 2021). First Leap for Beam-Hopping Constellation. <https://www.esa.int/Applications/Telecommunications_Integrated_Applications/First_leap_for_beam-hopping_constellation>.

as a result of removal by others. Therefore, it is ultimately at the discretion of the State of registry to determine whether and how its space objects are to be removed.

Following an evaluation of the sensitivity of its space objects, the State of registry may decide that some of its debris objects are closely associated with its national security interests for which no permission for removal would be granted in any event, while some do not contain any sensitive information. There could also be objects in between these two cases for which the grant of removal permission is possible but further negotiations are needed according to the circumstances. For instance, from an export control perspective, it is more likely for the US to grant permission to its allies such as Japan and the UK than to other countries.[209]

To facilitate the removal of space objects under foreign jurisdiction, this dissertation proposes that the UN General Assembly could recommend its member States to furnish "additional information" on the removable status of their space objects to UNOOSA. For instance, States may categorise their non-functional objects in orbit as non-removable, negotiable, and free for removal, or as appropriate into more specific classifications. The State of registry may impose conditions on the removal operations, such as restrictions on the removal methods to reduce the need to share sensitive data.[210] If it so wishes, the State of registry may also include in the notification the reward it is willing to pay for the removal, motivated by, for instance, its desire to live up to the commitment it has made to remove space debris. This provision of additional information can be regarded as an invitation to tender to the international community, and a State interested in the removal may enter into consultation with the State of registry to determine the technical and legal issues involved in the ADR operation. Through the consultation process, the State of registry could exercise necessary control over the planning and conducting of the operation to ensure that its interests would not be adversely affected.

As noted in Chapter 2, to preserve the long-term sustainability of the outer space environment, priority of debris removal should be given to massive space objects with a high risk of collision, as they are potential sources of fragmentation debris. Therefore, States may individually or jointly establish a list of the most dangerous space debris objects under their jurisdiction and provide, to the greatest extent feasible, information on the removable status of the top-ranking objects. The list of the top 50 statistically-most-concerning objects in LEO produced by a global consortium of experts could serve

209 Way & Koller (2021), *supra* note 184, p. 10.

210 As submitted by Way and Koller, "a debris-capturing net would not necessarily require many technical details of the internals of the satellite" compared to the use of other more sophisticated docking mechanisms. See ibid.

as a basis for international discussion.[211] A step towards this direction may be taken by the US if its ORBITS Act can be passed as law, which would direct the Secretary of Commerce to lead the efforts in publishing a list of identified space debris that "may be remediated to improve the safety and sustainability of orbiting satellites and on-orbit activities".[212] If the major spacefaring nations could provide in good faith information on the removability of their most dangerous debris objects, then the international community could have a good list of removal targets for ADR operations.

5.3.3 Removal of Space Objects of Unknown Origin

As the current space surveillance systems only allow the tracking and cataloguing of objects larger than 5-10 cm in LEO and larger than 0.3-1.0 m in GEO, the origin of most debris objects cannot be identified. Therefore, a question arises as to whether objects of unknown origin can be targeted for removal, if in the future the removal of small-sized debris objects becomes a feasible option. Pursuant to Article VIII of the OST, the State of registry retains jurisdiction and control over its space object after its useful life, and even after such object has been fragmented into pieces. In addition, the owner retains perpetual ownership of its space object, whether such object remains in outer space or returns to Earth. Therefore, the break of identity link between the State of registry and its space object does not affect the sovereign and ownership link between them from a legal perspective.

Reference can be made to Article X(2) of the Liability Convention, which provides that if "a State does not know of the occurrence of the damage or has not been able to identify the launching State which is liable, it may present a claim within one year following the date on which it learned", or should have learned through the exercise of due diligence, of the aforementioned facts. This provision indicates that the unidentifiability of a space object causing damage does not exonerate its launching States from liability of compensation, which can be subsequently claimed by the injured State following the establishment of the identity within the one-year time limit. As the liability link is not cut off even when the identity of a space object cannot be ascertained, so should the sovereignty link between the State of registry and its space object. An understanding otherwise would render the allocation of responsibility and liability under international space law asymmetric.[213]

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211 McKnight, D. S., Witner, R., Letizia, F., Lemmens, S., Anselmo, L., Pardini, C., Rossi, A., Kunstadter, C., Kawamoto, S., Aslanov, V., Dolado Perez, J.-C., Ruch, V., Lewis, H., Nicolls, M., Liu, J., Shen, D., Wang, D., Baranov, A., & Grishko, D. (2021). Identifying the 50 Statistically-Most-Concerning Derelict Objects in LEO. *Acta Astronautica*, *181*, pp. 282-291.

212 Sec. 4(a), US ORBITS Act, *supra* note 5.

213 Su, J. (2016). Active Debris Removal: Potential Legal Barriers and Possible Ways Forward. *Journal of East Asia and International Law*, *9*, p. 408.

In addition, an attempt to argue that a space object becomes *res nullius* when its identity cannot be ascertained can create complexities in practice, for there is no global unitary SSA data centre. The leading spacefaring nations and agencies in the world have developed their own SSA capabilities, and there are also private entities such as the Space Data Association (SDA), which is an organisation of satellite operators that collect and share SSA data.[214] Therefore, if the existence of sovereignty rights and ownership is contingent on the identifiability of space objects, a question may arise as to how to deal with the information inconsistency among different SSA systems. This approach would also render the legal status of unidentifiable objects unstable, for with the advancement of SSA technologies, a space object of unknown origin today may be able to be associated with a certain launching State tomorrow.

Still, it is impossible for a State planning an ADR mission to request consent for the removal of an unidentifiable object, for the launching State of such object is unknown. As submitted by Larsen, uncertainty about ownership of unidentifiable space debris creates "legal difficulty as to the right of third party states to remove such debris".[215] As a result, States would be hesitant to select this kind of object as their removal target.[216] In this regard, the CONFERS Recommended Practices provide a solution for servicing space objects with no known owner:

> "For cases where no owner of the space object can be identified (e.g., space debris objects) provide adequate public notice and communication of intent with all States agencies which may have reasonably been the source of the object. If the source is identified during/following the [on-orbit] service, notify the relevant States."[217]

Similar recommendations can be found in ISO 24330.[218] As noted in Chapter 4, both the CONFERS Recommended Practices and ISO 24330 apply to ADR, which is considered in these instruments as a category of OOS. Hence, the above recommendations are applicable to the removal of space debris of unknown origin. Admittedly, prior notification and timely communication of intent to States that are possibly the source of the object can increase the transparency of the removal missions and solve some problems

214 Blount, P. J. (2019). Space Traffic Management: Standardizing On-Orbit Behavior. *American Journal of International Law*, *113*, p. 122.In addition, private companies such as LeoLabs and NorthStar also collect SSA data and provide commercial SSA services. See e.g., Rainbow, J. (17 June 2022). Getting SSA off the Ground. *SpaceNews*. <https://spacenews.com/getting-ssa-off-the-ground/>.

215 Larsen, P. B. (2018). Solving the Space Debris Crisis. *Journal of Air Law and Commerce*, *83*(3), p. 486.

216 Ibid.

217 Sec. 1.4.1.2., CONFERS Recommended Practices.

218 Secs. 5.2.1.2. & 5.2.1.3., ISO 24330:2022.

by allowing the potential State of registry to claim identity. Yet, there remain several legal issues to be considered.

Firstly, there are issues relating to compensation and payment. On the one hand, if the origin of a de-orbited object is identified after the mission, can the State of registry claim compensation from the ADR operator by contending that the de-orbited object still has value? Or can the State of registry be asked to pay because a hazard has been removed from space? On the other hand, if the target debris object causes damage to third parties during the ADR operation, who is liable? The launching States of the ADR spacecraft could be liable if such spacecraft collides with the target debris object and thereby causes damage to others as per Article IV(1) of the Liability Convention. However, what if the debris object is accidentally and uncontrollably knocked out of orbit by the ADR spacecraft and thereby causes damage to a third State?[219] If the launching State of the target debris object is identified after the operation, should it be held at fault and liable for the damage caused?

Secondly, if the State of registry of the target debris object is identified and notified during the ADR operation, and such State requires the cessation of such operation, is the ADR operator obliged to cease the operation? If the operation is ceased, should the State of registry compensate the ADR operator for the expenses incurred for planning and conducting the ADR operation? What if the State of registry demands the ADR operator to relocate the removed object to its original position?

Thirdly, since there are many identifiable objects that could be selected as removal targets, especially many massive objects that are potentially a long-term source of space debris, selecting an object with no known owner as the removal target could raise doubts of other States as to the real intention underlying the ADR operation. In particular, knowledge of the physical state of the debris object, including its physical and orbital properties, is a critical factor relating to mission success.[220] In this sense, it would be presumably safer to select objects of known origin as removal targets since their owners may provide useful information to facilitate the removal operation. Therefore, to avoid unnecessary misunderstandings, the State planning the removal of an unidentifiable space debris object may need to explain the rationale for target selection in a public notice.

Until consensus can be reached among States on the above matters, the removal of objects of unknown origin may bring about many legal risks and uncertainties. In addition, there may also be political implications if

219 Blount (2019), *supra* note 36, p. 184.

220 May, C. R. (25 January 2021). Game Changer: Triggers and Effects of an Active Debris Removal Market. *The Aerospace Corporation*. <https://csps.aerospace.org/papers>.

the removed object is considered as entailing strategic values for its State of origin, which may be identified during or after the mission. Therefore, unless in exceptional circumstances where inaction would have far greater negative consequences, it is preferable for ADR operators to focus on objects of known origin.

As mentioned earlier, most unidentifiable debris objects are small fragments that cannot be tracked or catalogued by current SSA systems. While the removal of large and massive objects is generally considered to be a more practical and cost-effective option as these objects are the potential sources of small debris,[221] the removal of small-size debris can help to reduce the risk to the current fleet of operational spacecraft.[222] Therefore, when it becomes technically and economically feasible, entities possessing a vast amount of space assets in orbit would also have the motivation to remove small debris.[223] These entities may include spacefaring nations such as the US and mega-constellation operators such as SpaceX, which can have strong interests in ensuring the safety of their spacecraft.

Reference can be made to the "*Satellite Orbital Safety Best Practices*" jointly released by the American Institute of Aeronautics and Astronautics (AIAA) and the major constellation operators Iridium, OneWeb, and SpaceX in September 2022.[224] Among other things, the document recommends operators to "[i]nvestigate the active satellite populations and *known debris object densities* at the injection orbit and along the trajectory to the final orbit if needed" [italics added].[225] This indicates that space debris densities are something within the safety considerations of constellation operators. Therefore, if such densities substantially obstruct orbital accessibility in the future, these operators would likely initiate the clearance of the orbital space they need for the deployment of their constellations. With regard to governmental actors, the US ORBITS Act recognises that "[e]xploration and scientific research missions and commercial space services of critical importance to the United States rely on continued and secure access to outer space".[226] Similarly, China's national space policy states that "[t]he space industry is

221 UN Doc. A/AC.105/C.1/2012/CRP.16 (2012), *supra* note 103, p. 24.
222 NASA Orbital Debris Program Office. Debris Remediation. <https://orbitaldebris.jsc.nasa.gov/remediation/>.
223 For instance, small debris pieces may be removed through laser technology. See Dumestier, D., Scheidel, D., Rousset, H., Thiry, N., Peltoniemi, J., & Di, A. Space Debris Deflection by Space Based Laser Study. *Proceedings of 8th European Conference on Space Debris*, p. 1.
224 *Satellite Orbital Safety Best Practices Guide*, published 8 September 2022, updated 24 October 2022. <https://www.ascend.events/outcomes/satelittle-orbital-safety-best-practices-by-iridium-oneweb-spacex-aiaa/>.
225 Practice A-1, ibid.
226 Sec. 2(a), US ORBITS Act, *supra* note 5.

a critical element of the overall national strategy".[227] Therefore, it would be in the interest of the spacefaring nations to remove debris pieces in order to protect their space assets. In that case, the jurisdiction over small debris fragments would present a hurdle when with technological development, safe and affordable solutions for the removal of small debris pieces become available.

To overcome this obstacle, States may consider concluding an international agreement to jointly consent to the removal of small debris fragments under their jurisdiction in order to facilitate the removal of these fragments. In the agreement, the States Parties may define what "small debris fragments" means, e.g., space debris pieces below the size threshold of 5 cm. Since it is less likely for debris fragments to contain sensitive data compared to large intact space objects, there would be fewer strategic and national security concerns and thus easier for States to reach consensus. Reference can be made to draft guideline 22 proposed in the development of the LTS Guidelines.[228] This draft guideline recommends the establishment of a shared vision which allows States, consistent with their authority and responsibilities under international space law, to adjust the "status of space objects under their jurisdiction and control (including objects originally part of such space objects)" that have become non-functional, "so as to provide definitive eligibility with regard to potential international efforts" to remediate space debris.[229] This is particularly relevant to space debris fragments when "it is convincingly established that such fragments have irretrievably lost the ability to function or sustain functionality and that lifting constraints on their removal could be the best solution".[230] International bodies like COPUOS could promote this process by encouraging States to pursue negotiation in good faith on issues relating to the effective removal of debris fragments such as the determination of a commonly accepted size threshold and the investigation of reliable removal methods.

5.3.4 Adoption of a UNGA Resolution to Promote International Cooperation on ADR

The recommendations proposed in this section may be adopted by States in the form of a UN General Assembly resolution. Specifically, to facilitate international cooperation for debris removal, it would be beneficial for States to harmonise their practices, as this could provide more legal certainty and streamline the process of negotiation. An analogy can be drawn

227 State Council Information Office of China. (January 2022). *China's Space Program: A 2021 Perspective*. The text of the policy is available at: <https://www.cnsa.gov.cn/english/n6465645/n6465648/c6813088/content.html>.
228 UN Doc. A/AC.105/C.1/L.367 (2018), *supra* note 112, pp. 6-7.
229 Ibid, p. 7.
230 Ibid.

to UN General Resolution 59/115 of 2004, which recommends COPUOS to invite its Member States to "submit information on a voluntary basis on their current practices regarding on-orbit transfer of ownership of space objects".[231] The resolution further recommends States to "consider, on the basis of that information, the possibility of harmonizing such practices as appropriate with a view to increasing the consistency of national space legislation with international law".[232] Similarly, the UN General Assembly could adopt a resolution recommending States to share their experiences and standardise their practices regarding international cooperation in ADR.

The resolution can also recommend States to submit additional information to UNOOSA about the removability of their space objects, to establish a priority list of candidate debris targets for removal, and to pursue negotiations on the possible solutions for the remediation of small debris fragments. These recommendations could either be adopted as a distinct resolution dedicated to the enhancement of the practices of States in international cooperation regarding ADR, or be incorporated in the annual UN General Assembly resolution on international cooperation in the peaceful uses of outer space. If implemented by States in good faith, these recommendations could facilitate the seeking and granting of approval among States for the removal of existing debris objects in orbit that pose significant threats to space safety and sustainability. In addition, the recommendations may help to surmount the legal hurdle for the removal of debris objects of unknown origin, in particular small debris fragments.

5.4 *Issue 4*: Norms of Responsible Behaviours to Address Dual-Use Concerns over ADR

As mentioned in Chapter 3, when a removal spacecraft is used for peaceful purposes, such spacecraft should not be considered as a "weapon" or "weapon of mass destruction". Therefore, States are not prohibited from deploying and using ADR mechanisms in outer space. However, while being lawful is a *conditio sine qua non* for being responsible, a responsible behaviour requires more than acting in compliance with international law. As noted by Canada, an action that is lawful under international law does not necessarily mean that such action can be viewed as responsible, and Canada encourages States to act both lawfully and responsibly in outer

231 UN Doc. A/RES/59/115 (2004), *supra* note 187, para. 3. As noted by Way and Koller, transfer of ownership of the target debris object is not needed for ADR, just like the owner of a defunct car does not need to transfer ownership to a towing company for removing such car. See Way & Koller (2021), *supra* note 184, p. 8.

232 Ibid, para. 4.

space.[233] In particular, as Norway submits, [s]ome legitimate operations in space, such as close proximity or inspection operations, can easily be mistaken for dangerous or even hostile operations".[234] Since ADR technologies and capabilities may raise security concerns due to their dual-use nature, norms of responsible behaviours should be developed to reduce the risks of misperceptions and unwanted tensions associated with ADR operations. Section 5.4.1 will assess the approach and form to be taken for the development of norms and principles on reducing space threats within the OEWG. Section 5.4.2 will analyse the views of States and international organisations regarding the possible norms of responsible behaviours for ADR.

5.4.1 The Way Forward for Normative Development to Reduce Space Threats

There are essentially two approaches for normative development to govern issues relating to space security: a behaviour-based approach and a capabilities-based approach.[235] The former approach is adopted in the UNGA Resolution 76/231 of 2021, where the General Assembly decides to convene, beginning in 2022, an Open-Ended Working Group (OEWG):[236]

(a) To take stock of the existing legal and other normative frameworks concerning threats arising from States' space-related behaviours;
(b) To consider current and future threats by States to space systems and actions, activities and omissions that could be regarded as irresponsible;
(c) To make recommendations on possible norms, rules and principles of responsible behaviours in outer space including, as appropriate, how they would contribute to the negotiation of legally binding instruments; and
(d) To submit a report to the General Assembly at its seventy-eighth session in 2023.

The mandate of the OEWG shows that it will focus on behaviours, actions and activities for future normative development. As noted in an Executive Brief published by the European Space Policy Institute (ESPI), this represents "a shift in approach to consider and value behaviours – instead of technological hardware and capabilities – as the basis for international norm-setting".[237] Many States and international organisations have underlined the advantages of a behaviour-based approach. In France's view, a behaviour-based approach obviates the need for distinguishing between

233 UN Doc. A/AC.294/2022/WP.7 (6 May 2022). Canada's Views on Reducing Space Threats through norms, rules and principles of Responsible Behaviour, para. 9.
234 UN Doc. A/76/77 (2021), *supra* note 183, p. 75.
235 Ibid, pp. 11-12.
236 UN Doc. A/RES/76/231 (2021), *supra* note 10.
237 ESPI. (November 2021). UN Resolution on Norms of Responsible Behaviours in Space – a Step Forward to Preserve Stability in Space? *ESPI Briefs No. 54*, p. 1.

aggressive and peaceful capabilities and ultimately, to decide which capabilities to prohibit.[238] France further adds that a behaviour-based approach "is more suitable [than a capability-based approach] as it cannot be rendered obsolete by future technological development".[239] Similarly, Japan submits that the inherently dual-use nature of space technologies "brings complexity to verification".[240] Therefore, Japan considers it more feasible for States to reach "a common understanding on patterns of behaviors that are regarded as either responsible or irresponsible", which can serve as measurable criteria for the verification of compliance.[241] The behaviour-based approach is also advocated by the EU and its Member States as "the most pragmatic and immediate way forward to improve space security today", for it "will help to reduce the risks of misunderstanding, misinterpretation and miscalculation, and therefore decrease the risks of conflicts and escalation in outer space."[242] Since ADR systems have inherent dual-use potential, a behaviour-based approach constitutes a feasible path forward for their governance by specifying the measures that ADR operators should take to ensure mission transparency.

UNGA resolution 76/231 also states in its preamble that the further development and implementation of norms, rules and principles of responsible behaviours in space might "contribute to further consideration of legally binding instruments on the prevention of an arms race in outer space".[243] This is also reflected in the mandate of the OEWG, which, as mentioned earlier, is to make recommendations on how possible norms, rules and principles of responsible behaviours "would contribute to the negotiation of legally binding instruments".[244]

In fact, many States and international organisations consider the development of non-legally binding norms and principles as a pragmatic first step towards the establishment of international legally binding agreements. In particular, as noted in an EU contribution, most of the provisions contained in legally binding treaties governing outer space activities were inspired from principles contained in previous UN General Assembly resolutions.[245]

238 UN Doc. A/76/77 (2021), *supra* note 183, pp. 38-39.
239 Ibid, p. 39.
240 Ibid, p. 56.
241 Ibid.
242 The EU. (13 September 2022). Open Ended Working Group on reducing space threats through norms, rules and principles of responsible behaviours - EU Statement. <https://www.eeas.europa.eu/delegations/un-geneva/open-ended-working-group-reducing-space-threats-through-norms-rules-and_en?s=62>.
243 UN Doc. A/RES/76/231 (2021), *supra* note 10, p. 3.
244 Ibid, p. 3, para. 5(c).
245 UN Doc. A/AC.294/2022/WP.5 (5 May 2022), EU joint contribution to the works of the Open-Ended Working Group on reducing space threats through norms, rules and principles of responsible behaviours: second part: existing international legal and other normative frameworks concerning threats arising from State behaviours with respect to outer space, p. 4.

In this context, the EU considers voluntary norms as "useful tools to shape international consensus and to build trust to take more ambitious steps potentially leading to a comprehensive, effective and verifiable legally binding instrument".[246] It follows that non-binding instruments and legally binding treaties should not be seen as mutually exclusive, for both of them are useful in contributing to the preservation of a safe, secure and sustainable space environment.[247] In a similar vein, the UK states that the development of voluntary norms on responsible behaviours in space "is not an alternative to but a first step towards legally binding agreements".[248] To take this first step, the UK suggests the international community to adopt "a holistic, inclusive, and iterative approach, beginning with dialogue and promoting common understanding".[249] The view is also shared by Canada that "pragmatic, non-binding standards of responsible behaviours should be applied as soon as possible which, if accepted by a majority of spacefaring nations, could become legally binding international law in the future".[250]

The above statements show that the discussion within the OEWG for the development of norms and principles to reduce space threats will focus on behaviours. In this sense, what matters most is how States behave and act when carrying out space activities, as distinct from the potential capabilities of their space systems. In addition, this will start from the development of voluntary norms, principles and standards, which are expected to pave the way for the future development of legally binding agreements. In view of the dual-use nature of ADR capabilities, the question is how an ADR operation should be conducted in a way that is perceived as responsible rather than threatening.

5.4.2 Development of Norms of Responsible Behaviours for ADR

At the sessions of the OEWG, States have shared their views and perspectives on the further development and implementation of norms and principles of responsible behaviours in outer space to reduce the risks of misperceptions and misunderstandings. In Canada's view, responsible behaviours in space are "those behaviours that promote the safety, security, and sustainability of outer space activities and the space environment", which can "increase the predictability and general transparency of operations and therefore reduce the potential for hostilities in, from, or through space".[251] These include actions such as the exchange of information and communication with other parties in a timely manner in order to reduce

246 Ibid.
247 Ibid.
248 The UK (2022), *supra* note 255.
249 Ibid.
250 UN Doc. A/AC.294/2022/WP.7 (2022), *supra* note 233, para. 8.
251 Ibid.

adverse impacts to space operations and to avoid misunderstandings of the intent.[252] According to the EU, "the characterisation of what constitutes an irresponsible behaviour should consider the consequences on safety, sustainability and security in outer space as well as international peace, security and stability".[253] In the view of Switzerland, acting responsibly requires States to refrain from "actions that are likely to lead to misperceptions and, therefore, to the risk of escalation".[254]

It can be seen from the above views that the overall objective of promoting responsible behaviours is to ensure the safety, security and sustainability in outer space. To achieve this aim, States should enhance the transparency of their missions in order to clarify intentions and avoid misunderstandings. Specifically, many States and international organisations have shared their views on how RPO are to be conducted responsibly. As RPO can be part of ADR, these views are also relevant to how ADR activities are to be conducted in a responsible manner.

In view of the dual-use nature of RPO, the UK submits that to build trust, it is important that "the development and testing of such technologies is done as transparently as possible and that there are clear and agreed procedures for the conduct of such activity".[255] In addition, as suggested by the Philippines, when a satellite of one State approaches a satellite of another State and leads to a risk of collision, "immediate communication with the potentially affected State is an urgent exigency".[256] Such communication could include "clarification whether the proximity operation arises from a deliberate action, and if so, what is the rationale for such action".[257] This is particularly relevant for satellites with RPO capabilities, for these satellites are more likely to raise security concerns. Therefore, if such satellites accidentally approach other satellites, timely communication would be essential to avoid unwanted tensions.

On the other side of the coin, being responsible means refraining from conducting actions and activities that are considered as irresponsible. The EU

252 Ibid.

253 UN Doc. A/AC.294/2022/WP.18 (15 September 2022). EU joint contribution to the Open Ended Working Group on reducing space threats, Third part: current and future threats by States to space systems, and actions, activities and omissions that could be considered irresponsible: submitted by the European Union, p. 1.

254 UN Doc. A/76/77 (2021), *supra* note 183, p. 91.

255 The UK. (14 September 2022). Statement by the United Kingdom at the 2nd session of OEWG. <https://documents.unoda.org/wp-content/uploads/2022/09/UK-Statement-Topic-3-Current-and-future-space-to-space-threats-by-States-to-space-systems.pdf>.

256 Philippines. (12 September 2022). Statement by the Philippines at the 2nd session of OEWG. <https://documents.unoda.org/wp-content/uploads/2022/09/TOPIC-3-PHL-STATEMENT.pdf>.

257 Ibid.

is of the view that non-transparent RPO may be perceived as a threatening or hostile action.[258] More specifically, "[t]he omission to inform, notify or communicate about a proximity operation that affects another State's space system" is considered by the EU as an irresponsible behaviour.[259] According to Canada, to reduce the potential for a peaceful-use system to be mistaken for a weapon, a responsible behaviour could require States to disclose the mission plan of their ADR and OOS operations.[260] Again, effective communication is considered as a key element to ensure that ADR activities are carried in a responsible manner.

Moreover, Switzerland views that unfriendly RPO in orbit represent a threat to the safety and security of space systems.[261] As RPO technologies can be used to disable the satellite of another State, "[u]nexpected close approaches to foreign satellites without notification, coordination and consent may be interpreted as a hostile act".[262] The threat of hostile RPO may lead countries to equip their satellites with defensive capabilities, which may further jeopardise the stability of space security.[263] Similarly, in Canada's view, the conduct of non-cooperative RPO could be seen as irresponsible or even threatening, such as approaching or following another satellite.[264] In this context, Canada proposes that responsible behaviour could include notification of RPO to potentially affected States in order to coordinate operations and avoid misinterpretation.[265] In brief, RPO should not be conducted in an ambiguous or even threatening manner.

The examination of the views of the States and international organisations indicates that effective and timely notification, consultation, coordination and consent are essential elements for a responsible ADR operation. All these can be considered as TCBMs, which can contribute to reducing or even eliminating the risks of misperceptions and misunderstandings with regard to space activities. In fact, TCBMs constituted one key issue of consideration at the sessions of OEWG. In particular, in his statement at the first session of the OEWG in 2022, Victor Vasiliev, Chair of the GGE, expressed his belief that the GGE Report of 2013 will be helpful for the considerations

258 UN Doc. A/AC.294/2022/WP.2 (13 April 2022). EU Joint Contributions to the Works of the Open-Ended Working Group on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours – Part One: Scoping, para. 8.
259 The EU (2022), *supra* note 242.
260 UN Doc. A/AC.294/2022/WP.7 (2022), *supra* note 233, para. 14.
261 Switzerland. (12 September 2022). Remarks by the Swiss delegation at the 2nd session of the OEWG, p. 2. <https://documents.unoda.org/wp-content/uploads/2022/09/2022-09-OEWG-Space-2ndSession-CH-Statement-GenExOfViews-v2.pdf>.
262 Ibid.
263 Ibid.
264 UN Doc. A/AC.294/2022/WP.7 (2022), *supra* note 233, para. 14.
265 Ibid.

of delegates to the OEWG.[266] At the third session of the OEWG held in early 2023, topics 7 and 8 were directly related to TCBMs.[267] Specifically, the UK stated under these two topics that "[i]f States are as transparent as possible about their intentions, capabilities, doctrine and policies it can all help to improve mutual understanding, build trust and reduce risks of conflict".[268] To enhance transparency, the UK referred expressly to the GGE Report of 2013 and encouraged States to implement the measures recommended therein.[269] As discussed in Chapter 4, while the GGE Report of 2013 does not specifically address ADR, many of the recommendations contained in this Report are relevant to ADR and their implementation can help to enhance the transparency of ADR missions.

Although the final session of the OEWG failed to achieve the adoption of a formal report due to the lack of consensus among the participating States, the process has provided a forum for States to share and discuss their views on the nature of threats related to space security and the possible measures to address the potential risk of misperceptions.[270] In particular, many States considered that the dual-use nature of certain types of capabilities and operations such as OOS and ADR makes it difficult to distinguish between threatening and benign capabilities and operations.[271] In addition, many States stressed the importance of effective and timely communication in building transparency and trust, and considered it advisable to elaborate further TCBMs with the goal of preventing an arms race in outer space.[272] On 4 December 2023, the UN General Assembly adopted resolution 78/20, which decides to convene, in Geneva, a new open-ended working group ("OEWG 2.0"), building on the work of the 2022-2023 OEWG and other relevant bodies and the existing international legal framework, "to further elaborate the concept, and to make recommendations on the prevention of an arms race in outer space through the development of norms, rules and principles of responsible behaviours" in areas including, among others, "[r]endezvous operations and proximity operations that could increase the risk

266 Vasiliev, V. (9 May 2022). Statement by the Chair of the GGE on Transparency and Confidence-Building Measures in Outer Space Activities, p. 3. <https://meetings.unoda.org/meeting/57866/statements>.

267 See UN Doc. A/AC.294/2023/INF.1/Rev.2 (31 January 2023). Indicative timetable for the 3rd Session of the OEWG. Topic 7 is entitled "Norms, rules and principles relating to information exchange on space policies". Topic 8 is entitled "Norms, rules and principles relating to information exchange and risk reduction notifications related to outer space activities as well as to consultative mechanisms".

268 The UK. (2 February 2023). Statement by the United Kingdom at the 3rd Session of the OEWG, p. 1. <https://meetings.unoda.org/meeting/57866/statements>.

269 Ibid.

270 The UK. (1 September 2023). Statement by the United Kingdom at the 4th session of the OEWG, p. 2. <https://meetings.unoda.org/meeting/57866/statements>.

271 UN Doc. A/AC.294/2023/WP.22 (1 September 2023), OEWG Chairperson's Summary, para. 40.

272 Ibid, para. 26.

of misunderstanding and miscalculation".[273] Therefore, the discussions and interactions that took place at the four sessions of the OEWG between 2022 and 2023 can serve as a useful basis for future work to develop norms and principles of responsible behaviours for ADR activities to reduce the potential risk of security concerns over these activities.

5.5 Chapter Conclusion

The research question of this chapter is how should international space law move forward to better regulate the four issues relating to the governance of ADR. The potential path forward can be outlined in four words, which are commitment, safety, consent and transparency.

With regard to *Issue 1*, the keyword is "commitment". In view of the global dimension of the space debris problem, collective efforts of the international community are needed to tackle this challenge. However, the current international legal framework for space activities does not impose a clear obligation upon States to mitigate and remove space debris. Considering that the conclusion of a legally binding agreement does not appear a feasible near-term option, the international community has to consider other alternatives to deal with the ever-growing amount of space debris. The path forward may start with some States acting as trailblazers which take the lead in making unilateral and multilateral commitments on space debris mitigation and remediation, and other States may subsequently join the initiative. The US-led moratorium on direct-ascent anti-satellite testing illustrates how a unilateral commitment is joined by other States and leads to the adoption of a UN General Assembly resolution on this matter. The statement and communiqué made by the G7 nations and the ESA-initiated Zero Debris Charter represent examples of commitments at the multilateral and regional levels. This also indicates that some actors are already taking steps to shape global consensus on space sustainability.

The commitments and initiatives made by some forward-looking States and institutions would hopefully create a snowball effect and lead to the adoption of an international agreement systematising the process for the contracting parties to make and review their commitments. The Paris Agreement may serve as a relevant model, and the review mechanisms established in this Agreement could be modelled after for the development of an international agreement to mitigate and remove space debris. With the growing role of private actors in space activities, their involvement in the preservation of the outer space environment will become increasingly important. The Net Zero Space initiative represents an inclusive forum where all stakeholders

273 UN Doc. A/RES/78/20 (4 December 2023). Reducing space threats through norms, rules and principles of responsible behaviours, para. 4.

over the world, ranging from governmental agencies to actors from the commercial and civil sectors, may join the coalition and commit to the sustainable use of outer space. This process, beginning from unilateral and multilateral commitments, and ultimately leading to the commitments made at a global scale, can allow the international community to respond rapidly to the imminent need to tackle the space debris problem. With some States kicking start this process and other States following suit, this process may have already created considerable results in reducing space debris even before the conclusion of a legally binding agreement. It could also exert pressure on States that have not yet done so to commit and act.

With regard to *Issue 2*, the keyword is "safety". Although under the existing international framework for space activities, States are required to carry out their space activities with due regard to the rights and interests of others, which could mean to avoid harmful interference with other space activities and to limit the generation of space debris, the regime does not provide specific guidance on how ADR activities should be conducted in such a manner to comply with these requirements. Also, the ambiguity of the concept of "fault" may disincentivise States from engaging in ADR activities. As soft law can be used to specify the notions of "due regard" and "fault", the development of internationally accepted guidelines and standards for ADR would provide more clarity to ADR advocates. The development of new LTS guidelines may provide general principles for ADR activities, including the overall aim of these activities to contribute to the long-term sustainability of outer space activities. The adoption of this kind of guidelines can be useful in ensuring the safety of ADR, but considering the technical complexity of ADR missions, more specific guidelines on the design and operations of ADR missions are also needed. Some States are starting to develop national guidelines and standard practices expressly addressing ADR activities, and they may inform the future development of international ADR guidelines, which could follow a similar path where the first set of international space debris mitigation guidelines was developed. The contributions of the commercial space sector such as the guiding principles and recommended practices published by CONFERS, as well as the ISO 24330:2022 developed on the basis of the CONFERS publications, can also be used as a foundation for further legal development. The IADC appears an appropriate forum in this regard, because its members include the leading space agencies active in ADR, and the IADC has already addressed this matter to some extent.

With regard to *Issue 3*, the keyword is "consent". Under current international space law, no State can remove a debris object under the jurisdiction of another State without the express consent of the latter. In view of the potential strategic sensitivity of space assets, this regime contributes to the maintenance of international peace and security in outer space. Therefore, the direction of future legal development should be to contemplate the

means to promote consensual ADR activities, where a State grants approval to another State to remove a debris object under its jurisdiction and control. To this end, it would be advisable for the UN General Assembly to adopt a resolution, which provides recommendations to facilitate the seeking and granting of approval for debris removal. Firstly, the resolution could recommend States to consider harmonising their practices in bilateral agreements for cooperative ADR programs, such as to establish some standard clauses for liability apportionment and export control. Secondly, the resolution could encourage States to notify the UN Secretary-General of the removability of their space debris objects and the conditions of their removal. This could be made on the basis of the provision of additional information under Article IV(2) of the Registration Convention. It may further encourage States to establish a list of the candidate removal targets that pose critical threats to the space environment. Thirdly, the resolution could recommend States to pursue negotiations on the way to lift the legal constraints on the removal of unidentifiable small debris fragments. One possible option would be for States to agree that they consent to the removal of debris fragments under their jurisdiction below a certain size threshold of, e.g., 5 cm.

With regard to *Issue 4*, the keyword is "transparency". Due to the dual-use nature of ADR technologies and mechanisms, ADR activities may raise security concerns, which should be properly addressed through transparency and confidence-building measures. The discussion took place within the OEWG adopted a behaviour-based approach for further normative development. This can start from the development of voluntary norms and principles of responsible behaviours, which may serve as a basis for the negotiation of legally binding instruments at a later stage. Many States and international organisations have contributed their views and inputs on enhancing the transparency of ADR operations, which can help to clarify the peaceful intention underlying these operations and reduce the risk of misunderstandings. Responsible behaviour may require the prior disclosure of mission plan, timely consultation with potentially affected actors, and effective coordination in the event of contingencies. As discussed in Chapter 4, many recommendations contained in the GGE Report of 2013 can be used to enhance the transparency of ADR missions. As such, the GGE Report could serve as a foundation for the further development of norms and principles of responsible behaviours for ADR to reduce the risk of security concerns over ADR activities. Therefore, the elaboration of specific norms of TCBMs to reduce potential dual-use concerns over ADR activities may represent an area of consideration by the OEWG 2.0 convened to address space threats.

In the end, the four keywords – commitment, safety, consent and transparency – can be boiled down to one word – *communication*:

– Precursors leading international efforts can communicate their commitments and determination to mitigate and remove space debris loudly

and broadly at the international level, calling upon other States and international organisations to follow suit.
- States can share their safety concerns over ADR activities at international forums and exchange opinions on the appropriate measures to address these concerns, which can lead to the development of international guidelines for ADR activities.
- A State contemplating the removal of a debris object under the jurisdiction of another State may clearly communicate the reasons and plans of the mission to the latter State, which could be followed by consultation and negotiation of the terms and conditions of the agreement between them regarding the removal. States may also consider communicating information on the removability of their space objects to the international community.
- Communication is also an essential tool to enhance mission transparency and reduce the risk of misperceptions and misunderstandings regarding ADR activities.

As Masson-Zwaan observes, to ensure the long-term sustainability of space activities, it is important to start actively removing objects from orbit.[274] To that end, it is time for constructive communications within the international community to fill the gaps for the governance of ADR.

274 Masson-Zwaan, T. L. (19 January 2021). Sustainability in Space. *Leiden Law Blog*. <https://www.leidenlawblog.nl/articles/sustainability-in-space>.