A Search for the Basic Rules-of-the-Road in Orbit: Summarized Findings from Hunting Basic Traffic Rules in Treaties, Guidelines and Standards

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Abstract[1]

In this paper it is argued that the long-running arguments about the most feasible regulatory approach to Space Traffic Management, has been overshadowing the equally important discussion concerning the actual core provisions of the traffic regime, namely the Rules-of-the-Road. The paper seeks to clarify the concept of Rules-of-the-Road in the context of space traffic. The core contribution is an analysis of the state of Rules-of-the-Road in international space law today, considering a broad array of hard and soft legal instruments.

The investigation find that despite the many initiatives related to Space Traffic Management, there are few tangible, specific rules clarifying how actual Space Traffic should be conducted on an operational level. In other words, there is an absence of actual "Rules-of-the-Road" for traffic in Low Earth Orbit in the current body of international space law.

1. Introduction

Earths orbits are getting crowded. Technological developments such as re-useable rockets and inexpensive smallsats, are lowering the barriers to access and utilise space. Cost of commercial launches has dropped by a factor of 20 in the last decade.[2] In addition to the growing number of space assets,

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1 This article is a condensed account of the research presented by the author at the International Astronautical Congress 25-29 October 2021. For an updated and full presentation of the original study see: Hjalte Osborn Franden, *Looking for the Rules-of-the-Road of Outer Space - A thorough search for basic traffic rules in treaties, guidelines and standards*, 2022 (forthcoming).

2 See Harry Jones, *The Recent Large Reduction in Space Launch Cost* (48th International Conference on Environmental Systems 2018).

controlled by a still more diverse set of actors, safety in the space domain is further complicated by the increased scope of manoeuvres and actions in space.[3] Several recent studies indicate that the currently dominant approach to space operations will not be sustainable under the conditions of expanding activities.[4]

I argue that the actual *Rules-of-the-Road (RotR)* are under-developed from a legal perspective. Irrespective of what treaty, soft law or other regulatory form a future Space Traffic Management (STM) regime will ultimately take; there is merit in developing the substantive core of the traffic rules. Simply put, what basic rules should operators follow to handle conjunctions in the present space environment with insufficient data, insufficient regulation and insufficient communication with other operators. These basic, operational rules are what this paper conceptualise as *Rules-of-the-Road*.

This paper investigates the presence of actual RotR provisions in international space law today, including the major international STM related policy-instruments. The rules discussed here are spatially delimited to traffic in Low and Medium Earth Orbit, because the traffic here is more complex and less regulated compared to Geosynchronous Orbit.[5]

2. What Are Rules-of-the-Road and Why Are They Essential?

A traffic governance system consists of many different levels and subareas, spanning everything from licensing of vehicles and operators to traffic rules. At the core of any traffic governance system's substantive rules, are the rules regulating the interactions and coordination between traffic actors in traffic situations, commonly referred to as the RotR. The term RotR, in the conventional earthly meaning, covers both the traffic laws and the informal rules and practices that have developed to ensure orderly, efficient and safe conduct of traffic participants.[6]

3 Theodore J. Muelhaupt et al., *Space Traffic Management in the New Space Era*, 6 Journal of Space Safety Engineering 80 (Jun. 2019).

4 See: D Gates et al., *An Extended Parametric Study of the Effects of Large Constellations on the Future Debris Environment* 15 (2019); Muelhaupt et al., *supra* note 3; Daniel L. Oltrogge & Ian A. Christensen, *Space Governance in the New Space Era*, 7 Journal of Space Safety Engineering 432 (Sep. 2020); B Bastida Virgili et al., *Risk to Space Sustainability from Large Constellations of Satellites*, 126 Acta Astronautica 154 (2016).

5 Satellites in LEO are much more numerous, moves at higher speeds, and in more varied directions relative to Earth compared to satellites in GEO. In addition, the International Telecommunication Union regulates and coordinates orbital slots and traffic in GEO, while no organization currently plays a similar role for LEO or MEO.

6 Oxford Languages Dictionary definition of Rules of the Road: *"a custom or law regulating the direction in which two vehicles (or riders or ships) should move to pass one another on meeting, or which should yield to the other, so as to avoid collision."*

From an economics perspective, RotR lowers transaction costs for participants in a system by eliminating or reducing the need for frequent coordination between actors. When all participants share the understanding of who has priority, when and how to signal etc., there is less need for individual and frequent negotiations and less uncertainty about the intentions of other actors. For RotR to serve their purpose, actors must trust that other actors also know and adhere to the common rules.

2.1. Terrestrial Rules-of-the-Road

Terrestrially, we have comprehensive regulatory regimes stipulating RotR for aviation, seafaring and ground traffic. Traffic in the different domains is not comparable in all aspects as important differences exist, not least the basic physical constraints on actors (for example, road and water usually only allows actors movement in a two-dimensional plane, while movement in all directions is possible in air and space). Still, in regard to the aims, benefits and challenges relating to governing traffic there is enough overlap to warrant comparison.

On the oceans, we have *The International Regulations for the Prevention of Collision at Sea* (COLREGs) published by the International Maritime Organization (IMO), setting out the RotR for all vessels at sea. Most seafaring nations are signatories to the IMO convention and the COLREGs enjoys almost universal acceptance. Historically, the COLREGs were to a large degree based on a codification of customary and common law rules and principles developed over centuries.[7]

Already in roman times, various forms of traffic regulation for roads were introduced. For example, regulation of what type of traffic actors could use certain roads and at certain times of day formed part of the "*Lex Julia Municipalis*" introduced around year 60BC.[8] The first modern formal code stipulating ground-traffic RotR was written by William Phelps Eno for New York and contained several provisions that became global standards such as driving on the right and right-of-way rules.[9] Since then, road traffic regulations have been gradually harmonized through the UN organisation *World Forum for Harmonization of Vehicle Regulations* and several multilateral treaties. Most notably the 1949 *Geneva Convention on Road*

7 J. Harrison, Making the Law of the Sea: A Study in the Development of International Law (Cambridge University Press 2011).

8 C. van Tilburg, Traffic and Congestion in the Roman Empire (Taylor & Francis 2007).

9 W.P. Eno, Street Traffic Regulation: General Street Traffic Regulations - Special Street Traffic Regulations, Dedicated to the Traffic Squad of the Bureau of Street Traffic of the Police Department of the City of New York (Rider and driver publishing Company 1909).

Traffic[10] set out a number of basic RotR (art. 6-16), detailing how traffic participants should conduct themselves.[11]

In the airspace, it only took a few decades from the first flight by the Wright brothers at Kitty Hawk before the first air traffic regulations started to emerge around the globe. The first national RotR for aircrafts were published in 1927 by the Department of Commerce in the United States. Two decades later the international regime governing global air navigation were agreed at the Chicago Conference in 1944 with the signing by 52 nations of the *Convention on International Civil Aviation*.

Since its inception, ICAO has provided a forum and regulatory framework for continuously updating and amending the international regulation of air traffic to cope with developments in technology, changes in the airline industry or other factors affecting air traffic.[12] The ICAO regime is the most extensive international traffic management system and governs thousands of traffic interactions between airplanes every day.[13]

A common trait for the three domains of road, air and sea traffic is that they are generally regarded as highly successful international regulatory regimes, in terms of both global coverage and compliance. Historically, RotR for the different domains emerged in response to growing traffic issues and were largely driven by increase in civilian and commercial activity. Recently, the space industry is experiencing an increase in activity and inflow of private actors, but as will be argued in this article, real RotR have yet to emerge.

2.2. What Are Rules-Of-The-Road in the Context of Orbital Space?

Several authors have analysed the potential transfer of the institutional models and approaches to regulation underlying these terrestrial regimes to the space domain.[14] These studies have generally focused on the regulatory approaches and sought to determine whether the form of successful

10 *Convention on Road Traffic*, Geneva, 19. September 1949. See full text: https://unece.org/fileadmin/DAM/trans/conventn/Convention_on_Road_Traffic_of_1949.pdf (last visited 23/08/2021)

11 The treaty was superseded by the 1968 Vienna Convention on Road Traffic. See full text: https://treaties.un.org/doc/Treaties/1977/05/19770524%2000-13%20AM/Ch_XI_B_19.pdf ((last visited 23/08/2021)

12 For a thorough description of ICAO, including history and political background see: D. MacKenzie, ICAO: A History of the International Civil Aviation Organization (University of Toronto Press 2010). For a review of ICAOs central role in air law in general see: M. Milde, International Air Law and ICAO (Eleven International Publishing 2008).

13 The ICAO approach to regulation has been suggested as a strong candidate for a future international Space Traffic Management regime and would require a new treaty or convention, see Larsen *infra* note 15.

14 Bryon C Brittingham, *Does the World Really Need New Space Law*, 12 Or. Rev. Int'l L. 31 (2010); Larsen, *infra* note 15.

institutions such as ICAO, can be emulated for a future STM regime.[15] The actual, substantive RotR are not analysed or compared in these prior studies. The prior academic research's focus on the regulatory framework is at first glance justified by the reasonable assumption that the overarching or organisational structure of the regulation is more transferable between traffic domains than the substantive rules. However, the traffic problems that the substantive traffic rules aim to solve are surprisingly similar between the domains. Therefore, we can recognise a number of core substantive RotR-type provisions aimed at similar issues across the traffic domains.
Like for their terrestrial counterparts, RotR in space are the general practices and procedures that space actors are required to follow to ensure efficient and safe conduct of traffic during space operations. In this paper, the focus is on the core provisions of a RotR regime in space, namely:

- *Right-of-way rules*, defining who is obligated to move to avoid a potential collision and who can maintain orbit or trajectory
- *Safety distance rules*, defining the minimum distance that must be maintained to other space object
- *Zoning rules*, defining selection criteria and rights to orbits, differentiated rules based on positions, altitudes, mission-purpose or similar
- *Corridor & entry/exit rules*, defining special rules for space ports, launch and End-of-Lifetime-operations (EOL-operations)

3. Looking for the Rules-of-the-Road

3.1. Sources of Rules-of-the-Road

There is no formal international regime for STM and no single source from which to extract the current set of RotR. To ensure the exhaustiveness of the source material the desk research in academic journals and repositories has been supplemented with interviews in which academics, industry experts and satellite operators were probed for relevant instruments.
For this article, the sources reviewed for RotR have been structured in the following categories; *International Space Law, Softlaw instruments, Technical standards and Contracts & private agreements*. This paper does not list or describe all reviewed instruments, only the most preeminent and the ones in which RotR-type provisions have been successfully identified.

15 See for example Paul B. Larsen's seminal paper comparing various institutional models for setting international minimum standards for Space Traffic Management, including ICAO, ITU and softlaw developed by private actors, Paul B. Larsen, *Space Traffic Management Standards*, 83 J. Air L. & Com. 359 (2018) https://scholar.smu.edu/jalc/vol83/iss2/5.

3.2. RotR in International Space Law

The bedrock on international space law consists of the five original Outer Space Treaties concluded in the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS). The outer space treaties enjoy broad global support and the core principles have, with the exception of the more controversial Moon Treaty, achieved customary international law status.[16] Therefore, the core principles they set out, such as the right to free exploration and use of Outer Space,[17] will have to be respected by any STM regime. However, none of the Outer Space Treaties negotiated through UNCOPUOS are explicitly concerned with, or mentions STM.

3.2.1. RotR Absent in the Treaties

Since the last of the five major original Space Law Treaties was created in 1979, there have been no amendments or new space treaties with wider international support. The original treaties were created by states, foremost to govern interstate relations and not to regulate the activities of private space actors, beyond a few provisions. At the time of the drafting of the treaties, the very idea that the vast expanse of space should be susceptible to traffic issues and congestion would have seemed unlikely. It is therefore not surprising that formal international law as such does not provide much in terms of operational rules or RotR to guide the swelling traffic in space. However, as long as the free access to space guaranteed by OST art. 1 is not impeded, the treaties does not preclude the emergence of binding RotR for space.

Even though the international community has not been able to agree on new binding agreements for decades, the discussion in forums such as UNCOPUOS, has brought the development of international space law forward through other means. Over the last decades the UN General Assembly has adopted several resolutions with the aim of clarifying central concepts in international space law. Although the issue of collisions in space is explicitly mentioned as an important concern in GA Resolutions[18] no resolution containing proposed RotR or similar have been adopted.

16 Cassandra Steer, *Sources and Law-Making Processes Relating to Space Activities*, *in* Paul S. Dempsey and Ram Jakhu (eds.)," Routledge Handbook on Space Law" 388 (Routledge 2017).

17 Outer Space Treaty, Art. 1.

18 See e.g.: A/55/569 (*International cooperation in the peaceful uses of outer space: report of the Special Political and Decolonization Committee: General Assembly, 55th session*). Full text available: https://digitallibrary.un.org/record/427779/files/A_55_569-EN.pdf (last visited 19/11/2021).

3.3. RotR in Soft Law Instruments

The term "soft law" signifies agreements, declarations and principles that are not legally binding, such as UN General Assembly Resolutions.[19] The lack of success in formulating and enacting binding multilateral instruments in space law, as well as the growing importance of non-state actors, have led to an increased reliance on the non-binding written norms or soft law for furthering policy goals in the space arena.[20]

3.3.1. The IADC Space Debris Guidelines

One of the most successful examples of soft law-based standard setting in space law is the *IADC Space Debris Guidelines*,[21] developed by the *Inter-Agency Space Debris Coordination Committee*[22] created by 13 of the world's leading space agencies and including all major space powers. The objective of the IADC guidelines is to promote the best practice for dealing with, and preventing space debris. After the Inter-Agency Debris Coordination Committee officially adopted the guidelines in 2002, they were approved by UNCOPUOS in 2007 and later endorsed by the UN General Assembly.[23]

In addition to the UN endorsement, the IADC guidelines have been successful in that European Space Agency (ESA), the United States and several other major space powers have adopted and included them by reference in national legislation, thereby giving them binding effect. The IADC guidelines have no specific RotR provisions, although the guidelines do have zoning in the form of *"Protected Regions"* in regards to generation of space debris.

3.3.2. The Guidelines for the Long-term Sustainability of Outer Space Activities

After the success with developing space debris guidelines,[24] UNCOPUOS expanded the focus to the general long-term sustainability of space activities and in 2010 a working group was formed to develop a new, comprehensive set of guidelines. In 2019 the resulting *Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space (Guidelines)* were formally adopted by UNCPUOS and their implementation in national law recommended.

19 For a discussion of the role of "soft law" in international law see: Alan Boyle et al., The Making of International Law 212–29 (Oxford University Press 2007).

20 See: Steven Freeland, For Better or for Worse? The Use of "soft Law" within the International Legal Regulation of Outer Space, 36 *Annals of Air and Space Law* 409 (2011).

21 Available at: https://www.unoosa.org/documents/pdf/spacelaw/sd/IADC-2002-01-IADC-Space_Debris-Guidelines-Revision1.pdf.

22 See: https://www.iadc-home.org/what_iadc.

23 See: UNGA resolution 62/217, section 26 and 27, where the UN GA endorses the guidelines and recommends implementation in national law

24 For a critical discussion of the role of softlaw in regulating space activities see: Jack M Beard, *Soft Law's Failure on the Horizon: The International Code of Conduct for Outer Space Activities*, 38 U. Pa. J. Int'l L. 335 (2016).

A functional, international STM regime is largely a pre-requisite for sustainable space activities and therefore the instrument could be expected to include guidelines for space traffic.

Several provisions in the UNCPUOS guidelines are concerned with STM, including the suggestion that national legislation should require all space actors to designate a contact point for coordination,[25] the requirement that states should establish appropriate means to reduce the probability of orbital collisions[26] and the stipulation that states should encourage and develop conjunction assessment capabilities.[27] However, the guidelines are silent on how to handle the actual conjunction once it has been identified and assessed. Sharing of data and correct identification of potential conjunctions is important, but the lack of guidance on who is obliged to maneuver might lead to significant issues in a future with many diverse space actors from around the world.[28] The guidelines remain too vague on concrete procedures or guidance on how the actual coordination between actors should be handled. The Guidelines, as currently adopted, cannot be said to contain RotR as such. However, the Guidelines are intended as a living document and might therefore serve as a way to legitimize and spread RotR in the future.

The central role of private, non-governmental organizations from industry and academia in forming the standards and best-practice procedures for sustainable use of outer space is noted several times in the UNCOPUOS Guidelines.[29]

3.3.3. Soft law initiatives from non-state actors

Aside from the initiatives by space agencies, UN and other state-led actors, a number of soft law instruments have been created and promoted by private industry actors. The *Space Safety Coalition (SSC)* was established in 2019 by a group of space companies and organisations[30] with the goal of furthering space safety and sustainability by promoting industry best practices. The members of the SSC drafted and committed to the *Best Practices for the Sustainability of Space Operations* instrument providing detailed

25 *UNCOPUOS Guidelines*, A.3, 4 (e)

26 *UNCOPUOS Guidelines*, B.1, 2

27 *UNCOPUOS Guidelines*, B.4

28 Interview with western space actors show that already today they struggle with communicating and resolving potential conjunctions with Chinese and Russian satellites.

29 See for example: "*Non-governmental entities can also play important roles in bringing stakeholders together to develop common approaches to certain aspects of space activities that can collectively enhance the long-term sustainability of space activities*", UNCOPUOS Guidelines C.4, 4

30 The SSC Best Practices has been endorsed by many of the words largest satellite operators, along with a host of other companies and organizations in the space sector. The updated list of endorsees is available at: https://spacesafety.org/endorsees/

recommendations for space operators and references to technical standards on everything from designing to operating spacecraft.
The SCC best practices make explicit reference to the IADC Debris Guidelines and UNCOPUOS Sustainability Guidelines referenced above and aim to help industry implement those guidelines by being more specific. The SSC best practices contain several provisions resembling RotR, such as requiring manoeuvrability of certain satellites[31] and stipulating coordination and active collision avoidance.[32]
The SCC best practices require actors to make active manoeuvres to avoid collisions, but gives no guidance on the best practice for handling the actual manoeuvres. In their current form, the provisions fall short of real RotR, i.e. clear, operational rules to guide actors in traffic scenarios. However, in the preamble it is recognised that future work may be needed to:

> "Address maneuver prioritization in the event that two spacecraft with maneuver capability conjunct. In the meantime, spacecraft operator communications and data sharing will remain the best strategy for avoiding collisions."[33]

In other words, until the international community can agree on clear RotR for space, we will have to ensure ongoing ad hoc communication to avoid collisions. The SSC best practices are still new and might provide a framework and occasion for the industry actors to propose RotR as that would fit well with the purpose of the instrument.

3.4. RotR in Technical Standards

One place to look for specific and precise rules for highly technical areas is industry standards. Spacefaring is a highly technical endeavour and technical standards set by organisations such as the International Organization for Standardization[34] (ISO) and the European Cooperation for Space Standardization[35] form a central part of regulation in the space industry.[36]
Most national space laws require national space actors to comply with the relevant international standards as a prerequisite for licensing space

31 SCC Best Practices, 4, c
32 SCC Best Practices, 5, a
33 SCC Best Practices page 3
34 ISO is an independent NGO, which aim to support international trade and innovation through development of consensus-based and market-relevant standards for industry and technology. See: https://www.iso.org/about-us.html
35 The European Cooperation for Space Standardization is an initiative established to develop a coherent, single set of user-friendly standards for use in all European space activities. See https://ecss.nl/.
36 H. Stokes et al., *Evolution of ISO's Space Debris Mitigation Standards*, 7 Journal of Space Safety Engineering 325 (Sep. 2020).

activities.[37] Through the national licensing schemes, technical standards thus achieve binding effect for public and private space actors[38] and become a reasonable source to look for RotR.

3.4.1. The effects of Technical Standards

Functionally, technical standards can certainly have international effect, as the technical standards discussed here are referenced into many spacefaring nations space legislation and endorsed by most major space agencies. In addition, the standards can become binding by being referenced in commercial contracts between suppliers and customers in the space industry.
There is currently no technical standard for STM as such, although it has been discussed in ISO and other standard setting bodies for years.[39] A thorough review of available standards reveal that although there is at present no international STM technical standards as such, there is several instruments with direct relevance to space traffic.

3.4.2. Technical Standards for Space Debris Mitigation

As with the soft law instruments discussed above the issue of space debris is the most matured area of traffic regulation and several relevant standards have been developed and widely applied. The *ISO 24113:2019 Space Systems — Space Debris Mitigation* is a high-level standard, with a host of related sub-documents, aimed at reducing the growth of space debris in orbit. Relevant to the present inquiry are the provisions aimed at minimizing collision risk between active space objects. Specifically, provision 6.2.3.2 and 6.2.3.3 in ISO 24113 obliges spacecrafts with the ability to manoeuvre, to do so to reduce collision risk, if it is assessed to be above a specified threshold.
How to handle the manoeuvres to reduce collision risk is described in the Technical Report[40] *"ISO/TR 16158:2013 Space systems — Avoiding collisions with orbiting objects"*. The report describes best practice for

37 The UN Compendium on Space Debris Mitigation Standards compiles a long list of national space laws approach to Space Debris Mitigation. The list shows how a majority of nations refer to the international standards such as ISO24113, I their national legislation.

38 There is a global tendency to reference technical standards into national legislation across industries and thereby regulatory power is delegated to international private-sector organisations. For a thorough investigation into this form of privatisation of regulation see: Tim Büthe & Walter Mattli, The New Global Rulers : The Privatization of Regulation in the World Economy 30ff (Princeton University Press 2011).

39 In 2021 a working group in ISO (*ISO/AWI 9490 Space systems — Space Traffic Coordination*) has begun development of a Space Traffic Management standard. However, the work is in the very early stages and several fundamental controversies between delegates at the first meetings indicate that the development will take some time. See: https://www.iso.org/standard/83500.html.

40 ISO/TR 16158 is a ISO document of the type "Technical Report" and not a standard as such. Rather it is informing of the perceived "state-of-the-art". For more details on the various types of ISO documents see: https://www.iso.org/deliverables-all.html.

assessing conjunction for collision risk and deciding on mitigating actions. The report explicitly states that the decision to take mitigating actions, such as manoeuvres, is based on the subjective risk-appetite of each operator and sets no standards for prudent conduct in this regard.

In general, the practices described in the report are devoid of specific guidance on communication[41] and coordination between operators and instead focus on the internal processes. In a future space domain characterised by ever increasing number and diversity of actors, the interactions between actors will become central to avoiding collisions.

Other organizations such as the *International Association for the Advancement of Space Safety*[42] and the *Consultative Committee for Space Data Systems*[43] also create and publish standards with relevance to STM, but no RotR-elements have been identified in the instruments.

In conclusion, the current body of international technical standards does not provide RotR provisions to guide space actors. Space Traffic is a frequent topic in the Space Systems working group of ISO and other standard bodies and we might very well see standards containing more direct RotR in the future. There are mutual references made between ISO standards and guidelines, such as the *UNCOPUOS Guidelines*, so RotR-type provisions might migrate between them if added to one or the other.

3.5. RotR in Bilateral and Multilateral Private Law Agreements

Safety is a key concern for all active public and private space actors. The growing risk of collisions in orbits pose a threat to the business case underlying many of the private sector's investments in space.[44] In the absence of public regulation, private agreements between space actors can help clarify how the actors should handle traffic incidents such as conjunctions. Although the agreements are contractual and not relevant to other actors as such, they might reflect the RotR that space industry actors deem necessary.

The recent signing of the agreement in January 2021[45] between two of the world's most influential space actors, NASA and SpaceX, can be construed as signifier for a potential way forward for achieving RotR in space. Although

41 There is reference to other technical standards such as *ISO 26900 Space data and information transfer systems — Orbit data messages* specifying formats for data messages, but these other standards also focus on the individual operator.

42 See: https://iaass.space-safety.org/publications/standards/.

43 See: https://public.ccsds.org/Publications/default.aspx

44 Several large American satellite operators are petitioning the US government for increased regulation of space traffic. See: https://www.wsj.com/articles/elon-musks-satellite-internet-project-is-too-risky-rivals-say-11618827368

45 Formally: "Nonreimbursable Space Act Agreement Between The National Aeronautics And Space Administration And Space Exploration Technologies Corp For Flight Safety Coordination With Nasa Assets". Full text of the agreement is available at: https://www.nasa.gov/sites/default/files/atoms/files/nasa-spacex_starlink_agreement_final.pdf. (Last visited 24/09/2021)

the agreement does not provide detailed rules as such, it provides a framework for developing more formal practices for coordinating traffic.
The agreement stipulates a form of "Right-of-Way", in that it makes it the obligation of SpaceX to move their assets in case of a potential collision risk. The agreement reduces complexity of coordinating traffic among the two parties, by effectively designating NASA spacecraft as what in the *COLREGs* is referred to as a "Stand On" vessel, meaning they maintain course and speed. Conversely, the agreement designates all SpaceX spacecraft as "Give Way" vessels, obliged to execute any manoeuvre required to avoid collisions. The clear designation of roles ensures that the parties avoid dangerous scenarios where either both parties or none of the parties manoeuvre at the same time during a conjunction. The traffic rules in the agreement resemble RotR more than any other provisions identified in this review.
Currently, there are few of this type of public bilateral agreements related to coordinating traffic in space.[46] Unless multilateral coordination mechanisms emerge, we might see more actors looking to bilateral agreements for coordinating traffic.

4. Conclusions

This paper has established that there is no RotR as such to be found in formal international space law today nor among soft law instruments. Some Technical Standards consider conjunctions and suggest strategies to mitigate collision risk. However, they are focused on the conduct of the individual operator and fail to provide guidance on the interactions *between* the operators. By not viewing the conjunctions from a systematic, traffic perspective, they forfeit the opportunity to provide the needed RotR. Despite the many initiatives related to STM, there are few suggestions of tangible, specific rules clarifying how actual STM should be conducted on an operational level.
In the absence of internationally agreed RotR, individual actors will be incentivised to make private, bilateral arrangements to ensure the safe and efficient handling of conjunctions. Such agreements might improve the safety of the space assets of the parties to the agreement, but will not necessarily improve the overall sustainability and safety for the orbital domain. In addition, it is unclear if privately agreed RotR will be a scalable solution in a future with a growing number and diversity of space actors.
Technical and legal scholars and industry participants need to get together to work on formulating actual, specific rules that might guide space actors in coordinating and managing traffic in the ever more crowded space domain on the operational level

46 This author's interviews with many actors from the space industry indicates that there are also not many undisclosed agreements of this type.