Oceans as spaceports: state jurisdiction and responsibility for space launch projects at sea

Alla Pozdnakova
Law Faculty, University of Oslo

Sea-based launches of satellites provide advantages for the space sector, such as flexibility of the launching location, but may also pose security and environmental concerns for states in the proximity of launches. States must properly exercise their competences under international law to supervise space activities under their jurisdiction effectively. This article examines the application of UNCLOS for determining state jurisdiction and responsibilities with regard to such activities, arguing that UNCLOS provides a relevant but not fully adequate framework for launches from sea, and may even prevent responsible states from meeting their obligations under the Outer Space Treaty. The flag state regime fills in some of the jurisdictional gaps in space law, but the traditional approach to flag state jurisdiction under UNCLOS may not satisfactorily meet the objectives of space law. The duty of 'due regard' is, in practice, crucial for regulating the conduct of sea-launching states, but depends on inter-state dialogue and cooperation effectively to resolve potential conflicting uses of the sea. Effectiveness of the international responsibility regime laid down in the Outer Space Treaty may be weakened by unclear and under-developed standards of conduct. Further, it is necessary to ensure that liability for damage caused by space objects launched from the high seas is not 'channelled' to the flag state of the launch facility. Interpretation of UNCLOS in light of the international space law objectives may be helpful to resolve some of these issues, but workable solutions for safe launches from sea may only be found in further cooperation between the states concerned.

1 Introduction

Space-based services are vital for securing critical infrastructures and for the supply of data and services on the Earth; for example, satellites enable communication and navigation in the maritime sector and are indispensable for states to meet their safety obligations under international maritime law.[1] The increasing global demand for the access to space[2] may partly be met by floating spaceports, ie vessels or platforms located at sea from which satellites can be launched into orbit. Currently, sea-based launches represent only a marginal share of all launches, but an increase can be anticipated as more states and non-state actors develop sea-based launch systems.[3]

[1] See eg International Convention for the Safety of Life at Sea (SOLAS) 1184, 1185 UNTS 2. See also Johnny Grøneng Aase and Julia Jabour 'How satellites can support the information requirements of the Polar Code' (2016) 8 *The Yearbook of Polar Law* 247.

[2] See eg OECD 'The space economy in figures: how space contributes to the global economy' (OECD 2019) https://doi.org/10.1787/c5996201-en.

[3] See eg Sea Launch project (see n 12 below) and the Black Arrow project https://blackarrow-space.uk/; Ji Yuqiao 'China to build first harbor for sea launch of space rockets' *Global Times* (1 August 2019).

The idea of launching satellites into space from the sea dates back to the early 1960s.[4] Sea-based launch sites have certain advantages over conventional spaceports. In the event of an accident, launches from the high seas are less likely to result in significant damage to the population and the coastal environment. Capacity limitations at land-based spaceports may also favour development a sea-based launch system.[5] Importantly, launching from the sea gives more flexibility in terms of geographical positioning of the launching site, and is also economically attractive for launches into specific orbits, eg launches to the geostationary orbit from vast equatorial ocean areas.[6] Non-equatorial ocean areas may also be relevant; for example, the rocket range in the High North is well suited to the launch of sounding rockets for space weather research, earth observation and for launches into polar orbit.[7]

Launches at sea may have negative implications for the safety and security of coastal states, especially considering the significant strategic potential of the geographical positioning flexibility and rapid response capabilities provided by sea-based launches.[8] The marine environment may be polluted by jettisoned parts of space rockets and fuel residues.[9] Launches at sea may also generally contribute to increased tensions between different users of congested maritime areas.[10]

The development of sea launch projects is occurring within the broader context of the contemporary space sector, in which non-state entities play an increasingly active, if not central, role.[11] A commercial project that successfully launched satellites into geostationary orbit from the high seas was the Sea Launch multinational spacecraft launch service, which used a mobile maritime launch platform to assemble and launch 32 rockets into space between 1997 and 2014.[12] However, not only large commercial actors (such as Boeing, a partner in the Sea Launch service) but also smaller non-state entities are exploring possibilities for the development of low-cost, accessible space launch services at sea.[13]

To ensure responsible conduct by private actors in the space sector, states must properly exercise their competences under international law effectively to supervise space activities under their jurisdiction. National measures are crucial to ensure the necessary legal basis at the domestic level to regulate the behaviour of private actors in the space sector. Some states have included launches

[4] An unsuccessful project is Sea Dragon (1962) https://en.wikipedia.org/wiki/Sea_Dragon_(rocket).

[5] Joosung Lee 'Legal analysis of Sea Launch license: national security and environmental concerns' (2008) 24 *Space Policy* 104.

[6] Yuqiao (n 3); Gerasimos Rodotheatos 'From sea to outer space and back: political, economic, and environmental considerations for ocean-based space launching activities' in George D Kyriakopoulos, Maria Manoli (eds) *Space Treaties at the Crossroads: Considerations de lege ferenda* (Springer 2019) 109–24; Armel Kerrest 'The launch of spacecraft from the sea' in G Lafferranderie and Daphné Crowther (eds) *Outlook on Space Law over the Next 30 Years* (Kluwer Law International 1997) 217–33.

[7] Norwegian Space Agency 'Norway in space' https://www.romsenter.no/eng/Norway-in-Space/A-Brief-Overview/A-Longer-Overview. See also 'Shtil conversion rocket to orbit South African satellite' *Interfax Russia&CIS Military Newswire* (14 March 2007), reporting the launch of satellites on a rocket from the Russian submarine in the Barents Sea.

[8] 'China gains new flexible launch capabilities with first sea launch' *BruDirect* (7 June 2019). See also Namrata Goswani 'Why China's Long March 11 launch matters' *The Diplomat* (10 June 2019) https://thediplomat.com/2019/06/why-chinas-long-march-11-launch-matters/.

[9] See Lee (n 5). See also Michael Byers, Cameron Byers 'Toxic splash: Russian rocket stages dropped in Arctic waters raise health, environmental and legal concerns' (2017) 53(6) *Polar Record* 580; and Vito de Lucia, Viviana Iavicoli 'From outer space to ocean depths: the "spacecraft cemetery" and the protection of the marine environment in areas beyond national jurisdiction' (2018) 49 *California Western International Law Journal* 346.

[10] See eg Chinese *Long March 11* rocket launch (2019) from the Yellow Sea by coastal states China, South Korea, North Korea and Japan, in an area with unsettled maritime delimitations and busy with fisheries, navigation and other economic activities. See Didier Ortoland and Jean-Pierre Pirat *Geopolitical Atlas of the Oceans: the Law of the Sea, Issues of Delimitation, Maritime Transport and Security, International Straits, Seabed Resources* (Editions Technip 2017) and *Britannica* 'Yellow Sea' https://academic-eb-com.ezproxy.uio.no/levels/collegiate/article/Yellow-Sea/108650.

[11] Stephan Hobe *Space Law* (Nomos 2019).

[12] Armel Kerrest 'Launching spacecraft from the sea and the Outer Space Treaty: the Sea Launch project' (1998) 1 *Air & Space Law* 16; Phillip Clark 'Russian proposal for launching satellites from the oceans' (1999) 15 *Space Policy* 9. According to Russian News Agency *TASS* 'Sea Launch to be restored at a cost of $470 million' (24 August 2020), Russia is planning to restore the Sea Launch project. See https://tass.com/science/1193137.

[13] On the Copenhagen suborbitals project see Erik Seedhouse *Suborbital Industry in the Age of Space* (Springer 2014) 97–111.

from vessels of their registry within the scope of their national laws on outer space activities, exercising control over space activities from such vessels by licensing and supervision procedures.[14]

Measures adopted at the national level must comply with the relevant rules of international law, including rules on state jurisdiction over activities conducted outside their territory, ie extraterritorial prescriptive and enforcement jurisdiction. The issues of state jurisdiction and responsibilities may be particularly complicated in the case of multinational commercial ventures such as Sea Launch, when private actors from multiple states are involved in the launch project on the high seas. As explained later in more detail, international law of the sea provides for a relevant normative framework for allocating jurisdiction over sea-based space launches. However, application of the law of the sea to sea-based space launches also raises significant legal challenges which may not be satisfactorily resolved in isolation from space law itself. For the purposes of the following discussion, it is useful briefly to present relevant provisions of international space law and the law of the sea and highlight significant issues arising from interactions between these two branches of international law.

2 The international legal framework governing state jurisdiction over space activities at sea

2.1 The Outer Space Treaty

The cornerstone of the international space law is the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other celestial bodies (Outer Space Treaty).[15] Two provisions of the treaty are particularly relevant for the discussion in this article. First, Article VI imposes international responsibility on state parties for their *national* governmental and *non-governmental* activities in outer space, and for assuring that national activities are carried out in conformity with the Treaty's provisions. Arguably, this provision contains a lex specialis rule under which state parties have assumed direct responsibility for their governmental and non-governmental activities alike.[16] The treaty does not define 'national governmental and non-governmental activities in outer space'. In principle, it applies also to space-related activities on Earth, notably launches and returns of space objects, and includes governmental and commercial launches. With regard to sea-based launches, this provision arguably provides for state responsibility for launches from governmental vessels as well as from vessels in private ownership.[17]

Article VI also requires authorisation and continuing supervision by the *appropriate* state party of activities of non-governmental entities in outer space. It would be consistent with the objectives of international space law to assign these responsibilities to a state or states holding effective jurisdiction over the activities in question.[18] In the case of launches from a spaceport located in a foreign state's territory, the latter will generally hold effective jurisdiction over activities in line with the general rules of international law.[19] In the case of launches from the high seas, ie areas beyond national jurisdiction of any state, the necessary juridical link with the relevant state(s) may not be

[14] National Space Law Collection, United Nations, Office for Outer Space Affairs https://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/index.html.

[15] 610 UNTS 205. The principles set out in the Outer Space Treaty have arguably passed into customary international law. See eg Francis Lyall, Paul B Larsen *Space Law* (Routledge 2007) 36.

[16] Bin Cheng 'Article VI of the 1967 Space Treaty revisited: "international responsibility", "national activities" and "the appropriate state"' (1998) 26 *Journal of Space Law* 7, 15. See also Pablo Mendes de Leon and Hanneke Van Traa 'Space Law' in André Nollkaemper and Ilias Plakokefalos (eds) *The Practice of Shared Responsibility in International Law* (Cambridge University Press 2017) 453–78.

[17] This follows from the overall context of the Treaty and is backed up in the UN Resolution 'Recommendations on national legislation relevant to the peaceful exploration and use of outer space' 68/74 (2013) A/RES/68/74 at 2. See also Cheng (n 16) 19.

[18] The notion of 'effective jurisdiction' may be summarised as legal and actual power of a State to exercise jurisdiction over certain activities, particularly the enforcement power. See Cheng (n 16) 24; Michel Bourely 'The institutional framework of space activities in outer space' (1998) 26 *Journal of Space Law* 1, 29.

[19] See eg Cheng (n 16).

adequately ensured by the application of the territoriality principle of jurisdiction.[20] The treaty does not contain any provisions which would specifically address sea-based launches and similar space-related activities at sea, and does not elaborate on the rules of jurisdiction in the case of sea-based launches. It does not in any case expressly channel jurisdiction over sea launch platforms to a specific nationality state or states, such as the state of registration of the launch platform, or home state(s) of the project owners.

Secondly, Article VII of the treaty envisages international liability of states for damage caused by the launching of objects into space.[21] Space conventions do not provide a definition of a 'space object'; however, they clarify that 'the term "space object" includes component parts of a space object as well as its launch vehicle and parts thereof',[22] ie space rockets and their payload such as satellites or spacecraft. The Registration Convention[23] establishes an international system of registration of space objects and requires states to maintain a register of objects they launch into space, as well as to inform the Secretary General of the United Nations of such launches.[24] The liability for damage is imposed on a 'launching state', ie on the state that launched the space object or the state from whose territory or facility the object was launched.[25] The 'facility', however, is not defined. As examined further below, a launch vessel or a similar structure may be viewed as a 'facility' for the purposes of liability rules.

2.2 UN Convention on the Law of the Sea

The UN Convention on the Law of the Sea 1982 (UNCLOS)[26] does not govern outer space-related activities at sea as such, but establishes a dynamic legal framework for seas and oceans capable of addressing new uses of maritime areas.[27] UNCLOS seeks to settle 'all issues related to the law of the sea', but resolves this ambitious goal through the interpretative implementation of the Convention, application of the general international law[28] and adoption of new legal instruments.[29] Like the Outer Space Treaty, UNCLOS does not contain provisions delimiting its substantive or geographic scope from other regimes and applies across 'vertical' spaces.[30] Space treaties may in any case not preclude the application of UNCLOS to activities with law-of-the-sea relevance.[31]

As discussed further below, UNCLOS is relevant for sea-based space launches because it regulates the jurisdiction of states in various maritime zones such as the territorial sea, the exclusive economic zone (EEZ) and the high seas. Navigational rights and freedoms of the high seas envisaged by UNCLOS are indispensable for achieving the objectives of sea launch projects. For example, free access to space for all states protected by the Outer Space Treaty[32] is dependent on the availability

[20] ibid.

[21] Article VII of the Outer Space Treaty is developed further in the Convention on International Liability for Damage Caused by Space Objects (Liability Convention) 961 UNTS 187.

[22] ibid art I(d).

[23] The 1974 Convention on the Registration of Objects Launched into Outer Space (Registration Convention) 1023 UNTS 15.

[24] The Registration Convention implements art VIII of the Outer Space Treaty providing, among other things, that: 'a State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object'.

[25] ibid art I(c)(ii).

[26] A sea-launching state, the USA has signed but not ratified UNCLOS. See J Ashley Roach 'Today's customary international law of the sea' (2014) 45 *Ocean Development & International Law* 239; Robin B Churchill 'The 1982 United Nations Convention on the Law of the Sea' in Donald R Rothwell, Alex G Oude Elferink, Karen N Scott and Tim Stephens (eds) *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) 34–38.

[27] See eg Richard Barnes 'The continuing vitality of UNCLOS' in Jill Barrett and Richard Barnes (eds) *Law of the Sea: UNCLOS as a Living Treaty* (British Institute of International and Comparative Law 2016) 459–89.

[28] UNCLOS preamble, last recital.

[29] The future legally binding treaty on biodiversity in areas beyond national jurisdiction may clarify some of the issues raised in this article, but falls outside the discussion in this article.

[30] Although UNCLOS governs the maritime domain it also addresses (albeit briefly) the right of overflight and air pollution.

[31] UNCLOS art 311(2). See also ITLOS Order of 3 December 2001 *The Mox Plant (Ireland v. United Kingdom)* (Provisional Measures) para 50.

[32] Outer Space Treaty art 1.

of a suitable launch site. In the case of sea-based launches, access to outer space will ultimately depend on the right of innocent passage or transit rights and the freedoms of the high seas. However, private actors operating sea-based launches exercise law of the sea rights through their legal relationship with a state.

Are space launches from the high seas included in the 'freedoms of the high seas' protected under UNCLOS? The lawfulness of high seas launches may be questioned, in particular, owing to significant restrictions they may impose on other states exercising their rights on the high seas.[33] By comparison, naval maneuvers and weapon testing on the high seas have raised objections from some states.[34] UNCLOS is generally open to all peaceful uses of the high seas, on the condition that states shall have due regard for the interests of other states; however, the Convention does not establish a comprehensive set of principles on the resolution of conflicting state interests on the high seas. High seas launches conducted contrary to Article VI of the Outer Space Treaty (eg non-governmental projects which are not authorised and continuously supervised by an 'appropriate' state) should not enjoy the freedoms of the high seas under UNCLOS. The 'first come, first served' approach is in any case not acceptable as a sound governance principle for the high seas areas subject to increasing pressures from multiple industrial and research activities.[35]

2.3 Further discussion

From the outset, the Outer Space Treaty and UNCLOS do not exist in isolation from the general international law but implement the existing general norms of international law and establish common principles governing state activities at sea. Both the Outer Space Treaty and UNCLOS are based on principles of peaceful uses and non-appropriation of common areas, state responsibility for national activities, state cooperation and due regard. As argued in this article, it may be feasible to interpret the law of the sea provisions in light of the space treaties (and vice versa) when determining the normative framework governing space activities at sea.[36] UNCLOS and the Outer Space Treaty are 'constitutional' treaties and ought to adapt to novelties in the space and maritime sector, for example, by means of evolutionary interpretation.[37] The international legal framework governing rights and obligations of sea launching states should be charted in light of these considerations.

At the same time, the interaction between international space law and the law of the sea requires further clarification. The two regimes differ in a number of significant aspects. UNCLOS sets out a comprehensive regime governing state jurisdiction, rights and obligations in the maritime domain (including shipping and rights to natural resources), marine environmental protection rules (implemented further by other international agreements) and a dispute settlement system. In contrast, the Outer Space Treaty does not spell out normative contents of state responsibilities in any considerable detail and has not been implemented or developed further by agreements setting out technical and procedural standards. The treaty also does not contain international mechanisms to secure compliance by states parties.[38] Thus, one activity, a sea-based space launch – and potentially, the harmful implications of this activity for other states – will be governed by legal frameworks with broadly different normative approaches.

[33] See also Kerrest (n 12).

[34] R R Churchill and A V Lowe *The Law of the Sea* (3rd edn Manchester University Press 1999) 205–207.

[35] See eg Michaela Young 'Then and now: reappraising freedom of the seas in modern law of the sea' (2016) 47 *Ocean Development & International Law* 165; Maria Gavounelli 'Energy installations in the marine environment' in Jill Barrett and Richard Barnes (eds) *Law of the Sea: UNCLOS as a Living Treaty* (British Institute of International and Comparative Law 2016) 187–208.

[36] See eg provisions on search and rescue of astronauts in case of landing on the high seas envisaged in art V.1 of the Outer Space Treaty and the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched in Outer Space (672 UNTS 119) rely on the rules and mechanisms set up under UNCLOS and related agreements.

[37] See eg Barnes 'The continuing vitality of UNCLOS' (n 27) 461.

[38] See generally Hobe (n 11) on space law-making, which is taking place under auspices the UN but also other international bodies.

UNCLOS does not rule out that provisions of other agreements may apply to issues falling within the UNCLOS domain. According to Article 311(2), UNCLOS 'does not alter the rights and obligations of states parties which arise from other agreements compatible with this Convention and which do not affect the enjoyment by other states parties of their rights or the performance of their obligations under UNCLOS'.[39] The provisions of the Outer Space Treaty and other space instruments should be applied so as to avoid directly conflicting outcomes or preclude states parties from exercising their rights and obligations under UNCLOS. Arguably, it is necessary to focus on the relevance of the international space law for the interpretation or filling in the gaps of UNCLOS (or vice versa). For example, as discussed further below, the provisions on flag state regimes in UNCLOS may fill in the gaps in international space law regarding the international legal status of sea-launch platforms, while jurisdictional principles sketched out in the Outer Space Treaty should be relevant for determining the nationality of launch platforms falling outside the flag state regime.

At the same time, the traditional UNCLOS approach to jurisdiction issues may not always be suitable for novel uses of oceans such as space activities. It is argued in the next section that, among other things, the UNCLOS provisions on exclusive enforcement by flag states on the high seas may preclude a non-flag state whose nationals participate in launches on the high seas from meeting their obligation continuously to supervise space activities as the 'appropriate' state within the meaning of the Outer Space Treaty. The discussion then turns to jurisdictional issues with regard to space activities in areas under the jurisdiction of coastal states (section 5) and then scrutinises the obligation of due regard and its implications for the right to conduct sea launches from the high seas and the EEZ (section 6).

The analysis then turns to the issues pertaining to state responsibility for sea-based launch activities and liability for damage caused by launches of space objects (section 7). Section 8 concludes.

3 International legal status and nationality of seaborne launch platforms

3.1 Is a seaborne launch platform a ship?

The international legal status of seaborne launch platforms is not clear under international space law.[40] As explained above, outer space law generally seeks to include all 'national activities in outer space' within the state responsibility regime, regardless of the location or technical characteristics of the spaceport. Such an approach relies on international law principles of jurisdiction but does not provide for clear criteria to identify a state or states responsible for high seas launches by private entities.

Furthermore, unlike satellites and spacecraft launched into outer space, no international system of registration is provided for seaborne launch platforms under international space law.[41] Thus, no formal criteria exist in international space law to determine a juridical link between a launch vessel and a relevant state. This leaves a considerable gap in the international legal regime governing sea-based space launches, which is particularly obvious in case of non-governmentally owned or operated launch vessels.

As examined further below, this gap may partly be filled by UNCLOS provisions on ship registration and flag state jurisdiction. For UNCLOS, the type of launch facility and its location in a particular maritime zone are relevant for determining the legal status and the applicable jurisdictional regime. The classification of a launch platform as a 'ship' ('vessel') or an 'installation' ('structure' or similar) is an important starting point for determining a legal link between the platform and a state, and, accordingly, for the allocation of state jurisdiction, rights and obligations with regard to such platforms.

UNCLOS does not contain a definition of a 'ship', a 'vessel' or an 'installation'. In cases where a definition of a particular vessel as a 'ship' is questioned under a specific convention, an adequate

[39] UNCLOS art 311(2). No equivalent provision is contained in the Outer Space Treaty.

[40] See also Kerrest (n 12).

[41] See text accompanying n 24 above.

solution should be based on the appraisal of the context and purposes of that convention, and in light of the intention of the states parties.[42] Generally, common features of a 'ship' as recognised in both municipal and international law are seagoing ability, navigability and self-propulsion.[43] Technologically and functionally novel structures such as sea launch platforms raise, however, definitional challenges owing to their modus operandi, technological features and multiple functions (notably, non-navigational uses).[44]

In practice, space launches can be conducted from vessels or floating platforms, fixed platforms and even submarines.[45] Most known launch projects at sea deploy floating structures on which a launch vehicle is placed. For example, the Sea Launch venture launched satellites from a refurbished oil platform LP *Odyssey*, assisted by an auxiliary command ship and a satellite tracking ship. LP *Odyssey* was reportedly self-propelled and, in practice, was capable of navigation as a ship in order to reach its destination on the high seas. It served as the transport vessel for the launch vehicle (including the space rocket and its payload) and provided accommodation for the marine and launch crews during transit to and from the launch location.[46] Also, in the Long March 11 project, the mobile and floating platform was reportedly used to conduct launches.[47]

As navigability seems to be the most common characteristic of a 'ship', launch devices permanently attached to the seabed, such as fixed offshore installations, or platforms which are not self-propelled but are towed to the destination of the launch are excluded from the concept of a 'ship'.[48] However, the principal use of mobile launch platforms is not navigation or transportation but space launch operations, when the platforms are, for a certain period of time, not capable of navigation. Moreover, at the time of the launch they are immobilised while staying afloat, for example by submerging to a more stable position in the water column prior to the launch operations (eg LP *Odyssey*[49]) or lowering the legs of the platform to the sea bottom (San Marco).[50]

The wording of the existing maritime conventions or the intention of the states parties to UNCLOS do not provide conclusive answers on the status of sea-launch platforms.[51] UNCLOS has generally accepted a broad definition of a 'ship', which may evolve to meet the new realities of shipping and affords significant discretion to states.[52] In this author's view, it is important to take into account not

[42] Some conventions seek to include nearly all types of crafts into their scope, regardless of more specific uses, design and mobility features (eg art 2(7) of the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships), while others adopt a more restrictive definition. See also Vaughan Lowe 'Report on the interpretation of the term "ship" in the 1992 Civil Liability Convention (September 2011) written for the IOPC Funds, document IOPC/OCT11/4/4 https://documentservices.iopcfunds.org/meeting-documents/.

[43] Richard A Barnes 'Flag states' in Donald R Rothwell, Alex G Oude Elferink, Karen N Scott and Tim Stephens (eds) *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) 311; Mikhail Kashubsky *Offshore Oil and Gas Installations Security: an International Perspective* (Informa Law/Routledge 2016) 152; Richard A Barnes 'Article 17' in Alexander Proelss (ed) *United Nations Convention on the Law of the Sea: A Commentary* (Hart Nomos 2017) 180.

[44] For example, emergence of autonomous and unmanned vessels put the notion of a law of the sea definition of a 'ship' under pressure. See eg Eric Van Hooydonk 'The law of unmanned merchant shipping: an exploration' (2014) 20 *Journal of International Maritime Law* 403.

[45] See n 7 above.

[46] See n 5 above.

[47] Yuqiao (note 3); Kerrest (n 12).

[48] See eg Danish Suborbitals (n 13). Cf arguments submitted by Finland with regard to navigational rights of oil rigs and drill ships through Great Bells: Application to the International Court of Justice instituting proceedings (17 May 1991) *Passage through the Great Bell (Finland v Denmark)* case discontinued.

[49] See ICF Kaiser Consulting Group 'Final environmental impact assessment for the sea launch project' (1999) https://www.faa.gov/about/office_org/headquarters_offices/ast/media/final_ea_sea_launch.pdf.

[50] The Italian project 'San Marco' (1967–1980) was used to launch research satellites from a fixed platform established off the coast of Kenya. See H N Nesbitt 'History of the Italian San Marco equatorial mobile range' (1 January 1971) https://ntrs.nasa.gov/citations/19720007316.

[51] It is obvious that sea launch platforms are ships for the purpose of some maritime conventions, but not others.

[52] Flag states are largely free to decide what structure is a 'ship' for the purposes of national law. For example, a floating, non-self-propelled Ocean Cleanup structure could meet the definition of a ship under Dutch law (but has so far not been registered as such). See Rozemarijn Roland Holst 'The Netherlands: the 2018 agreement between The Ocean Cleanup and the Netherlands' (2019) 34 *The International Journal of Marine and Coastal Law* 351.

only the navigational, functional and technological features of floating launch platforms as such but also the general objective of UNCLOS to provide for a reasonable allocation of competences between the flag state and the coastal state in various maritime zones. As 'ships', seaborne launch platforms acquire a clear legal connection to a flag state, thereby positively contributing to international space law objectives. While the application of the coastal state regime to such platforms under other provisions of UNCLOS cannot be ruled out,[53] a sound conclusion is that, at the very least, mobile, floating and self-propelled platforms should generally be viewed as ships for the purposes of UNCLOS.

3.2 The nationality of sea launch platforms

A significant implication for the legal status of such platforms following their classification as 'ships' is that they would generally be subject to the flag state regime set out in UNCLOS, including the exclusive flag state jurisdiction on the high seas. As the freedom of the high seas is a right accorded to states, non-state actors involved in sea-based launches may only exercise this right through their legal relationship with a flag state.[54] This legal relationship emerges when a state grants its nationality to the launch vessel.[55] The flag state is also required to maintain a ship register containing information on the ships flying its flag.[56]

The registration of a launch platform by a flag state arguably ensures the necessary formal evidence of a juridical link between a state and launch activities conducted from the platform of its registry outside the state's territory. Such a transparent and traceable connection between the launch vessel and a state may be decisive for determining the internationally responsible and, as the case may be, 'appropriate' state for the purposes of authorisation and 'continuous supervision' of space activities at sea, as required by the Outer Space Treaty. Last but not least, it may also be relevant for determining the state bearing liability for damage caused by space objects launched from the seaborne launch platform ('facility').[57]

In the case of state-run space projects (eg the Long March 11 project), launches are most likely to be conducted from vessels registered in the same state.[58] However, in multinational commercial projects, the nationality of the actors and the place of registration of the launch vessel may not necessarily coincide. For example, in the Sea Launch project, the launch platform LP *Odyssey* was reportedly registered in the ship register of Liberia, while joint venture partners came from elsewhere.[59] The project was authorised by the USA, which was a state of nationality of some of the project owners and most customers, and a home port of the LP *Odyssey*.[60] The relevance of the flag state to determine the nationality of the launch vessel may be questioned in such cases. However, it is generally up to the state of registration (ie the flag state) to decide on the criteria and conditions for granting their nationality to vessels, as UNCLOS only requires the existence of a 'genuine link between the state and the ship', without detailing further requirements.[61] Neither is the nationality of the owners entirely irrelevant for the determination of a ship's status under UNCLOS: Article 92 says

[53] See UNCLOS art 60.

[54] ibid art 92. See also Nilüfer Oral 'Jurisdiction and control over activities by non-state entities on the high seas' in Robert C Beckman, Millicent McCreath, J Ashley Roach and Zhen Sun (eds) *High Seas Governance: Gaps and Challenges* (Brill 2018) 9, 11.

[55] See Cheng (n 16), who notes the 'quasi-territorial' nature of the flag state jurisdiction. On a ship's nationality see generally Guilfoyle 'Article 92' (n 43) 703.

[56] Being the names and particulars of ships flying its flag (UNCLOS art 94).

[57] See text accompanying n 25 above.

[58] Zero Hedge 'Watch: China becomes first nation to "own and operate" space rocket that launches from sea' *Phil's Stock World* (7 June 2019).

[59] The Sea Launch Limited Partnership (SLLP) was organised as a joint venture under the laws of the Cayman Islands (UK) with the partners Boeing Commercial Space Company (USA) RSC Energia (Russia) KB Yuzhnoe (Ukraine) and Kværner Maritime AS (Norway). See ICF Kaiser Consulting Group (n 49).

[60] See ICF Kaiser Consulting Group (n 49).

[61] UNCLOS art 91(1).

that a 'ship may not change its flag during a voyage or while in a port of call, save in the case of a real transfer of ownership or change of registry'. Nevertheless, no binding rules of contemporary international law make a ship's nationality conditional upon the owner's citizenship, domicile or place of registration.[62] The objectives of space law with regard to the authorisation and supervision of launch activities may probably be safeguarded by the stringent requirements regarding space activities in the national laws of the other states involved;[63] however, some issues remain unresolved, eg those related to liability for damage caused by space objects launched from a seaborne vessel that has a weak link with the flag state.

Arguably, in the absence of a formal registration by a flag state (or in case of multiple flags contrary to Article 92 UNCLOS), the nationality or domicile of the non-state owners of a launch vessel will arguably per se provide sufficient evidence of a legal link between the seaborne launch platform and the relevant state. The same approach appears feasible to determine the nationality or establish a juridical link with a launch platform which is not a 'ship' within the meaning of international law, and hence not subject to the flag state regime. As no particular system of registration of installations, offshore platforms and similar structures is envisaged under the international law of the sea, identification of a relevant legal link with a state (or states) with regard to launches from such platforms on the high seas conducted by non-state actors should be based on the application of general international law rules, where the nationality (domicile or place of registration of the project owners) would arguably be a relevant factor.[64] The further discussion of jurisdiction over sea-based launches on the high seas shows that this approach would be compatible with the UNCLOS and international law rules of jurisdiction, as well as feasible to achieve the objectives of the Outer Space Treaty.

4 Jurisdiction over sea-based launches on the high seas

4.1 Flag state jurisdiction over seaborne launch vessels

The flag state is required 'effectively to exercise its jurisdiction and control in administrative, technical and social matters' over the ships flying its flag, which entails a duty to have sufficient legislation and organisation to ensure effective legal control in these matters.[65] Thus, flag state jurisdiction is generally consistent with the objectives of international space law in cases where the flag state is the only state holding effective jurisdiction over the vessel and persons (including foreign nationals) involved with space activities on the vessel, eg the Long March 11 project in China.[66] The flag state will be responsible for adopting and enforcing appropriate regulations for space launch operations on board. At the same time, the flag state's exclusive jurisdiction on the high seas will ensure that launch operations at sea are not disturbed by other states.[67] Exclusive enforcement jurisdiction of the flag state on the high seas precludes other states from carrying out inspections and similar interventions with the platform on the high seas other than with the consent of the flag state.

However, implementing the nationality principle of jurisdiction over sea-based space activities *exclusively* through flag states may not necessarily provide for an optimal solution for commercial and multinational projects as used on the Sea Launch project.[68] The flag state may be selected by the launch project participants for a variety of reasons, such as convenience of flying such a flag,

[62] UN Convention on Conditions for Registration of Ships (7 February 1986 26 ILM 1229, not in force) arts 7–9 contains provisions suggesting that the ownership (or alternatively crewing) of the ship by nationals of the flag state is viewed as relevant for the effective exercise of flag state jurisdiction and control. Considering potential implications of the flag State's responsibility and liability for inherently ultra-hazardous space launches conducted from their vessels, it may be reasonable for flag States to impose stricter nationality, or at least ownership transparency, requirements on launch vessels to be registered in their ship registers.

[63] See eg Sea Launch (flagged in Liberia but licensed in the US) did not reportedly raise such concerns.

[64] See also Oral (n 54) 29 and Roland Holst (n 52).

[65] UNCLOS art 94. See also James G Devaney, Christian J Tams 'Article 304' (n 43) 1961.

[66] On the notion of 'effective jurisdiction' see eg Cheng (n 16) 24.

[67] UNCLOS art 92.

[68] See n 59 above on the Sea Launch participants.

stringency of requirements as to the nationality of the shipowners, a favourable tax system and other factors. At the same time, as the Sea Launch project illustrated, other states may be better suited for regulating, authorising and supervising space activities from such a vessel. In the Sea Launch project, neither the crew, owners nor operators of the Sea Launch platform and the launch vehicle (the rocket) were nationals of the flag state (Liberia).[69] The real control over launches was exercised by a joint venture effectively controlled by US citizens but registered elsewhere. The crew was employed by a company registered in Norway. The home port of the platform was in the United States. The US authorities, not Liberia, authorised and regulated this project.[70]

State jurisdiction over space activities under space law is connected with the crucial issue of international responsibility for such activities, and the duty to act as the 'appropriate' state designated by the Outer Space Treaty to authorise and continuously supervise non-governmental space activities.[71] If real control over space activities on board a launch vessel is exercised from elsewhere, vesting all jurisdiction over the launch vessel and activities on board in the flag state creates significant uncertainty with regard to determining the relevant state(s).

It is pertinent to consider whether states other than the flag state may hold jurisdiction over a seaborne launch vessel and space activities undertaken on board. In principle, the UNCLOS provisions on a flag state's duty to exercise effective jurisdiction may be understood as being limited to matters traditionally 'concerning the ships', which arguably do not include space launches as such.[72] In such a case, the UNCLOS provisions should not preclude other states from meeting their international responsibilities with regard to space activities on the high seas by prescribing national provisions on space activities undertaken on board.

Furthermore, the right to exercise *prescriptive* jurisdiction over ships is arguably not confined exclusively to flag states. With respect to vessels on the high seas, non-flag states may exercise prescriptive jurisdiction if a sufficient connection exists between the state and the ship.[73] However, the *Norstar* judgment illustrates that extraterritorial prescriptive jurisdiction by non-flag states is not uncontroversial.[74] In the majority view, the principle of exclusive flag state jurisdiction being an inherent component of the freedom of navigation 'prohibits not only the exercise of enforcement jurisdiction on the high seas by states other than the flag state but also the extension of their prescriptive jurisdiction to *lawful activities conducted by foreign ships on the high seas* …'.[75] An exception may be justified by the Convention or 'other international treaties' only 'in exceptional cases expressly provided for' therein.[76]

In this author's view, non-governmental launches of space objects from the high seas without an authorisation and supervision by the appropriate state within the meaning of Article VI of the Outer Space Treaty may not be 'lawful activities of foreign ships on the high seas'.[77] Thus, it may be possible to reconcile non-flag state jurisdiction with UNCLOS by applying its provisions in line with

[69] See https://www.vesseltracker.com/es/Ships/L-P-Odyssey-8753196.html?show=details. See also Peter van Fenema 'Legal aspects of launch services and space transportation' in Frans von der Dunk, Fabio Tronchetti (eds) *Handbook of Space Law* (Edward Elgar Publishing 2015) 382–454, 401.

[70] ICF Kaiser Consulting Group (n 49).

[71] Outer Space Treaty (n 15) art VI.

[72] On a corresponding approach with regard to mobile oil rigs see Rebecca K Richards 'Deepwater mobile oil rigs in the exclusive economic zone and the uncertainty of coastal state jurisdiction' (2011) 10(2) *Journal of International Business and Law* 387.

[73] Guilfoyle (n 55) 700–701. On extraterritorial jurisdiction generally see Cedric Ryngaert *Jurisdiction in International Law* (Oxford University Press 2017) 101 ff.

[74] *M/V Norstar Case (Panama v. Italy)* (Judgment) ITLOS Reports 2018–2019. The judgment challenges the dominating opinion by scholars that the flag state exclusivity extends only to enforcement activity occurring on the high seas. See Richard Collins 'Introductory Note to the *M/V Norstar Case (Panama v. Italy)* (ITLOS) American Society of International Law (10 April 2019) DOI:10.1017/ilm.2019.30.

[75] *M/V Norstar Case (Panama v. Italy)* (n 74) para 225 (emphasis added).

[76] UNCLOS art 92(1).

[77] See also discussion in section 2.2.

international space law obligations.[78] Arguably, states which may fall within the category of 'launching states' for the purposes of liability provisions[79] should be granted prescriptive jurisdiction under international law with regard to regulating space activities on the high seas. Thus, the nationality state of the launch project participants should be able to exercise its obligations under international space law by prescribing authorisation requirements and related sanctions provisions in its national law also with respect to extra-territorially conducted space launches. An important category of relevant states also includes states of registry for satellites launched into space from the high seas within the meaning of the Registration Convention.[80]

A broad approach to prescriptive jurisdiction which includes states with sufficient connection to the launch project is consistent with states' national practices, for example in the Sea Launch project authorised and supervised by a non-flag state (USA), owing to the important interests of US entities and citizens in the project.[81] There is also no reported evidence of Liberia as a flag state exercising its competence to adopt regulations applying to space operations from the LP *Odyssey*, although it may have done so with regard to traditional flag states' obligations to apply international maritime standards.[82]

A strict approach to prescriptive jurisdiction of non-flag states on the high seas also makes no sense in practice, because it means that non-flag states may not impose export control laws for satellites and similar assets used for launches on the high seas, simply because the ship is registered elsewhere. Thus, an approach to the extraterritorial prescriptive jurisdiction of non-flag states based on a general assessment of a 'sufficient connection' with the launch activity at sea would provide for more feasible solutions in the context of space launches from the sea.

4.2 Shortcomings and ambiguities of the UNCLOS jurisdictional regime

The exclusive *enforcement* jurisdiction of the flag state on the high seas generally precludes other states from carrying out inspections and similar interventions with the platform on the high seas. As noted above, such intervention into the flag state's rights protected by UNCLOS requires an express provision to this end in an international treaty.[83] The space conventions do not address issues of extraterritorial enforcement expressly.[84] In this author's view, a generally restrictive approach established in UNCLOS precludes exercise of the enforcement jurisdiction vis-à-vis a foreign-flagged launch vessel without consent of the flag state.[85] This logically means that other potentially 'appropriate' states than the flag state would not be able to meet their obligation of continuous supervision under Article VI of the Outer Space Treaty. Such states may only carry out necessary inspections when the launch platform is situated in their internal waters or ports (or consent is obtained from the flag state). From a space law perspective, this may imply that only the flag state is the 'appropriate' state with regard to sea launch activities, as no other state holds effective jurisdiction over those activities.

---

[78] UNCLOS art 92(1).

[79] On the notion of a 'launching state' see eg van Fenema (n 69) 398.

[80] National space laws include extraterritorial activities by nationals abroad, at least with regard to licensing requirements.

[81] The USA considered that the company Boeing held 40% shares in the company and see also UNCLOS art 139 (The Area) referring to 'state enterprises or national or juridical persons which possess the nationality of States Parties or are effectively controlled by them or their nationals'.

[82] Notably, Liberia, the flag state of LP Odyssey (Sea Launch) is not a party to any space conventions.
In the case of Sea Launch, there was reportedly an agreement between the US and other participants designating the US as the licensing authority (but not with the flag state of the platform). See Lee (n 5).

[83] UNCLOS art 92(1). Exceptions to the exclusive jurisdiction of the flag state possible 'only and, save in exceptional cases expressly provided for in international treaties or in this Convention».

[84] Article VI in conjunction with art VIII of the Outer Space Treaty arguably suggests a rule to that effect ('jurisdiction and control over' a space object while in outer space) but would not provide a sufficiently clear exception for the purposes of non-flag state enforcement at sea.

[85] See also Guilfoyle 'The high seas' in Donald R Rothwell, Alex G Oude Elferink, Karen N Scott and Tim Stephens (eds) *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) 201–25.

While this may be an adequate solution for some flag states, it may in certain cases lead to outcomes inconsistent with the objectives of international space law. Flag state jurisdiction may not resolve all the problems arising from space activities on the high seas. As noted above, there is a serious risk of insufficient or ineffective regulation in cases where the flag state is not acting responsibly and/or does not in practice have control over space activities conducted from its vessel.[86] In any case, shipowners may change the flag of their vessels at any time they wish to do so.

Seaborne launch facilities may be categorised as 'installations' falling outside the flag state regime and ship registration system.[87] States may generally deploy such platforms on the high seas by invoking their freedom to construct artificial islands and other installations permitted under international law.[88] UNCLOS does not, in principle, exclude sea launches which are conducted in a manner compatible with its provisions.[89] However, significant gaps remain with regard to the identification of a state responsible for such installations. A state responsible for sea launch 'installations' may arguably be determined by analogy with rules in other UNCLOS provisions, eg nationality and 'effective control' criteria (the Area) or the state of registration of a research installation (marine scientific research).[90] This approach would also be in line with the provisions of the Outer Space Treaty on the responsible and 'appropriate' state(s). For privately operated projects like the Sea Launch service, additional arrangements between the states concerned would be necessary to ensure that there is always a state which exercises real supervision over all stages of operations, irrespective of the location of the platform.[91] This may also be particularly important in cases where vessels registered in flag states with a poor record of enforcement and flags of convenience are engaged in such projects.[92] From the flag state perspective, it is also necessary to cooperate with other states involved in a multinational launch project to ensure that the allocation of responsibilities over high seas launches from its vessel is not entirely governed by the general provisions of UNCLOS on flag state regimes.

A significant issue raised by sea launches is the need to establish vast safety zones, far in excess of the commonly accepted maximum of 500 metres.[93] Although UNCLOS does not expressly provide for a limitation with regard to installations on the high seas,[94] launches of space objects from the high seas may disproportionately interfere with the freedom of the high seas for other states[95] and be considered incompatible with the 'due regard' obligation.[96]

5 Space launches in areas under the jurisdiction of the coastal state

5.1 Introduction

It is unlikely that routine launches of space objects will be conducted from seas near a state's coastline, as these activities may pose serious environmental and safety concerns for the coastal state

[86] For example, LP Odyssey (Sea Launch) was registered in Liberia, one of flag states reportedly allowing anonymity. See OECD *Ownership and Control of Ships* (March 2003). See also John N K Mansell *Flag State Responsibility: Historical Development and Contemporary Issues* (Springer 2009) 110.

[87] See also Oral (n 54) 29.

[88] UNCLOS art 87.

[89] See text accompanying n 33 above.

[90] UNCLOS arts 139(1) and 262. See also Roland Holst (n 52) on The Ocean Cleanup, where the nationality state of the project owners, the Netherlands, assumed jurisdiction over the project by 'analogy' with UNCLOS art 262. The structure bears identification marks of the Netherlands, although it is not reportedly registered in the Dutch ship registry.

[91] See eg Request for Advisory Opinion submitted by the Sub-Regional Fisheries Commission (Advisory Opinion) ITLOS Reports (2 April 2015) 4.

[92] It should be noted that Liberia, the flag state of LP Odyssey (Sea Launch) is not party to any space conventions. See UN Office for Outer Space Affairs 'Status of international agreements relating to activities in outer space' (1 January 2020) https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html.

[93] See Tommaso Sgobba (ed) *Safety Design for Space Operations* (Elsevier 2013).

[94] See UNCLOS arts 60 and 260. The Ocean Cleanup structure is reportedly 50 km long. See Oral (n 54) 31, and should also raise objections.

[95] UNCLOS arts 89 and 311(2). See also Churchill and Lowe (n 34). The Sea Launch project did not reportedly raise protests by other states, but it had been preceded by a dialogue with regional States. See ICF Kaiser Consulting Group (n 49).

[96] See further below.

concerned.[97] However, launch vessels need to rely on their navigational rights when transiting through maritime areas under the national jurisdiction of other states to reach their destination on the high seas. For example, in the Sea Launch project, the platform LP *Odyssey* and launch components were transported to the launching site on the high seas from Europe to the Pacific Ocean, crossing waters under the national jurisdiction of other states.[98] Furthermore, as illustrated by Copenhagen Suborbitals (Danmark) and Shtil launches from a submarine in the Russian part of the Barents Sea,[99] maritime areas claimed as an EEZ may in practice be used for launches of space objects by governmental or private entities. These launch projects involved launch vessels and nationals of the coastal state in whose waters the launches took place. Another possible situation – not yet reported to have taken place – involves *foreign* launch projects in a coastal state's EEZ. Launches from foreign vessels in a coastal state's EEZ may obviously raise serious concerns for the coastal state. In addition to the possible interference with its own economic uses of the EEZ, the coastal state may be concerned about potential security threats inherent in space activities.[100] Damage to the coastal state's environment caused by a launch accident may also be devastating.[101]

The following discussion will first examine the right of innocent passage for sea launch platforms through the territorial seas of a coastal state, and then turn to the issue of allocation of the jurisdiction between the coastal state and the flag state whose vessels are involved in sea-based launches in the EEZ. As explained further below, a coastal state holds exclusive jurisdiction with regard to 'installations' in its EEZ and continental shelf, but more limited jurisdiction with regard to 'ships' under foreign flags in its EEZ. From an international space law perspective, the jurisdictional regime under the law of the sea applicable to coastal and flag states in the EEZ is subject to examination in order to determine an internationally responsible and 'appropriate' state for the purposes of Article VII of the Outer Space Treaty.

5.2 Passage rights for sea launch platforms in the territorial sea

UNCLOS clarifies that the sovereignty of a coastal state extends to its internal waters and territorial sea.[102] The sovereignty of the coastal state over its territorial sea suggests that the coastal state is a 'launching state' within the meaning of liability rules for damage caused by space objects launched from the state's territory.[103] In line with the Outer Space Treaty, the coastal state is under an obligation to authorise and supervise space activities by non-governmental actors in its territorial waters. Although space conventions do not define 'space activities', launches of space objects and certain related activities are generally viewed as such.[104]

At the same time, UNCLOS provides that the sovereignty of the coastal state in its territorial sea is limited by the right of innocent passage enjoyed by foreign vessels. As 'ships' sailing under the flag of a state,[105] launch vessels generally fall within the scope of UNCLOS provisions laid down in Article 17 ff and are, in principle, entitled to exercise the right of innocent passage through a territorial sea of a coastal state. Launches of space objects from territorial seas would clearly go far beyond the scope of 'innocent passage' within the meaning of Articles 18 and 19 of UNCLOS. Space launches from ships will not meet the requirements that the 'passage' is continuous and expeditious,

[97] See n 50 above on the San Marco project, which was located just off the then three-nautical mile territorial sea of Kenya (reportedly by agreement with the latter).

[98] See ICF Kaiser Consulting Group (n 49) fn 27, 2–2. China's launch vessel *Long March 11* would also inevitably have to travel from the Yellow Sea through maritime zones of other states or waters subject to inter-state agreements to reach the equatorial areas of the Pacific Ocean.

[99] See nn 13 and 7 above.

[100] *BruDirect* (Asia) (n 7).

[101] See n 9 above.

[102] UNCLOS art 2.

[103] The *Long March 11* launch may have taken place from the Chinese territorial waters as the location of the anchorage was reported at 34,90N and 121,19E (Wikipedia), ie within China's territorial sea: Ortoland and Pirat (n 10) 202.

[104] National Space Law Collection (n 14).

[105] See discussion in section 3.

and that any stopping by a foreign vessel may only be 'incidental to ordinary navigation'. As illustrated by the Sea Launch project, sea-based launches require long periods of stopping and preparations at the location of the launch, including the correct positioning of the platform and the launch vehicle. In addition, a vast safety zone has to be established in relation to the launch.[106]

Further, the condition of the passage being 'innocent' will also not be met: hazards of space launches make them 'prejudicial to the peace, good order or security of the coastal state'. Admittedly, launching or landing of *space objects* such as space rockets is not mentioned in Article 19 as such, but they may arguably be viewed as 'any aircraft' (Article 19(2)(e)) or, as the case may be, a 'military device'. In any case, such activities may be covered by the prohibition on 'any other activity not having a direct bearing on the passage' laid down in Article 19(2)(l).[107]

Other launch-related activities onboard a foreign launch platform such as preparations for launch on board the launch vessel may also involve some potentially hazardous activities of concern for the coastal state. For example, in the Sea Launch project, the journey time to the launch location on the high seas was used for rehearsals and checks for the launch, such as testing of electrical systems of the launch vehicle, and checks of launch command processes and contingency measures.[108] While not being as explicitly prejudicial to the security of the coastal state as actual launches of space objects, such activities do not, strictly speaking, have a direct bearing on the passage within the meaning of Article 19(2)(l).[109]

If the foreign launch vessel is *not* in innocent passage, the coastal state may avail itself of the right of protection by taking the necessary steps to prevent such passage. Such steps require a proportionality assessment by the coastal state and may, if necessary, include such drastic measures as stopping the launch platform from entering its territorial sea or requesting it to interrupt the passage and exit its territorial sea.[110] By contrast, with regard to the *innocent* passage by a foreign launch platform, the coastal state's possibilities for regulating and restricting foreign launch vessels' navigation are more limited. Article 21 of UNCLOS allows coastal states to impose certain conditions on the exercise of a right to innocent passage such as adopting regulations on the safety of navigation, the preservation of the coastal state's environment and the prevention, reduction and control of pollution, except for construction, design, equipment and manning (CDEM) standards (unless these give effect to generally accepted international rules and standards).[111] Importantly, UNCLOS entitles coastal states to designate sea lanes for ships 'carrying nuclear or other inherently dangerous or noxious substances or materials'.[112]

One of the potential matters of concern for the coastal state is that an unsafe accident or leakage of hazardous fuel while a space object is in transit on board a ship, compromising environmental safety interests of the coastal state. [113] UNCLOS does not allow coastal states to take preventive measures against *potentially* unsafe foreign ships passing through their territorial sea. Even a prior notification requirement by a coastal state for vessels carrying dangerous cargoes is generally not recognised under the international law of the sea. Thus, an argument that the launch vehicle and its cargo (ie fuel for the space rocket and its payload) may be explosive or highly toxic is not acceptable for the purposes of preventing the passage, although in practice, some states have reportedly asserted such

[106] ICF Kaiser Consulting Group (n 49) fn 27, 2–1.

[107] See also Kerrest (n 12) 219 ff.

[108] See ICF Kaiser Consulting Group (n 49) 2–2, Figure 2.1.–1.

[109] See art 39(1)(c) regulating transit rights through international straits which says that ships and aircrafts shall 'refrain from any activities other than those incident to their normal modes of continuous and expeditious transit unless rendered necessary by *force majeure* or by distress'.

[110] UNCLOS art 25(1). On coastal states' right of protection generally, see Richard A Barnes, 'art 25' in Proelss (n 43) 222 ff.

[111] Currently, there are no internationally accepted safety and environmental standards in the space sector within the meaning of art 21 or any international agreements within the meaning of art 23.

[112] UNCLOS art 22. See generally Barnes 'Article 17' (n 43) 208–17.

[113] Generally on environmental concerns raised by fuels in the space sector see, eg European Space Agency, 'Green' Satellite Fuel designed to make space safer https://www.esa.int/Our_Activities/Space_Engineering_Technology/Green_satellite_fuel_designed_to_make_space_safer.

rights vis-à-vis vessels carrying nuclear or other inherently dangerous or noxious substances, not only in territorial seas but also in the EEZ.[114] UNCLOS only allows coastal states to require that foreign ships observe special precautionary measures established for such ships by international agreements.[115] Considering the marginal scope of sea-based launch activities, the passage of launch vessels through the territorial waters of other states will, for the time being, best be addressed within the framework of existing agreements.

5.3 Coastal state's competences with regard to space launch activities in its EEZ

5.3.1 Launch platforms as 'installations' subject to Article 60 of UNCLOS

Classification of a launch platform as a 'ship' or an 'installation' is a starting point for determining which state – the flag state or the coastal state – holds jurisdiction over the platform in the EEZ or on the continental shelf.[116] The coastal state's exclusive jurisdiction over installations in the EEZ includes the right to construct, authorise and regulate the construction, operation and use of artificial islands, installations and structures for 'economic purposes'. In addition, coastal state jurisdiction also applies to installations and structures which may interfere with the exercise of the rights of the coastal state in the EEZ.[117] This arguably encompasses foreign actors conducting non-economic launches from the EEZ.[118]

Article 60(1) establishes a clear regulatory authority of the coastal state over structures covered by this provision, regardless of other possible legal links to the flag state.[119] Therefore, it is feasible to consider the coastal state as the 'appropriate state' (or one of the 'appropriate' states) for the purposes of authorisation and supervision of private space activities from installations falling under the scope of Article 60. However, Article 60 of UNCLOS does not resolve all issues which may arise in case of launches from the EEZ. As noted above, the breadth of a safety zone around an installation permitted under Article 60 of UNCLOS (maximum 500m, 'except as authorised by generally accepted international standards or as recommended by the competent international organisation') would indeed be far from sufficient for the purposes of space launches.[120]

Furthermore, it may be unclear whether a mobile launch platform is a ship or an installation within the meaning of Article 60 owing to the complex modus operandi of mobile launch platforms. While launch vessels do operate like ships when they navigate to the launch location at sea and remain afloat at the time of the launch, they are submerged to a more stable position in the water column prior to the launch operations and do not differ much from mobile rigs when performing functions unrelated to navigation, ie at the time of the actual launches (as illustrated by LP *Odyssey*).[121] For the purposes of Article 60, it is reasonable to examine whether the platform is used for navigation or economic purposes other than navigation.[122] By analogy with mobile oil rigs, launch platforms are functioning as installations rather than ships when conducting launches of space objects. Even if the coastal state asserts jurisdiction under Article 60, the coastal state's complete and uninterrupted jurisdiction over all aspects of the activities on mobile launch platforms in its EEZ is uncertain under UNCLOS because the ambiguity remains with regard to mobile platforms which are also registered as 'ships', which may result in an unclear division of competences with regard to safety inspections and related measures between the coastal state and the flag state.[123] In this author's view, seaborne launch platforms conducting actual launches in the EEZ should generally be governed by coastal

[114] Natalie Klein *Maritime Security and the Law of the Sea* (Oxford University Press 2015) 40–41.
[115] UNCLOS art 22. See generally Barnes 'Article 17' (n 43) 208–17.
[116] See section 3.1 above.
[117] UNCLOS art 60(1)(c).
[118] See eg military satellites and (arguably) satellites with research or governmental rather than private goals.
[119] UNCLOS art 60 applies mutatis mutandis to corresponding structures on the continental shelf of the coastal state; see also UNCLOS art 80.
[120] On launch danger zones see eg Sgobba (n 93) and Kerrest (n 12) 17.
[121] See ICF Kaiser Consulting Group (n 49).
[122] Alexander Proelss 'Article 60' (n 43) 470.
[123] The same problem exists with regard to mobile oil rigs. See Kashubsky (n 43); Richards (n 72).

state jurisdiction under Article 60 of UNCLOS. This would ensure a clear allocation of competences and preclude unnecessary fragmentation of the regulatory framework applicable to space activities at sea.

5.3.2 Space launches from foreign ships in EEZ

The flag state may reasonably object to the solution anchored in Article 60 if it considers a floating launch platform to be a 'ship' subject to the flag state regime and entitled to exercise its freedoms in the EEZ 'in so far as they are not incompatible with the provisions of Part V' (on EEZs).[124] Unresolved issues remain with regard to the compatibility of such projects with the international law of the sea. From the outset, Part V of UNCLOS does not expressly lay down limitations on the freedom of navigation for vessels engaged in sea-based launch activities. By comparison, the legality of foreign military activities in the EEZ (missile testing, launching of weapons or military aircraft; ie activities not related to navigation) is not expressly addressed in UNCLOS and is a controversial issue in the law of the sea.[125] Although sea-based launches examined in this article are not military by nature, the resemblance goes beyond purely operational similarities: eg in the case of high-altitude or sub-orbital launches, missiles may also be considered as 'space objects' within the meaning of space treaties. Like space launches, military activities at sea require lengthy stays in the maritime area, as well as adoption of measures restricting other states' use of the EEZ and air space (eg establishment of security zones).[126] However, one may not discern a general prohibition of all foreign military activities in the EEZ under the law of the sea.[127] On the basis of this, it may be reasonable to suggest that the coastal state is not entitled to ban foreign sea-based launch activities in the EEZ as such, at least where such activities are conducted by a foreign state.

In this author's view, analysis of coastal state jurisdiction over foreign flag states' space activities in its EEZ should rather be focused on what measures it may adopt to regulate such activities. Importantly, UNCLOS vests coastal states with certain regulatory powers with regard to foreign-flagged ships in their EEZs to give effect to its sovereign rights in this area.[128] The coastal state's regulatory powers over foreign launch activities in its EEZ are, however, not unlimited. From the outset, Article 58(3) requires states to 'comply with the laws and regulations adopted by the coastal state in accordance with the provisions of this Convention and other rules of international law in so far as they are not incompatible with [Part V UNCLOS]'. Thus, UNCLOS provides coastal states with prescriptive jurisdiction vis-à-vis other states in its EEZ, but the exercise of such jurisdiction must generally be compatible with the legal regime of EEZ, including provisions of Article 56 setting out the scope of the coastal state's jurisdiction in the EEZ.

It is questionable whether the coastal state may also prescribe measures (and if so, what measures) regulating activities which are not covered by those expressly mentioned in Article 56 (ie activities other than those related to offshore installations, marine scientific research, environmental protection and fisheries) or elsewhere in UNCLOS.[129] In some cases, UNCLOS expressly limits the coastal state's prescriptive competences to internationally applicable standards. For example, with regard to adopting rules on vessel-source pollution in the EEZ, the coastal state is subject to the detailed

[124] UNCLOS arts 58 and 85.

[125] UNCLOS art 88 requirement that '[t]he high seas shall be reserved for peaceful purposes' is generally not understood as precluding such uses. See generally Boleslaw Adam Boczek 'Peacetime military activities in the exclusive economic zone of third countries' (1988) 19 *Ocean Development and International Law* 445; Jon M Van Dyke 'Military ships and planes operating in the exclusive economic zone of another country' (2004) 28 *Marine Policy* 29.

[126] See eg National Research Council *Streamlining Space Launch Range Safety* (National Academies Press 2000) https://doi.org/10.17226/9790.

[127] See UNCLOS art 39(1)(c) regulating transit rights through international straits, which expressly precludes activities on foreign ships 'other than those incident to their normal modes of continuous and expeditious transit'. See also Boczek and Van Dyke (n 125). Obviously, states conducting space activities in other states' EEZ must respect not only UNCLOS but all applicable international law, including arms control treaties.

[128] UNCLOS art 56.

[129] ibid art 56(1)(b).

provisions of Article 211. This provision generally permits coastal states' national regulations in the EEZ to give effect to international standards.[130] Thus, the coastal state may adopt rules on pollution of sea resulting from space launches in its EEZ, to the extent the existing international standards are relevant for such pollution. This does not resolve environmental concerns of the coastal state in the present case, as no relevant international standards have been adopted with regard to the protection of the marine environment from pollution caused by space activities.

Enforcement jurisdiction vis-à-vis foreign ships may only be exercised by the coastal state in a narrow category of cases. These do not include situations where the coastal state wishes to perform supervision and control of foreign launch vessels in relation to space activities on board, even if the platform is operated by the coastal state's own nationals. The coastal state may also not apply coercive measures to foreign launch vessels on grounds related to safety other than ship-source pollution,[131] or in cases where the international law conditions of necessity or self-defence are met.[132] This generally means that UNCLOS rules on coastal state jurisdiction over launch ships under a foreign flag in the EEZ effectively prevent a coastal state from meeting its obligations as 'the appropriate state' to authorise and supervise space launches within the meaning of international space law.

Considering a marginal scope of sea-based space activities and absence of clear rules on allocation of jurisdiction with regard to sea-based launches, application of a 'back-up' rule of Article 59 may provide a relevant basis for resolving the issue of conflicting competences over these activities.[133] This provision governs precisely the situations where UNCLOS does not attribute rights or jurisdiction to a coastal or other state and prescribes that conflicts are resolved 'on the basis of equity and in light of all the relevant circumstances, taking into account the respective importance of the interests involved to the parties as well as to the international community'. Arguably, the protection of the freedom of navigation for third states would be a relevant consideration under Article 59 (including those cases where the coastal state itself is involved in space launches in its EEZ), as this provision expressly includes the interests of the international community in the balancing exercise. It is, however, unclear whether application of this provision will ultimately entitle the coastal state to take measures vis-à-vis foreign launch vessels other than may be lawfully adopted under the provisions of Articles 56 and 58, especially with respect to any enforcement measures vis-à-vis foreign space launches in the EEZ.

6 Duty of due regard

Launches from sea may significantly restrict navigation, overflight and other uses of the sea in proximity of the launch, in particular because they require the establishment of a temporary warning or exclusionary zone.[134] Thus, the essential interests of the third states (eg freedom of navigation and overflight) and the coastal state protected in UNCLOS (eg exploitation and preservation of living resources, exploitation of non-living natural resources and protection of the marine environment) may be considerably impaired by such activities.[135]

Provisions of the Outer Space Treaty on the duty to consult other states if an activity or experiment may cause harmful interference with activities of other states reflect a general principle of international law relevant also in the law of the sea context.[136] Thus, states should always conduct prior consultations regarding planned launches at sea with states whose interests may be affected by

[130] Marine scientific research, fisheries, environment.

[131] On conditions prescribed in UNCLOS arts 220 and 221 see UNCLOS art 73 (fisheries).

[132] See eg James Crawford *Brownlie's Principles of Public International Law* (Oxford University Press 2008) 751.

[133] Naval military manoeuvres in the EEZ may arguably be governed by this provision. See Proelss 'Article 59' (n 43) 462; Klein (n 114) 53.

[134] ICF Kaiser Consulting Group (n 49); Van Dyke (n 125) 35; Klein (n 114) 50.

[135] Van Dyke (n 125) 35.

[136] Outer Space Treaty (n 15) art IX. See also Hobe (n 11) 108.

such activities and ensure that they are in any case properly notified of the envisaged activities and able to take steps to protect their interests in line with international law.[137]

Under UNCLOS, space activities on the high seas and in EEZ are subject to the obligation for all states to take due regard of rights, duties and interests of other states.[138] The duty of due regard imposes a normative substantive and procedural requirement on states, and the evaluation of the rights and obligations of sea-launching state(s) and other states in light of the duty of due regard may result in specific legal implications for sea-launching states, such as the obligation to adjust or even terminate their planned activities.

With respect to the duty of due regard in the EEZ, international courts have clarified that, in a specific case, it may be relevant to consider the nature of the rights held by the state, their 'importance, the extent of the anticipated impairment, the nature and importance of the activities contemplated by the … state and the availability of the alternative approaches'.[139] Thus, if a state uses its EEZs very intensely for the purposes of shipping, fisheries, oil and gas production or similar economic activities, foreign actors envisaging launches from that EEZ will accordingly be subject to a stricter due regard obligation than if the EEZ is not used as intensely.[140] Obviously, the coastal state conducting launches from its own EEZ is under a corresponding obligation towards flag states whose vessels depend on the navigation through its EEZ and states exercising right of overflight.[141] Arguably, similar factors should be taken into account with regard to the space launch activities on the high seas. In the Sea Launch example, the actors reportedly chose a launch location as remote from land as possible, without material activities taking place in the proximity to the launch area.[142]

The assessment in the context of 'due regard' obligation should also take account of the ecological conditions and the importance and vulnerability of the marine environment of the respective EEZ. States may have to find alternative locations for their sea-based launches, prioritising sea areas of lesser ecological or economic importance. Such an assessment was reportedly conducted by the Sea Launch venture (with regard to launches from the high seas).[143] Nevertheless, island states located in relative proximity to the Sea Launch did voice their ecological concerns in the aftermath of an accident involving a rocket explosion.[144] While both the Yellow Sea (Long March 11) and the Arctic (Shtil, Barents Sea)[145] are ecologically fragile areas, it is not known whether any environmental assessment, or indeed any 'due regard' assessment, did take place prior to the launch.

Considering that the law of the sea and space law do not provide for a clear analytical framework to address conflicting uses of the EEZ and the high seas, this author submits that the obligation of due regard for other states should be given significant, even central relevance, in the assessment of the lawfulness of sea-based space launches. The violation of this requirement may entail state responsibility under international law.[146]

---

[137] The duty to consult is a pivotal principle of international law aimed at the protection of the environment (and hence the interests of the relevant State) and is codified in a number of international law sources. See Award of the Arbitral Tribunal established under Annex VII UNCLOS in Case 2011-03 *Republic of Mauritius v UK* (18 March 2015) para 519.

[138] UNCLOS arts 56(2), 58(3) and 87(2). The Outer Space Treaty reflects similar principles: cf art IX. On the duty of due regard see eg Rolf Einar Fife 'Obligations of "due regard" in the exclusive economic zone: their context, purpose and state practice' (2019) 34 *International Journal of Marine and Coastal Law* 43.

[139] Award of the Arbitral Tribunal in *Mauritius v UK* (n 137) para 719; *South China Sea Arbitration (The Philippines v China)* PCA Case No 2013-19 (12 July 2016) para 742. Both awards are available on the Permanent Court of Arbitration website www.pca-cpa.org.

[140] See eg the congested and busy Baltic Sea (Danish Suborbitals (n 12)) in comparison to remote areas of the Barents Sea (Shtil (n 6)) with less activity.

[141] UNCLOS does not establish any rebuttable presumptions in favour of the coastal state when balancing the conflicting interests of various states.

[142] ICF Kaiser Consulting Group (n 49).

[143] ibid.

[144] Lee (n 5).

[145] See nn 7 and 8 above.

[146] See section 7 below.

7 State responsibility and liability for sea-based space launches

7.1 Introduction

The overarching obligation of sea-launching states is to take all necessary measures to comply with their international obligations with regard to their space launch project. Importantly, states are also required to adopt measures to ensure that non-state entities under their effective jurisdiction act in compliance with international law.[147] With regard to sea-launch projects, these responsibilities may generally rest with the nationality states of the project owners and participants, the flag state of the launch vessel and the state(s) of registration of the satellite(s).[148]

Failure of sea-launching states to comply with their international law obligations may bring about a number of legal consequences, including claims for reparation to the injured state(s).[149] In cases where a single state owns and controls the launch vessels and the activity (eg China with regard to Long March 11[150]), the same state will be responsible for compliance with international law obligations in relation to this project, and liable for damage caused by the space object launched from the vessel under its flag. In joint ventures such as the Sea Launch project, multiple actors of different nationalities may act in different capacities and have different obligations depending on their roles: some may be responsible for maritime operations of the launch vessel, while others will do more space-related work such as preparation and launch of the space object or manage and supervise the project as a whole.[151] At the same time, the close interface between various functions means that all participants may contribute to a single violation or a single harmful outcome, eg environmental or other harm caused to third states by space activities. The responsibility in such a case may be shared between the different participants in a sea-launch project.[152]

The specific assessment of allegedly unlawful conduct has to take account of the substantive and procedural obligations laid down in the particular area of law. UNCLOS contains provisions laying down obligations and responsibilities for states in the maritime domain, eg the obligation of due regard for other states, the obligation to take measures to prevent transboundary marine pollution from activities under state jurisdiction and control, and flag state duties vis-à-vis its ships.[153] By contrast, international space law does not set out in detail general obligations in Article VI of the Outer Space Treaty and, in the absence of binding international standards for space activities, states retain a discretion in matters relating to substantive and procedural standards of space launches.[154] However, as discussed further below in more detail, Article VI of the Outer Space Treaty arguably lays down a higher standard of due diligence for states than UNCLOS does and also contains lex specialis provisions with regard to state responsibility for national space activities. As the same sea-based launch of space objects may, in principle, involve conduct which is governed by UNCLOS and the Outer Space Treaty, it may be feasible, in this author's view, to apply the provisions of both regimes to the same activity, for example, by relying on UNCLOS provisions governing its relationship with other agreements[155] or by way of harmonious interpretation. This may, however, result in states having imposed far more onerous obligations and responsibilities with regard to their sea-launching activities than if they acted in a traditional capacity under the respective regime, eg as a flag state of a ship on the high seas. In this author's view, the latter outcome may be fully

[147] See also Sub-Regional Fisheries Commission (n 91) and South China Sea Arbitration (n 139).

[148] See section 4.2 above.

[149] See generally Robert Kolb *The International Law of State Responsibility* (Edward Elgar Publishing 2016). For a more thorough analysis of state responsibility and liability regimes see eg Chen (n 16) and Henrik Ringbom 'Ship-source marine pollution' in André Nollkaemper and Ilias Plakokefalos (eds) *The Practice of Shared Responsibility in International Law* (Cambridge University Press 2017) 265–93.

[150] See n 8 above.

[151] A more detailed description of various functions and responsibilities is available in ICF Kaiser Consulting Group (n 49) C–2 and C–3.

[152] See generally Nollkaemper and Plakokefalos (n 16).

[153] Some obligations are regulated in other international instruments, eg IMO conventions and regional instruments.

[154] UNCLOS art IV prohibition and other agreements.

[155] UNCLOS art 311. See also text accompanying n 39.

compatible with the 'living' character of the international law of space and the law of the sea,[156] but requires further elaboration.

The due diligence-based approach only requires states to take measures necessary to prevent damage but do not automatically imply a duty to compensate actual damage caused. This may not be a satisfactory regime for highly dangerous activities with a high probability of third-party damage such as space launches. The explosion of a space rocket on board the LP *Odyssey* illustrates the potential for transboundary damage on the Earth, even if launches are conducted under the proper authorisation and in remote areas of the high seas.[157] To address this issue, in space law compensation for those injured from launching states is envisaged under certain conditions laid down in Article VII of the Outer Space Treaty and are detailed in the Liability Convention.[158] With regard to joint and multinational space activities on the high seas, the flag state may arguably be considered as a launching state for the purposes of the applicable liability regime.

The discussion below addresses issues pertaining to responsibility of sea-launching states and examines the normative contents of state obligations for sea-based launches (section 7.2) and then turns to state liability for damage caused by space objects launched from the high seas (section 7.3), with a focus on the legal position of the flag state.

7.2 Responsibility of flag state for space launch projects at sea

UNCLOS follows the general international doctrine of state responsibility, according to which a state is only responsible for (internationally unlawful) conduct if it is attributable to that state.[159] Thus, a flag state would generally be responsible for a vessel under its flag if the flag state holds effective control over the vessel. This may arguably be straightforward in case of governmental activities on a state-owned or operated vessel, but not with regard to commercial vessels.[160] In the law of the sea, the assessment usually focuses on the primary obligations of flag states laid down in UNCLOS and other maritime agreements, rather than on complexities of the secondary rules of state responsibility such as attribution of an internationally wrongful act of non-governmental actors against states.[161]

Article VI of the Outer Space Treaty imposes a direct international responsibility on states parties for national space activities, ie 'whether such activities are carried on by governmental agencies or by non-governmental entities'. This provision arguably makes the 'attributability' assessment of general international law irrelevant in the international space law as it imposes responsibility on a state exercising effective jurisdiction over the space activity.[162] Reading Article VI of the Outer Space Treaty in light of the UNCLOS provisions on a flag state's rights and obligations, it is feasible to conclude that the flag state of a sea-launch vessel may be viewed as (one of) the responsible states under the latter provision with regard to non-governmental launch activities from privately operated vessels.[163] This would be an entirely different legal position with regard to responsibility that flag states are used to in the maritime law context. In this author's view, however, the main concern for the flag state arises not from applicability of the secondary rules on state responsibility as such. What

[156] See text accompanying n 37.

[157] See Lee (n 5).

[158] Liability Convention (n 21) art II.

[159] International Law Commission 'Draft Articles on Responsibility of States for Internationally Wrongful Acts' (2001) 2 *Yearbook of the International Law Commission* 31. See also generally Kolb (n 149).

[160] See eg Peter L'Esperance 'In the wake of the *Erika*: flag state responsibility for the international obligations under the law of the sea' (2016) 30 *Ocean Yearbook* 505.

[161] Higgins points out that international courts usually focus 'on the *substantive law*, and not on any free-standing finding that State responsibility is incurred as a consequence of such breach' in Rosalyn Higgins 'Issues of state responsibility before the International Court of Justice' in Rosalyn Higgins *Themes and Theories* (Oxford University Press 2009) 1094–101. See also Sub-Regional Fisheries Commission (n 91) and South China Sea Arbitration (n 139), where tribunals focus on the due diligence obligations of the flag and coastal state, without giving attention to the evaluation of the responsibility criteria as such.

[162] See Chen (n 16).

[163] See section 4.

really matters is the content of the obligations imposed on the flag state of a launch vessel under international law.

The main question in this respect is whether the provisions of Article VI of the Outer Space Treaty are relevant for the assessment of the flag state's obligations with regard to launches of space objects from its vessel. In this author's view, the responsibilities of those flag states which are clearly 'responsible' states within the meaning of this provision should be assessed accordingly. Article VI of the Outer Space Treaty provides that states parties 'shall bear international responsibility for national activities in outer space' and emphasises the responsibility for 'assuring' that national activities are carried out in conformity with its provisions. In conjunction with other elements of this provision, this duty may arguably be understood as a stricter obligation to ensure compliance than would generally be the case under the general due diligence approach.[164]

However, in some cases, the role of the flag state as the 'responsible' state within the meaning of Article VI of the Outer Space Treaty may be more in doubt. For example, in the Sea Launch project, Liberia played a negligible role in the joint space project. As the flag state for LP *Odyssey* in the operations of Sea Launch, it would probably not have met the criteria of attribution (eg effective control).[165] Notably, functions related to maritime activities were assigned to Norway's Kværner Maritime AS (through subcontractors registered elsewhere), which constructed the assembly and command ship, refurbished the launch platform and managed all maritime activities, including the launch platform during space operations, and was responsible for environmental analysis of maritime activities as well as contingency activities and the safety of the crew and technicians.[166] (It is not known whether Liberia granted its consent to other states involved to exercise all enforcement over the launch vessel on the high seas or it never actively raised objections to this.)

Regardless of any shared responsibilities with other states involved under Article VI of the Outer Space Treaty or applicability of this provision to a flag state which does not as a matter of fact hold or exercise 'effective jurisdiction' over the launch platform, the flag state has a self-standing obligation 'effectively to exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag'.[167] Furthermore, Article 94(1)(b) of UNCLOS requires flag states to 'assume jurisdiction under its internal law over each ship flying its flag and its master, officers and crew in respect of administrative, technical and social *matters concerning the ship*' (emphasis added). The integrated nature of sea-launch projects illustrates that some 'space activities' may be characterised as 'matters concerning the ship', eg because they involve deployment or control of the vessel and its crew.[168]

Article 94 also sets out a number of safety, seaworthiness and manning requirements for flag states conforming to generally accepted international standards. The marginal extent of sea-based space launches makes the adoption of international standards designed specifically to regulate these activities improbable in the near future. The international treaty-based space law is also silent on the details of international obligations concerning safety and security of space activities, although non-binding regulation has been developed to address the most serious issues.[169] At the same time, it is consistent with the objectives and spirit of UNCLOS to include relevant rules and principles laid down in space-related safety instruments into the notion of 'international standards' applicable to flag states.[170]

[164] See eg Chen (n 16), who submits that art VI resembles a 'guarantee', ie a duty of 'result'.

[165] See section 4.2.

[166] Presumably, Kværner was also responsible for registering the vessel with a flag state and related functions.

[167] See section 4 above.

[168] ICF Kaiser Consulting Group (n 49) C–2 and C–3.

[169] However, there exist non-binding standards regulating certain aspects of safety in the space sector: eg UN Committee on the Peaceful Uses of Outer Space Scientific and Technical Committee and the International Atomic Energy Agency, Safety Framework for Nuclear Power Source Applications in Outer Space, A/AC.105/934 (2009) https://www.unoosa.org/pdf/publications/iaea-nps-sfrmwrkE.pdf; UN Office for Outer Space Affairs 'Space Debris Mitigation Guidelines' UN Committee on the Peaceful Uses of Outer Space (2010) https://www.unoosa.org/pdf/publications/st_space_49E.pdf.

[170] See Boyle (n 27) p 221 on non-agreed standards.

The flag state generally has a wide margin of discretion in matters pertaining to the exercise of its competence but is required to exercise due diligence when performing its obligations under UNCLOS. The absence of internationally agreed or accepted standards does not, in any case, release a flag state from its general duties with respect to safety of a vessel's operations at sea, including the proper exercise of the prescriptive and enforcement jurisdiction. Flag states should in any case take into consideration the real functions and purpose of the vessel when exercising their regulatory competences with regard to launch vessels. What remains unclear is whether the flag state's standard of due diligence with regard to sea-launching activities under UNCLOS will be equivalent to the high standard of Article VI of the Outer Space Treaty. In this author's view, the ultra-hazardous nature of space activities arguably imposes more stringent requirements on flag states to take regulatory and enforcement measures to prevent harm.[171]

UNCLOS provides a framework for states to exchange information and cooperate on issues of safety absent in space treaties, which may also be useful for space activities at sea. Thus, Article 94(6) provides non-flag states with the right to report the facts of alleged violations to the flag state, which is obliged to investigate the matter and, if appropriate, take any action necessary to remedy the situation. Article 94(7) requires flag states to investigate marine casualties or incidents of navigation on the high seas involving a ship flying their flag and causing loss of life or serious injury to nationals of another state or serious damage to ships or installations of another state or to the marine environment. While it is not certain that an accident during a space launch at sea would qualify as a 'marine casualty' or an 'incident of navigation', this provision may nonetheless be relevant with respect to investigation of incidents with space objects launched from the sea. Importantly, Article 94(7) requires the flag state to cooperate with the other states concerned in the course of any inquiry. In projects like the Sea Launch service, cooperation between the flag state and the appropriate non-flag states (eg the state of nationality) with regard to an accident on the high seas is indispensable.[172]

7.3 Liability for damage caused by the launch of space objects from sea

The approach to liability for damage caused under international space law differs significantly from the international law of the sea. In the context of marine pollution, UNCLOS requires states to adopt national recourse and compensation mechanisms to tackle compensation for damage by pollution caused by persons under their jurisdiction.[173] Flag states may, in principle, be subject to state liability for damage caused under general international law provisions or applicable lex specialis rules of liability.[174] In space law, the liability is linked to the notion of a 'launching state' (or states), ie the state from whose territory or facility the space object causing the damage was launched.[175] The discussion below examines whether the flag state may be viewed as a 'launching state' for the purposes of space law's liability regime.

As discussed above, a seaborne launch vessel is a 'facility' within the meaning of the Liability Convention.[176] The notion of a launching state in international space law appears to be confined to a 'state whose' facilities are used in the launch.[177] A ship's registration by a flag state arguably ensures the necessary formal and verifiable link between a launching state and its 'facility' at sea, in a way which provides for transparency of the liable state from the victims' perspective. However, in the case of privately owned or operated launch vessels, it may be unclear whether the conferral of

[171] See International Law Commission 'Draft Articles on Prevention of Transboundary Harm from Hazardous Activities' (A/56/10) ILCYB 2001) II(2).

[172] The explosion of the rocket after the launch in the Sea Launch incident resulted in no fatalities but rocket debris fell into the ocean, which caused Pacific Island state reactions. The law of the sea rules on flag state responsibilities were, however, reportedly not invoked. See Lee (n 5) 107.

[173] UNCLOS art 235(2).

[174] ibid art 304.

[175] See text accompanying n 17 above.

[176] See text accompanying n 19 above.

[177] The liability as such is also confined to a 'State Party to the Treaty that launches or procures the launch'.

a state's nationality and the registration of a vessel in the state's ship register indicates, in themselves, that this is the state 'whose' facility is used for the launch.[178] Obviously, excluding launches conducted from private vessels from the notion of a 'facility' and thereby from the liability regime may result in no state at all being liable for launches conducted by private ventures from maritime areas beyond national jurisdiction. This would be contrary to the objectives and wording of space conventions.[179]

However, from the space law perspective it may arguably not be sufficient to designate the flag state as the only state 'whose facility' was employed in the launch, for a number of reasons. First, a flag state may not be a party to the Outer Space Treaty and/or the Liability Convention,[180] decreasing the legal certainty for other states and the claimants in a particular accident. The flag state may also not be financially capable of meeting the claims for compensation. This may place an excessive financial burden on the other launching states involved.[181] A possible transfer of the launch vessel to another state's registry following the accident giving rise to liability may also complicate the situation for claimants, even if it does not cut off the legal link with the original flag state as a 'launching' state entirely.

Secondly, the launch vessel may have an actual and legal link with another state, arguably also the state 'whose facility' was used in the launch. Therefore, it is important to examine whether a relevant legal and actual connection exists between the launch vessel and a home state of the launch vessel's owners, ie the relevant factor may be the shipowner's or the charterer's nationality or domicile.[182] Other circumstances may also indicate a close connection between the vessel and the venture as a whole with a particular state: eg in the Sea Launch case, the US also supervised the project, in addition to being the state where the launch platform's home port was located.[183]

Thus, international responsibility for non-governmental space activities conducted on board a seaborne launch vessel and liability for any damage caused is likely to rest with more than one flag state. It is crucial to prevent situations where no state bears international responsibility for sea-based launches. In cases of privately operated sea-based launch projects, it is feasible for the states involved to enter into appropriate arrangements to clarify their roles, responsibilities and liabilities in the project.

8 Mapping out the international legal regime for space launch activities at sea: conclusions and future outlook

The increasing need for access to outer space may be met by developing futuristic solutions such as sea-based spaceports. While this may involve only a marginal share of the launch sector, some examples illustrate that such solutions may be feasible for launches of satellites and other space objects into orbit and for suborbital launches. To ensure responsible conduct of private actors involved in such projects and to comply with their international responsibilities, states need to adopt transparent and workable regulations for space launches at sea.

This article argues that UNCLOS generally governs sea-based launches and may be relevant for determining jurisdiction and responsibilities of states at sea because it fills some gaps in international law with regard to sea-based launches of space objects. At the same time, traditional approaches to jurisdiction and responsibilities in UNCLOS and the Outer Space Treaty may raise some challenges for sea-launching states and third states concerned.

---

[178] See van Fenema (n 69) 401, pointing out corresponding issues regarding privately owned aircraft.

[179] See eg for space conventions, a 'facility' is equivalent to the 'territory' of a state.

[180] See n 82 above.

[181] Liability Convention (n 16) arts I(1)(c) and V.

[182] This would also be in line with the rules of jurisdiction governing launch platforms which do not have a flag state. See the discussion above.

[183] See ICF Kaiser Consulting Group (n 49). Kerrest (n 12) 18, also notes that owing to their crucial roles in the Sea Launch project, both the USA and Russia should be viewed as 'launching states' – either as states 'that launch' or states 'whose facilities' are used for launching.

First, the traditional flag state-centred approach to jurisdiction does not provide for sufficient clarity on the central question: how is jurisdiction allocated between states participating in a joint launch venture on the high seas? The exclusive flag state jurisdiction on the high seas may preclude other states from exercising their space law duties with regard to private multinational launch projects. The flag state may not always have a sufficiently strong actual connection with the vessel flying its flag and the owners of the vessel. It may also not be able to perform the functions of the 'appropriate' state in practice because another state exercises this function and holds legal control over the project. Flag states should also be vigilant with regard to the registration requirements for launch vessels and to their own role in supervising such vessels. It is also unclear under UNCLOS which state bears responsibility for space launches from the high seas conducted from structures which are not 'ships' and consequently not subject to the flag state registration regime.

Secondly, how is the responsibility determined and allocated between the different participants in a sea-launch project? For the purposes of UNCLOS, the flag state may be viewed as (one of) the responsible – and possibly liable – state(s) within the meaning of space law. In this respect it is important to ascertain the normative contents of flag state's and other states' responsibilities. UNCLOS is considerably clearer with regard to the flag state's obligations than the Outer Space Treaty, although the former also does not set out obligations of other (non-flag) states in any significant detail. This author submits that flag state obligations under UNCLOS with regard to its ships should be interpreted in light of international space law provisions. Some of the practically important questions remain, however, unanswered. For example, is the flag state a 'responsible state' for the purposes of the Outer Space Treaty and does it bear (if only shared) international responsibility for unauthorised space launches from its vessels in a joint project? Would the nationality state(s) of participants involved in the space launch be responsible, alongside the flag state, for violating a duty of due regard for other states on the highs seas freedoms? What state(s) would be responsible for marine environmental damage caused by a launch on the high seas? What is the substantive and procedural content of due diligence obligation with regard to sea-based launches? UNCLOS and the Outer Space Treaty may only offer adequate solutions to regulate sea-based launches if they are interpreted in light of each other's objectives, supplemented by additional agreements between the states involved and which are followed up by effective national regulatory and enforcement measures.