Reconciling SSA Data Sharing Legal Practices through a Comparative Approach

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Abstract

With the intensification of space activities the urgency of STM has emerged and with it the necessity to harmonize, or at least coordinate, SSA data sharing practices. At the moment, the existing data sharing models mainly present a domestic approach in the determination of legal clauses and standards definition and display potential issues in terms of long-term sustainability, also vis-à-vis the amount of heterogeneous sources of SSA data expected to increase.

Through a comparative legal methodology with a problem-solving approach, this contribution will investigate the risks and opportunities posed by these heterogeneous approaches, with a specific focus on the models implemented by the US, the EU and China. Moreover, the integration of civil and commercial SSA data, or services, will be considered and the potential liability issues analyzed.

1. Introduction

Access to space is becoming increasingly inclusive, with more States joining the exclusive club of space-faring nations and commercial actors literally demanding a bigger "slice of the universe".

While on the one hand and also through commercial actors, access to space and diversity have significantly increased, the urgency of some rules of the road has also emerged with the intensification of space activities and with it the necessity to harmonize, or at least coordinate, Space Situational Awareness (SSA) data sharing practices, the backbone of any Space Traffic Management system (STM).

However, at present, the existing data sharing models mainly present a domestic approach in the determination of legal clauses and standards definition and display potential issues in terms of long-term sustainability, also vis-à-vis the amount of heterogeneous sources of SSA data expected to increase.

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In fact, there are no specific rules relating to SSA sharing in the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereafter Outer Space Treaty, OST),[1] the so-called *magna charta* of space activities, considered by many a mere framework treaty on principles that leaves ample manoeuvre to the actors involved in space exploration and use.
In targeting this phenomenon, the research will adopt a comparative approach selecting and investigating three main space powers for which an SST and SSA system is available: the United States, China and the European Union.
In particular, by analysing each model, this contribution will highlight the opportunities and criticalities that each approach presents, from the purely domestic approach of the US SSA Sharing Programme, to the Regionalism and Chinese leadership under APSCO, to the hybrid model of the EU, through the EU SST Consortium.
Finally, one specification. Although for SSA, as for STM, a univocal and international shared definition does not exist, for the purposes of this article, it will refer to "the requisite decision-making knowledge to deter, predict, avoid, operate through, recover from, or attribute cause to the loss, disruption, or degradation of space services, capabilities, or activities, including space traffic safety hazards".[2]

2. The Legal Framework of SSA in International Space Law

From a legal perspective there are no rules at the international level expressly regulating SSA practices.
However, a primitive regime for SSA can be deduced from four key provisions of the OST: Articles III, IX, X and XI.
First, from a joint reading of Articles III and IX it is evident that when conducting space activities, States have to respect international law, cooperate and non-interfere with each other activities, as well as conduct all their activities in space with due regard to the corresponding interests of the other States Parties to the Treaty. In this regard, the cooperation mechanism provided for in Article IX, which encourages the exchange of information through two consultation clauses could then be considered an implementation of the principles enshrined in Article I.
Second, if SSA is recognized as an instrument for international cooperation, two other provisions could be exploited to build on a regulatory framework

1 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 2222 (XXI), 1967.
2 O. Brown et al.: "Orbital Traffic Management Study – Final Report", prepared for National Aeronautics and Space Administration (NASA) Headquarters, prepared by Science Applications International Corporation (SAIC), 21 November 2016.

for SSA, namely Articles X and XI. On the one hand, Article X establishes a specific, albeit very weak, right of access to information, obliging States to "consider any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States", without discrimination and legitimizing requests for SSA data sharing. On the other hand, Article XI provides for the agreement of States "to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities".
For the purposes of SSA, Article XI is very relevant as it connects cooperation with information,
namely information on the nature, conduct and location of space activities, *de facto* constituting a strong mechanism for validating, for instance, the parameters of a space object, fostering the exchange of SSA information and potentially improving the accuracy of SSA data.
Unfortunately, while providing a legal basis for SSA, Article XI is made ineffective by the vagueness of its clause "to the greatest extent feasible and practicable", leaving the door open to an indefinite margin of appreciation by States parties in terms of timing and type of information to be shared especially in light of potential strategic and security interests, in the event of military activities, or of intellectual property rights, in case of commercial activities.
However, as authoritative doctrine pointed out, the significance of this provision should not be underestimated, keeping in mind that Article XI "has to be regarded as a legally binding provision under public international law" and implying that, in the event that the failure to provide such information harms other States, the State that fails to provide the relevant and useful information will engage in international responsibility.[3]
Here, therefore, the author suggests evaluating a potential standard of care, on which to determine whether the State has failed to provide the relevant and useful information, in light of the *actual* information the State had access and the *probability* of the occurrence of the harmful event, ensuring that SSA data sharing depends not primarily on the goodwill of the state, but rather on the duty not to cause harmful interference, through a joint reading of Article IX and Article I.
Finally, as regards the involvement of the private sector in SSA practices, Article XI, now also supported by soft law instruments, such as Guidelines B.1, B.2 and C.2 of the Guidelines for the long-term sustainability of outer space activities, does not restrict the provision of information only *to* and *from* States, but also includes non-governmental space activities, allowing the

3 J. F. Mayence, T. Reuter, Article XI, in S. Hobe, B. Schmidt-Tedd, K.U. Schrogl (Eds.), Cologne Commentary on Space Law, Carl Heymanns Verlag, 2009, pp. 189 – 206.

provision of information also by private and commercial operators and, vice versa, opening the reception of such information also to the public and to the international scientific community, including the private/commercial sector.[4]

3. The American Model: More Data at What Cost?

Without dwelling too much on the historical evolution of the US SSA Sharing Programme for which extensive literature already exists, for the purposes of this contribution it suffices to say that in the US the SSA programme has been initiated and operated mainly by the DoD, even though NASA was initially the front-desk that provided SSA data to commercial and foreign entities through the orbital Information Group website.[5]

In 2003, the programme evolved in the Commercial and Foreign Entities Pilot Programme and transitioned from NASA to the Air Force Space Command, while setting up an SSA sharing platform, space-track.org, starting 2005.

Finally, in 2009 the SSA Sharing Programme became a permanent programme transferred to the Joint Force Space Component Command, a component of the U.S. Strategic Command (USSTRATCOM), which, through the Combined Space Operations Center (CSpOC - until 2018 Joint Space Operations Center, JSPoC) currently operates the Space Surveillance Network to gather, catalogue and analyse SSA data.

Although the network was initially tasked with detecting only military objects, today it collects data on a wider range of space objects and since 2018 also integrates information from allies and commercial partners.[6]

To complement and integrate its data, the US has so far adopted a global model of SSA cooperation, as reconfirmed in the 2011 National Security Space Strategy, which offers three levels of access to SSA data: a basic one, through the Space Track Platform, only providing the orbital position of the space object; an emergency one, notifying satellite operators about close approaches of active payloads; and, an advanced one, with a two-way information exchange, accessible only through SSA Sharing Agreements.[7]

4 Report of the Working Group on the Long-term Sustainability of Outer Space Activities, Working Paper by the Chair of the Working Group, A/AC.105/2018/CRP.22.

5 For an extensive analysis of the historical evolution of the US SSA Programme see Q. Verspieren, "The United States Department of Defense space situational awareness sharing programme: Origins, development and drive towards transparency", Journal of Space Safety Engineering 8, 2021, 86 – 92.

6 Joint Force Space Component Command Public Affairs, Combined Space Operations Center established at Vandenberg AFB, 19 July 2018 <https://www.afspc.af.mil/News/Article-Display/Article/1579285/combined-space-operations-center-established-at-vandenberg-afb/> (accessed: 14 January 2022).

7 Department of defense, Office of National Intelligence (2011). National Security Space Strategy,<https://www.hsdl.org/?view&did=10828> (accessed: 30 September 2021).

Finally, recently and as a consequence of Space Policy Directive 3 of 2018, although USSPACECOM will continue to retain control over data collection and catalogue maintenance, the Department of Commerce (and in particular the Office of Space Commerce) has been tasked to create an Open Architecture Data Repository, also integrating SSA data from foreign, commercial and civil sources.[8]

As for the legal basis by which US designated entities thus far have shared and received SSA data with a greater degree of accuracy than the space-track website, this can be found in Section 10 of the US Code Paragraph 2274, as amended in 2018.[9]

For the purposes of this article, some clauses are of interest to SSA practice.

First, in sub-section a(1) the provision uses the term "may" provide (and obtain) space situational awareness services and information to non-United States Government, provided that "the Secretary determines that such action is consistent with the national security interests of the United States".[10] Here, the greatest limitation is already evident: the possibility of making the service selectively unavailable depending on actual or changing national security interests and/or priorities.

In fact, as relevant doctrine has pointed out: "DoD sees SSA capabilities as part of the 'space control' mission that includes offensive and defensive measures to ensure freedom of action in space",[11] where "the current US catalogue of SSA data is secretive by nature […] and treats collected data as a national security resource, subject to substantial classification".[12]

Today, while the strategic value of such programme is acknowledged, it is a fact that the lack of transparency in SSA data could severely jeopardize space safety, reducing trust in incomplete data and/or information and potentially making it difficult for operators and foreign entities to decide whether the warnings are reliable or not.[13]

8 Space Policy Directive 3, 18 June 2018, <https://trumpwhitehouse.archives.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/> (accessed: 14 January 2022).

9 10 U.S.C. 2274 - Space situational awareness services and information: provision to non-United States Government entities, <https://www.law.cornell.edu/uscode/text/10/2274> (accessed: 14 January 2022).

10 Idem.

11 T. Hitchens, "Small Satellites, Safety Challenges, and Reforms Related to Strategic Space Defense Systems", in J. N. Pelton, S. Madry (Eds), Handbook of Small Satellites, 2020, 854.

12 C. G. Starling, M. J. Massa, Lt Col C.P. Mulder, J. T. Siegel, "The future of security in space: A thirty-year US strategy", Atlantic Council Strategy Paper Series, April 2021, 86, <https://www.atlanticcouncil.org/wp-content/uploads/2021/04/TheFutureofSecurityinSpace.pdf> (accessed: 14 January 2022).

13 Mariel Borowitz, "Strategic Implications of the Proliferation of Space Situational Awareness Technology and Information: Lessons Learned from the Remote Sensing

In this regard, it is still unclear whether SPD-3 and particularly the shift to the DoC of SSA competences will prevent national security interests from intervening.[14]

Another novelty introduced in Section 10 following SPD-3 is that "Beginning January 1, 2024, the Secretary may provide (and obtain) space situational awareness services and information to non-United States Government entities under paragraph (1) *only to the extent that the Secretary determines such actions are necessary to meet the national security interests of the United States*", which means that if current national security interests are no longer satisfied, the programme could be terminated.

Here the issue is not merely rhetorical, as to date most space operators heavily rely on SSA data and conjunction avoidance services provided by USSPACECOM.

Other limitations present in the existing system are then included in sub-sections (c) and (d) of Section 10 of the US Code, Para. 2274, according to which (i) the service could be charged (putting at risk smaller operators which may not have the financial resources to purchase SSA data but whose safety will still affect the space safety of the overall population of space objects); and (ii) non-US Government entities entering into an SSA sharing agreement with the Secretary have to "agree not to transfer any data or technical information received under the agreement, including the analysis of data, to any other entity without the express approval of the Secretary", and, as explicitly foreseen in subsection c(3) will have to "agree to any other terms and conditions considered necessary by the Secretary", substantially accepting *ex-ante* any future unilateral and unspecified limitation on data use or distribution imposed by the US.

Finally, while labelling it as immunity, sub-section (g) introduces a broad waiver of liability to the US government and any agencies and instrumentalities thereof, but also to any *corporation* acting for the United States, where a crucial question is whether the clause can be extended to commercial entities providing SSA data and services (such as LeoLabs, Analytical Graphics, Inc. or Exoanalytic Solution) when, following SPD-3 transition, they are providing data and information to the DoC.[15]

Finally, as regards the integration of commercial and civil data, some concluding remarks are necessary.

Sector," Space Policy 47, February 1, 2019, 18–27, <https://doi.org/10.1016/j.spacepol.2018.05.002> (accessed: 29.09.2021).

14 Hitchens (11) 854.

15 In this regard, it is interesting (and worrying) to note that the clause ensures that the abovementioned entity/person/corporations are immune from *any suit in any court for any cause of action arising from the provision or receipt of space situational awareness services or information, whether or not provided in accordance with Section 10*, as well as any related action or omission.

First, the fact that the DoC will develop an open architecture SSA data repository can certainly be considered a positive transition both in terms of enhanced interoperability and comprehensiveness of the data and information provided.
However, it should be noted that two could be the downsides. First, being the United States, first through the DoD and now also through the DoC, the largest "recipients/buyers" of SSA data, these could also be the ones that unilaterally determine the "conditions" in terms of data requirements and formats, effectively contributing to a standardization process in which other international actors and operators may not necessarily have been involved.
Second, precisely in light of this sort of market monopoly and the fact that currently most providers of SSA Commercial data and services are US-based entities, in light of national security interests, some limitations on transmission of data to third parties and foreign subjects could be nationally and unilaterally imposed in the future.

4. The Chinese Model: Regionalism through International Cooperation

As regards the Chinese SSA capabilities and sharing models, also China possesses SSA assets, diversified between ground-based capabilities, mainly operated by the PLA, and observation capabilities, mainly of scientific value and operated by the Purple Mountain Observatory (PMO).[16]
In addition, since 2015, China has launched the Space Debris Observation and Application Center[17] to track orbital debris and provide collision avoidance services to Chinese and foreign entities.[18]
While one of the biggest limitations of the Chinese SSA infrastructure is that most of its indigenous SSA capabilities are located within its territory, in order to expand its capabilities, the country, consistently with its political discourse in international space fora, has engaged in international cooperative efforts with many countries to host SSA sensors and tracking facilities.
Here, and unlike the US which has exchanged data through a series of bilateral SSA sharing agreements under the umbrella of its SSA Sharing Programme, China has hinged the process in the institutionalized and

16 B. Weeden, "Current and Future Trends in Chinese Counterspace Capabilities", Proliferation Papers, Ifri, November 2020.
17 Which is part of the China National Space Administration.
18 China Launches Space Junk Monitoring Center, 9 June 2015, https://english.cas.cn/newsroom/archive/news_archive/nu2015/201506/t20150609_148319.shtml (accessed: 29.09.2021).

regional framework of APSCO, the Asia Pacific Space Cooperation Organization.[19]

In particular, as part of the space surveillance initiative Asia-Pacific Ground-Based Optical Space Object Observation System (APOSOS, now entering its second phase, APOSOS-II), APSCO has built a Satellite Data Sharing Service Platform and user group for its member States, where China has supplied observation capabilities to several countries (including Peru, Pakistan, and Iran) to track objects in LEO and GEO, with data analysis then performed by the Chinese Academy of Science's (CAS) National Astronomical Observatory.[20]

In addition, APSCO has obtained permanent observer status at the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and at the International Committee on Global Navigation Satellite Systems (ICG), as well as established cooperative relations with the European Space Agency (ESA).[21]

Again, the limitations of this model are not only the obvious national security interests to be protected, as a significant part of the current Chinese SSA tracking sensors are operated by the Chinese militaries, but also the regional integration of a SSA model.

Indeed, regionalism can represent both a limitation and a potential opportunity for the convergence of SSA models.

On the one side, the creation of a regional model could establish regional SSA standards which, in light of international discussion also on future STM, can get stuck in positional bargaining, making future agreements more difficult.

On the other side, through regionalism, enhanced interoperability, multilaterally-determined practices and standardization processes can be pursued. Here, regionalism could be used within a broader multi-step approach, first gathering the main SSA positions in regional models and then integrating them at the international level, in order to build a global and consistent SSA sharing model.

5. The EU Model: between Regionalism and Federalism

Finally, as regards the European perspective, Europe already benefits of a robust (albeit geographically limited) SSA network.

In Europe the SSA programme runs on two parallel and separated tracks.

19 Asia-Pacific Space Cooperation Organization, http://www.apsco.int/html/comp1/content/WhatisAPSCO/2018-06-06/33-144-1.shtml (accessed: 14 January 2022).

20 Idem.

21 Development Vision 2030 of the Asia-Pacific Space Cooperation Organization, 14 November 2018, http://www.apsco.int/upload/file/20190304/20190304110222308 05.pdf (accessed: 29.09.2021).

On the one hand, there is the optional ESA SSA programme, of a completely civilian nature and developing amongst others two new test radars, while setting up a catalogue of space objects under civil control *only*.[22]
On the other hand, the EU has so far relied on a pooling and sharing system based on the EU-SST Consortium, initially in the form of a Support Framework[23] which starting from 2021, with the new EU Space Regulation, has evolved into a segment of the larger EU Space Programme.[24]
The EU SST is a civilian framework, integrating and leveraging military and civil contributions from its MS.[25]
However, and consistently with the EU framework, the sovereignty component is preserved and the SSA capabilities are still owned and operated only by MS (mainly at the level of the militaries), as well as the definition of the joint data policy and the requirements for the exchange of information which remain prerogatives of MS.
In addition, through the pooling and sharing mechanism, participating MS have gradually networked their capabilities at the level of sensors, data processing and service functions and agreed on a division and specialization of tasks between the main contributing MS, while the EU SatCen acts as the front-desk with end-users.[26]
Through the EU SST database, which will form the basis for a European catalogue of space objects, MS have also overcome the major obstacle of inconsistency of data formats or lack of interoperability among the different national databases, establishing at regional level a standardization process of the SSA data sharing practice.[27]
However, and even more so than the Chinese model where some of the APSCO MS did not own or operate SSA capabilities, EU MS such as France, Germany, Italy or Spain that already had sensors and databases available at the national level have now integrated their systems at the EU level.

22 ESA SSA Programme Overview https://www.esa.int/Safety_Security/SSA_Programme_overview (accessed: 29.09.2021).
23 Decision No 541/2014/EU of the European Parliament and of the Council of 16 April 2014 establishing a Framework for Space Surveillance and Tracking Support, OJ L 158, 27.5.2014, p. 227–234.
24 Regulation (EU) 2021/696 of the European Parliament and of the Council of 28 April 2021 establishing the Union Space Programme and the European Union Agency for the Space Programme, OJ L 170, 12.5.2021, p. 69–148. Here referred to as the EU Space Regulation.
25 M. Becker, P. Faucher, "Recent Developments in the Implementation of European Surveillance & Tracking (EU SST) – Security and Data Policy", Journal of Space Safety Engineering 8, 2021, 178.
26 R. Peldszus, P. Faucher, "European Space Surveillance and Tracking Support Framework", in Handbook of Space Security: Applications and Programs, K.-U. Schrogl et al (Eds), Springer Nature, New York/ London, 2019, 1-22, <https://doi.org/10.1007/978-3-030-22786-9_104-1> (accessed: 14 January 2022).
27 Becker (24) 179.

Yet, also this model presents some limitations in its legal framework.
First, the current EU SST data policy hinges on an intricate network of bilateral SSA Sharing Agreements both internally, among MS, and externally, with the United States.[28]
Here, while SSA Sharing agreements remain the prerogatives of national MS, mostly at the Ministry of Defense level, the limitations deriving from the US model are evident in light of transfer/use of data with third parties, including other MS of the Consortium and transparency of the process. Again, this is not a mere rhetorical issue, especially in case of inaccurate collision avoidance services or accidents directly dependent on erroneous or inaccurate SSA data.
With this lack of transparency, the attribution and tracking of the data flow in the SSA supply chain becomes more complex and difficult (especially with the integration of commercial and civil data from the US) and the legal relationships deriving from possible accidents at the moment do not seem to protect the parties, both under US domestic law, as seen, and under EU law, with the new EU Space Regulation introducing fairly symmetrical provisions to its transatlantic counterpart.
In fact, if on the one hand the Regulation aims at a global burden-sharing in the field of SSA sharing and promotes cooperation, it retains its strong strategic dimension by not allowing third countries to participate in the SST sub-component and requiring them to conclude specific agreements in accordance with Article 218 TFEU to access SST services that are not publicly available.[29]
Here, and similarly to the US model, pursuant to Article 56.3 of the Regulation the Commission can impose more detailed provisions on access to these services and the related sharing procedure and it benefits of a waiver of liability with regard to damages due to a lack or interruption of service, delays and inaccuracy of the information.[30]
However, a significant difference compared to the US counterpart is that this clause is limited to institutional actors only, and not to any other external source of SSA data.
While the European approach somehow protects external users that have the guarantee that only institutional/public actors are involved in the SSA supply chain, it also hinders the European position in the global SSA market, limits the competitiveness of European players and internally could push European companies to rely on the service offered by the Open Architecture Data Repository (OADR).

28 Becker (24) 181.
29 See 40th recital of the Regulation's preamble and Article 8.2 of the EU Space Regulation.
30 See Article 55.3 of the EU Space Regulation.

Furthermore, the non-inclusion *ab origine* of commercial and industrial partners in the evolving European SSA enterprise might also harm the EU bargaining power vis-à-vis external SSA providers, including the US, which rely on the developing SSA commercial and civil industry, as well as in contributing to setting standards for SSA sharing practices.[31]
In fact, as in the case of China, the European model could certainly favour a process of regional standardization in the field of security and access to space (SST) data, which, however, should then be exported outside the EU borders, including through commercial partners which contribute or rely on that model, ultimately favouring the integration among the different systems through market dynamics.

6. Issues in terms of Liability

One last question concerns the issue of liability for inaccuracy of SSA data and/or services.
Here two could be the possible avenues to follow.
If the notion of "space activities" is interpreted broadly up to include the provision of SSA data, Article VI of the Outer Space Treaty (OST) will provide additional assurance to the SSA data recipients by anchoring the provision of SSA data to States' obligations under the OST and the associated responsibility regime, regardless of any liability waiver clause.
In fact, States Parties to the Treaty have to:

> [B]ear international responsibility for national activities in outer space […] whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.[32]

In this regard, a question to be addressed could be whether the Outer Space Treaty obligation to avoid harm, included in Article IX, includes the provision of information about the space environment, provided that space debris is considered a form of harmful contamination.
In fact, as authoritative doctrine suggested, if:

> Article IX implies that 'any contamination which would result in harm to a State's experiments or programs is to be avoided'[…] it seems correct to believe that the obligation to take all appropriate measures to prevent harm, or to minimise the risk thereof […] extends also to taking appropriate measures to identify activities which involve such a risk. This obligation is of a continuing character. Due diligence requires reasonable efforts by a State to inform itself of

31 Eurospace Position Paper: STM, an opportunity to seize for the European space sector, February 2021, 9.
32 Article VI of the Outer Space Treaty.

> factual and scientific components that relate to a contemplated activity and to take appropriate measures in timely fashion so as to address them.[33]

This interpretation could therefore substantiate a duty of both States and operators to share and request SSA data during the planning and conduct of space activities, including the manoeuvring of space objects.
However, as explained in the first section, the enforceability of the legal obligation under Article IX of the OST could be made ineffective by the vagueness of the subsequent clause "to the greatest extent feasible and practicable" and may place an excessive burden especially on countries with SSA capabilities.
On the other hand, a more restrictive interpretation may exclude SSA sharing from the scope of Article VI, mainly qualifying it as an "ancillary information service to space activities", for which liability could be expressly excluded by the parties through institutional or private arrangements, including SSA Sharing Agreements.[34]
Here, if one adheres to the interpretation that "the principle of co-operation and mutual assistance is not to be constructed as an obligation [but rather be] regarded as a 'general principle' that needs to be concretized by more detailed rules",[35] SSA Sharing Agreements could therefore only be seen as a specification of the broader principle of cooperation and mutual assistance.

7. Conclusions

As shown in this contribution, current approaches to SSA sharing practices essentially pose three risks:

1) with the increase in private offering and integration of SSA data and information, unilaterally determined SSA practices (and with them domestic liability waiver clauses) will find less and less consensus in the long-term.
2) In addition, diversified or non-existent licencing systems to provide SSA data and services across different legal systems, together with liability waiver clauses, could significantly hamper space safety and the achievement of a space traffic management regime already in the short-term, where enhanced integration of data is expected;
3) in the absence of a regulatory framework and a standardization of data sharing processes, legal uncertainty will translate in an

33 S. Marchisio, "Article IX", in S. Hobe, B. Schmidt-Tedd, K-U Schrogl, Cologne Commentary on Space Law, 2014, 177.
34 S. A. Kaiser, "Legal and policy aspects of space situational awareness", Space Policy 31, 2015, 11.
35 Marchisio (27) 175.

increasing number of disputes, both internationally and nationally, as well as in distrust and escalating tension in international relations;

4) finally, multiple and parallel SSA data sharing models will lead to inefficiency and inconsistency, as well as lack of interoperability.

Therefore, especially at this stage where some regional SSA practices are starting to consolidate, cooperation and coordination should be enhanced, leveraging the opportunities that each and every system presents, in a multi-step approach.

Certainly grouping the main practices into macro-systems could prove to be a successful approach. In fact, this would allow working on only four (already) established reference models (including Russia), potentially identifying common characteristics related to data processing, data formats and service functions, ultimately achieving interoperability between different SSA systems.