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Toward the International Regime for Space Traffic Management -What to Fix the Current International Regulations-

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1. Introduction

The concept of Space Traffic Management (STM) is not only beneficial for controlling suborbital flights but is more relevant for controlling orbital space activities or launch activities. STM is an effective concept for providing a solution to the current congested, contested, and competed situation of outer space. On the other hand, the status of international legal system governing outer space remains at its original formation of the 1960s. Filling this gap is becoming an inescapable task soon or late and it is necessary to establish the international regime for STM to do so. In order to establish an international regime for STM, it is necessary to reconsider several conditions of current international space law.

This paper will try to pinpoint the problems of the current international legal regime as necessary to be solved for establishing the STM regime and provide the eligible solutions for realizing international STM regime. In order to achieve this purpose, this paper tries to answer the following questions. Whether STM regime should be applicable only in outer space or air space or both? What should be the criteria of these two spaces? Should it only be space object that STM regime controls? How to treat the failure of control by the STM regime?

2. Realizing International STM Regime

International space law has been maintaining the same configuration since 1960's, although space activities have been changing their shape in this half of the 21st century.[2]

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[1] The views expressed herein are entirely those of the author and do not reflect those of Japan Aerospace Exploration Agency (JAXA) or the Government of Japan by any means. Yu Takeuchi is serving for JAXA since 2007 and currently working as administrative officer at Satellite Application Mission Directorate I. LLM candidate, Institute of Air and Space Law, McGill University (2015), M.A., International and Administrative Policy, Hitotsubashi University (2007), B.A., Law, Sophia University (2005). The ideas appearing in this paper was originally expressed in the author's thesis submitted to McGill University as partial requirement for his LLM degree in 2014.

[2] International treaties are solely the *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, 27 January 1967, 610 UNTS 205, 18 UST 2410 (entered into force on 10 October 1967) [*Outer Space Treaty*]*; Convention on International Liability for Damage Caused by Space Objects,* 29 March 1972, 961 UNTS 187; 24 UST 2389

This is the result of the huge efforts of the international community to pursue sustainable space activities without new international legislation. Efforts to promote a new legislation are facing to a deadlock situation in the existing negotiation organizations resulting from the US' clear opposition to the development of a new legal regime infringing its current rights to conduct space activities.[3] To date, soft laws[4] have promoted international cooperation for mutual understanding, addressed the problem, or suggested the development of a new regime,[5] but soft laws have not been able to play a more effective role, such as providing a common interpretation of the treaties. Consequently, soft laws have been partially serving to promote international cooperation on space activities, but their legal weakness in establishing an international regime is obvious.

Current trends of space activities that are yet to be reflected to the international space law are the increasing actors as well as the operating countries and operators, ever-increasing amounts of space debris, and becoming realized suborbital space flight activities. Increased number of space actors creates the necessity for realizing common understanding in regulating the activity. States regulate the activities partially in

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(1971) (entered into force 1 September 1972), [*Liability Convention*]; *Convention on Registration of Objects Launched into Outer Space,* 6 June 1975, 28 UST 695, 1023 UNTS 15 (entry into force 15 September 1976), [*Registration Convention*]; *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space,* 22 April 1968, 672 UNTS 119, 19 UST 7570 (entry into force 3 December 1968) [*Rescue Agreement*]; *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies,* 5 December 1979, 1363 UNTS 3 (entry into force 11 July 1984) [*Moon Agreement*].

[3] Wolfgang Rathgeber, Nina-Louisa Remuss & Kai-Uwe Schrogl, "Space security and the European Code of Conduct for Outer Space Activities" (2009):4 UNIDIR Disarmament Forum "A safer space environment?" 33 at 34; The US continuously took a policy to reject international treaties for possibilities to limit its freedom of action after clearly stating in the Bush administration's space policy (*National Space Policy of the United States of America*, (2006)). Theresa Hitchens, "Debris, Traffic Management, and Weaponization: Opportunities for and Challenges to Cooperation in Space" (2008) 14 Brown Journal of World Affairs 173 at 178; The Obama administration's space policy (*National Space Policy of the United States of America*, (2010)) does not specifically pinpoint the objection but it seems no sign of relaxation.

[4] Soft laws are the "instruments that might purport to specify standards of conduct, but do not emanate from the traditional 'sources' of public international law": Steven Freeland, "The Role of 'Soft Law' in Public International Law and its Relevance to the International Legal Regulation of Outer Space" in Irmgard Marboe, ed, *Soft Law in Outer Space* (Vienna: Heribert, 2012) 9 at 19.

[5] Setsuko Aoki, "The Function of 'Soft Law' in the Development of International Space Law" in Irmgard Marboe, ed., *Soft Law in Outer Space* (Vienna: Heribert, 2012) at 57-86.

accordance with their obligations stated in the international treaties, however their regulations are differ with one another on some essential points.[6] Issues on space debris are recognized as the most emerging problem related to space activities from the late 1970s but still in the situation that no international consensus has been made for their removal operations. Enthusiastic development of suborbital spaceflight business is leading the discussion for initiating space tourism in the United States. It is therefore becoming real that suborbital spacecrafts will be space traffic as well.

International space law should be modified aligned with the modern space activities in order to reach international regime for STM.

3. Issues on International Law for Establishing STM Regime

(1) Applicable in Outer Space or Airspace?

The delimitation of "outer space" is an issue which has been discussed in the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) for more than half of the century. Most of the space-faring nations have set forth to give priority neither to the functionalist nor the spatialist approach: it is given to the "wait-and-see" approach.[7] This attitude is followed by the other space-faring nations, and the issue is still on the agenda of the Legal Subcommittee of UNCOPUOS today. In considering the sustainability of space activities, therefore, the aerial scope of the existing legal regime is still ambiguous. This ambiguity does not bring practical problems at this moment, but remains the fundamental problem in regulating space activities, especially in the issue of to what extent the UN space treaties govern space activities. This problem will occur at some point in the near future because the development of space activities is approaching a crucial point, which will appear in marginal events.

The demarcation of applicable air law and space law is crucial for suborbital spaceflight because its nature of operation straddles both air and outer space.[8] In planning active space debris removal, it is necessary to identify the applicable space law and relevant air law, which may be affected by safety considerations. In controlling space activities, such as a satellite or launch vehicle as systematic traffic, the regulation

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[6] Daisuke Saisho, "Liability Risk Sharing Regime of the Bill of Japan's Legislation on Space Activities and Its Comparison with the US and French Law" (2011) 55 Proceedings of the Colloquium on the Law of Outer Space 107.

[7] Bin Cheng, "The Legal Status of Outer Space and Relevant Issues: Delimitation of Outer Space and Definition of Peaceful Use" (1983) 11 Journal of Space Law 89 at 92-95.

[8] Vernon Nase, "Delimitation and the Suborbital Passenger: Time to End Prevarication" (2012) 77 Journal of Air Law and Commerce 747.

should identify whether the applicable law should be air law, space law, or both, and to what extent.

It should be said that the time has come to go forward in terms of the developing variation of space activities.[9] But, at the same time, the changed circumstances of the activities have relativized the delimitation issue itself. Namely, considering the current practices of space activities to date, it is realistic to understand that outer space is a hybrid meaning of spatialist and functionalist approaches.

The merit of the spatialist approach involves differentiating air space from outer space with a clear-cut edge. Since this approach would establish a delimitation line between both types of space, defining the applicable law based on the area would be easier, despite the activity's nature. It would also be useful to classify military activity within the regulation of one area or the other. Several exemptions are also required in military activities, so taking the spatialist approach would allow their consideration within at least one of the regulation areas. Moreover, the spatialist approach would allow specifying the applicable law just based on the area of its activities, whatever nature the object or activity may retain. It is the easier way to address the objective indication.

The functionalist approach, on the other hand, would require close observation of the activity's function in order to identify whether the activity should be regulated by air law or space law. Therefore, it might be problematic to recognize that an activity falls under a certain category of law only from its external form. In terms of traffic management, it seems beneficial to have an identifiable external form to allow the regulator to easily identify the applicable rule of the object. However, the physical nature of spacecraft maneuver differs from that of aircrafts or vessels. It is impossible to gain visual images of a spacecraft during its flight in outer space. This differs greatly from the assumption to prioritize visual contact in aircrafts, vessels, or automobiles. Almost all spacecrafts are operated by positioning data, the transmitted GPS data from the satellite itself, the radar observation data from certain ground observation stations, and SSA data. Therefore, identifiability plays only a minor role in the delimitation of space activities. In fact, the functionalist approach is more reasonable, since space objects will be functionally identified by their telemetry, tracking, and control (TT&C) or operational capabilities.

Another rationale used to argue that the functionalist approach is more well-suited for application than the spatialist approach is that the functionalist approach may have the flexibility of allowing any other category of spacecraft or space activities within

[9] *Ibid*.

space regulations. For example, JAXA is currently developing a Super Low Altitude Test Satellite (SLATS), which flies at a relatively low altitude of 200-300km in order to advance the high-resolution Earth observation sensor technology.[10] This altitude is comparatively lower than the orbiting altitude of a normal satellite, which is around 600-800km, while the International Space Station orbit is around 400km. One should easily imagine that the spatialist approach can face another challenge to its criteria in the very near future. It is no exaggeration to say that the altitudes of space activities are gradually relativized, and thus, the criteria of the spatialist approach are gradually becoming vague. The functionalist approach has the advantage in contemporary space activities, but moreover, it is also reasonable to say that being a spatialist or a functionalist does not affect the STM regime in practice.

(2) Applicable to Space Object?

International space law has always faced the constant pressure involved with the absence of a clear definition of "space object". Its only definition in current international space law is "[t]he term of 'space object' includes component parts of a space object as well as its launch vehicle and parts thereof".[11] Literally, space objects are the only regulatory materials subject to the Liability Convention and Registration Convention, as well as Article VII and VIII of the Outer Space Treaty, while Article VI of the Outer Space Treaty only regulates the "activities in outer space". The provision of the definition of space object in the Liability and Registration Convention reinforces this notion. However, considering the way to comprehend these three Articles of the Outer Space Treaty aligned with their ordinary context, Articles VII and VIII can be understood as the detailed prescriptions for State liability of damage and for the registration of space objects, respectively.[12] In turn, Article VI should be understood as stating the general responsibility of the State for space activities. Consequently, the object falling under the definition of "space object" will become the international responsibility of the launching State with the duty of authorization and continuing supervision, as well as retained jurisdiction and control by the State of registry. Therefore, it can be said that the subject matter designated by "space object" is a dedicated description for the liability and registration systems, which are only a part of

[10] Keizo Nakagawa, "R&D of JAXA Satellite Application Mission", (Presentation delivered at the 26th Microelectronics Workshop, Tsukuba, 24 October 2013) [unpublished].

[11] *Liability Convention*, art 1(d); *Registration Convention*, art 1(b).

[12] Stephan Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrogl, *Cologne Commentary on Space Law Vol I Outer Space Treaty* (Cologne: Carl Heymanns Verlag, 2009) at 104.

international space law.

Aside from this fundamental issue, there are also some cases in which the concept of "space object" falls under ambiguity of application. It is obvious that the satellite, launch vehicle, and trans-orbital vehicle, including rovers on the surface of celestial bodies, fall into the definition of "space object". The controversial objects are space debris and suborbital spacecraft, which may fall outside of the definition. Nonetheless, the prescription of the Liability and Registration Convention on the definition of "space object" obviously expresses that space debris is included under the definition of "space object". This signifies that space debris should be recognized under the "authorization and continuing supervision" by the appropriate State, the damages occurred as a result of space debris should be liable to the launching State of that debris, and the "jurisdiction and control" over it are on the State of registry. As a result, it is clear at this point that space debris is not an issue of the definition of space object, but an issue of controlling its measures or determining the appropriate State in control, which will be discussed in the next section.

The case of suborbital spacecraft is much more complicated. A suborbital spacecraft, differing from space debris, cannot be settled spontaneously under the definition of space object because it can be both an aircraft and a space object at the same time. International air law defines "aircraft" as "[a]ny machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface."[13] The majority of the suborbital spacecraft takes off from and lands on a runway, similarly to an aircraft. It ascends into air space using jet propulsion in a similar way to the aircraft, and ignites the rocket propulsion system or separates the space flight module along with it to ascend further. After reaching an altitude of around 100 km to perform "space tourism", it descends back down to an altitude where it becomes possible to fly in aerodynamic reactions and come back to the ground as a glider.[14] Therefore, suborbital spacecraft have a reason to meet the definition of aircraft. Reflecting this controversy, ICAO has warned that suborbital spacecrafts should be regulated under international air law, at least when they share the same international air space of other aircrafts conducting international operations.[15] This observation is an inevitable conclusion from the safety point of view of aviation

[13] *Chicago Convention,* annex 7, chapter 1.
[14] *Concept of Suborbital Flights: Information from the International Civil Aviation Organization (ICAO)*, UNCOPUOSLSCOR, 49th Sess, UN Doc A/AC.105/C.2/2010/CRP.9, (2010), s 1.3 [*ICAO's Concept*].
[15] *Ibid*.

operation.[16] It is easy to imagine that the ICAO limits its own mentioning in international air space, simply because national air space is outside of ICAO's mandate.[17] It is obvious that the nature of safety consideration does not differ from national air space and international air space. Since suborbital spacecraft retain a high potential to pass through air space more frequently than launch vehicles, dodging each case by letting them pass through a special national air space dedicated to them will easily face the limit.[18] It was a self-explanatory conclusion for the aviation community that ICAO called for international regulation for suborbital spacecraft under air law. The ambiguity of the definition of "space object" emanates difficulties, not only for space law because of its applicability to suborbital spacecraft, but also for the demarcation of air law and space law to be applied to suborbital spacecraft.

From the STM viewpoint, it is practical to disconnect the subject matter of STM from space objects and focus on "space traffic", since the primary purpose of the STM regime is to regulate traffic in outer space in order to maintain safe and sustainable space activities. The status of "space object" functions in terms of the liability regime under the current international space law. Therefore, the STM regime can exist as a parallel regime of the existing liability regime of international space law. Nonetheless, the result of interference to a space "object" can be subject to the liability regime, interference to space "traffic" may not be subject to the liability regime unless specified to do so in the STM regime.

"Space traffic" needs to be defined as manageable traffic flow located outside of air traffic control. From the parallel thought involving the distinction between state and civil aircrafts, it is also possible to distinguish the security used spacecraft from the civil spacecraft based on the States' concerns regarding intelligence satellites. At this point, it is inevitable to establish regulations for due regards to the safety of the other civil

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[16] See also Ram S. Jakhu, Tommaso Sgobba & Paul Stephen Dempsey, *The Need for an Integrated Regulatory Regime for Aviation and Space, ICAO for Space?* (Vienna: Springer-Verlag, 2012).

[17] *ICAO's Concept, supra* note 14.

[18] See also Daniel P. Murray, "The FAA's Current Approach to Integrating Commercial Space Operations into the National Airspace System" in Ram S. Jakhu & Kuan-Wei (David) Chen, eds., *Regulation of Emerging Modes of Aerospace Transportation* (Montreal: McGill University Center for Research in Air and Space Law, 2014) 169. Although it seems still affordable to date to let them use dedicated national air space: John M. Falker, *Engineering and Policy Analysis of Strategic and Tactical Options for Future Aerospace Traffic Management* (Ph. D. in Aerospace Engineering and Policy Analysis Thesis, Massachusetts Institute of Technology, 2002) [unpublished].

spacecrafts like in air law, which is understood as a legal obligation from the Chicago Convention to the State.[19]

(3) Responsible State for STM

No other actors other than the sovereign States can play a major role in the international sphere. The "launching State" is considered the subjective actor for the identification of the liable State causing the damage.[20] Despite the importance of the concept, it creates some ambiguities when it comes to determining which State should be liable. The current issues regarding the concept of the launching State are its mismatch with the role of operating States, and poor bilateral coordination among the launching States. The liability system of the UN space treaties does not seem to consider that the operation of a spacecraft could be conducted in a different State than the launching State. However, understanding the "authorization and continuing supervision" as dynamic rights and obligations, and "jurisdiction and control" as static rights and obligations, it is also possible to understand that the active role for space objects is deemed to be the responsibility of the appropriate States, rather than that of the launching States. Consequently, the jurisdiction retained by the State of registry, which is one of the launching States, would be questioned only in the case of relinquishment of rights over space debris.

In the context of STM regime, it should be the appropriate States retaining responsibility as "authority and continuous supervision". Therefore, there is no need for the STM regime to focus on the launching State, but there is a need to entail certain responsibilities to the appropriate States.

(4) How to Remove Space Debris ?

The crucial points for the scope of space objects in terms of STM are the demarcation between an operational space object and a non-operational space object, as well as the procedure for relinquish the rights over non-operational one. From the stand point of the space operators, all space objects are targets for collision avoidance, but avoiding non-operational objects is given a higher priority since there is no chance that they could move by themselves to avoid the collision. Therefore, it is necessary to establish a measure to allow the operators to identify whether the object is an operational removable spacecraft or just space debris. Furthermore, it is inevitable to consider removing space debris in the near future.

From this viewpoint, a procedure to relinquish rights over abandoned satellites or

[19] *Chicago Convention*, art 15.
[20] *Liability Convention*; *Registration Convention*, arts 2, 4.

upper stages of launch vehicles should be established in order to allow their collection or abolishment in order to reduce space debris.[21] A new rule used in identifying operational and non-operational space objects and procedures for relinquish the rights over them should be determined by the STM regime.[22] This new rule should identify the condition and procedure of relinquishment of the State's rights, as well as the removing measures by ensuring international transparency over using proper technology. However, relinquish the rights over space debris is a double-edged sword: it means the suspension of "jurisdiction and control" of Article VIII from the Outer Space Treaty, as well as a waiver of the launching State's international responsibilities from Article VI, since obligations are always inextricably linked to relative rights. Therefore, the regime should ensure that the relinquishing of jurisdiction and control by the State should be extremely confined in certain conditions. It should also be considered that micro-satellites, which do not maintain abilities for maneuver, must be treated as similar as non-functional satellites in the context of safety operation. Since these satellites are still functional, it may cause conflicts among the respective operators. However, leaving these micro-satellites out of the regulation may cause further deployment of space debris in near future.

(5) Regulating Suborbital Spaceflight

From an STM viewpoint, it is also important to recognize suborbital spacecraft as traffic, since they are potential traffic for STM, showing behavior similar to that of launch vehicles until their re-entry. The registration and licensing regimes for suborbital spacecraft are necessary for vehicle identification, determination of liability, and safety operation.[23] As "[a] comprehensive and uniform legal regime that specifically envisages the complete launch and return journey of private individuals should be preferred",[24] there is no reason to prevent the application of both regimes of international air law and space law. Since the suborbital spacecraft used for space tourism is a hybrid type which should be regulated in both ways, there are only two options: establishing a new category for regulation, or regulating it by applying all of

[21] Brian Weeden, "Overview of the Legal and Policy Challenges of Orbital Debris Removal" (2011) 27:1 Space Policy 38.
[22] *Ibid* at 40.
[23] Zhao Yun, "Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space" (2009) 74 Journal of Air Law and Commerce 959 at 974-978.
[24] Steven Freeland, "Up, up and ... Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space" (2005-2006) 6:1 Chicago Journal of International Law 1 at 9; See also Jakhu, Sgobba & Dempsey, *supra* note 16 at 119-139.

the existing applicable regulations. It is, of course, more desirable to establish a new category rather than to forcibly regulate through a set of existing regulations, but the current political circumstances do not allow a new establishment of legal regulation. Therefore, at this stage, the only contemporary choice is to apply multiple applicable regulations. The definition of aircraft in international air law signifies that it would only be applicable to when the suborbital spacecraft flies as an aircraft. The regulation of international space law can be applied outside of these scopes, regardless of the delimitation of air space and outer space.[25]

Either way, in terms of traffic management, the hybrid-type suborbital spacecraft should be entitled under the regulation of air traffic as well as space traffic. As a desperate measure without establishing a new legal category, it is beneficial to regulate it as an aircraft while it is being operated as an aircraft, and as a space object when it does not fall under either of these categories. It is also beneficial to allow the international regime for outer space, including the STM regime, to be applicable to the suborbital spacecraft in such a manner in order to reduce the area of *lacunae* of law.

4. Conclusion

There is no exaggeration to state that STM is necessary and will be beneficial for achieving safe and effective space activities. It is equally reasonable to say that modifying relevant international space law is efficient to achieve STM regime. This paper argues that the delimitation outer space and air space can be relativized, STM regime would not necessarily be applied to space object, and responsible State for STM may be interpreted as the operating State of the relevant traffic. On the other hand, this paper also argued that a new legal obligation should be identified for removing space debris, and suborbital spaceflight should be newly subjected as applicable activity under relevant law. Consequently, one can say that it is not an extraordinary legal reconstruction of the current international space law required for establishing STM regime, but a few reinterpretations on its basis.

The benefit of achieving STM as an international regime will contribute to the safe and sustainable space activities for our future.

[25] Yu Takeuchi, "Regulatory Regime for Tomorrow‘s Suborbital Space Flights: Point-to-Point International Flights" (2014) 57 Proceedings of the Colloquium on the Law of Outer Space [to be published].