Space Traffic Management as a Guiding Principle of the International Regime of Sustainable Space Activities

Yu Takeuchi *

The necessity of Sustainable Development of Space Activities, which can be seen as a concept receiving some impression from Sustainable Development, has been actively debated over last decade. This paper examines the current status of the international regime of space activities by comparing the international regime of sustainable development and analyzing the norms and principles applied in the Draft Code of Conduct of Space Activities of the EU and the Long Term Sustainability of Space Activities. The paper concludes that the Space Traffic Management system should set the guiding principles for international space activities.

Keywords
Space Traffic Management, Long Term Sustainability of Space Activities, Draft Code of Conduct of Space Activities of the EU

I. Introduction

'Space activities' have drastically changed in the past half a century in terms of actors.[1] In the beginning, only the United States and the Soviet Union could conduct space activities. Governments were expected to exclusively carry out space activities at that

* Associate administrator at the Japan Aerospace Exploration Agency ("JAXA"). LL.B.(Sophia), M.A.(Hitotsubashi). The views expressed herein are entirely those of the author and do not necessarily reflect those of JAXA or the Government of Japan by any means. The author may be contacted at: takeuchi.yu@jaxa.jp/Address: 1-6-5 Marunouchi, Chiyoda-ku, Tokyo 100-8260 Japan.

1 There is no official definition for 'space activities.' However, this paper will use this term to mean every activity expected to reach outer space and contains the possibility to interfere the current activities. It includes launch, operation, maneuver or re-entry of orbital or suborbital objects.

time. The number of participants, however, has gradually increased. Entering into the 21st century, the international community faces a different situation. Today, the UN Committee on the Peaceful Use of Outer Space ("COPUOS") counts 70 countries in its membership as of 2010.[2] Commercial space flights have become a usual launch activity in spacefaring nations. Satellites, including those for government use, are under consideration for private sector operation, introducing a financial system of Public-Private Partnerships ("PPP") or Private Finance Initiatives ("PFI"). Even space tourism is under development. Though the space industry still remains at an early stage in its development, the activities themselves increase the number of participating actors as well as sectors.

This situation has triggered the space debris problem.[3] It has been recognized since the late 1980s; the temporary results of its discussion were concluded in the UN Space Debris Mitigation Guidelines of 2007.[4] On February 12, 2009, however, there was a serious collision for the first time between two large-scale satellites.[5] In January 2007, China's Anti-Satellite ("ASAT") missile demonstration resulted in more than 3000 pieces of space debris in scattered orbit.[6] The international community shared a sense of crisis about these situations and raised the issue of maintaining long-term sustainability of space activities as a primary international issue.[7] Though the issue of the sustainability of space activities first arose to prevent an arms race in outer space, harmonizing the development and protection of the environment is a parallel and common interest for sustainable development. Both goals are equally important to pre-empt international conflicts.

This paper attempts to develop a Space Traffic Management ("STM") system as a guiding principle for preventing conflicts among space activities in the international community. Part II will examine the current international legal regime governing space

2 United Nations Office of Outer Space Affairs ("UNOOSA"), United Nations Committee on the Peaceful Uses of Outer Space: Members, *available at* http://www.oosa.unvienna.org/oosa/en/COPUOS/members.html (last visited on Aug. 09, 2011).

3 UN Technical Report on Space Debris, U.N. Doc. A/AC.105/720, at 26 & 39 (1999).

4 Space Debris Mitigation Guidelines of the Scientific and Technical Subcommittee of the COPUOS, U.N. GAOR 62nd Sess., U.N. Doc. A/AC.105/890 (2007), *available at* http://www.reachingcriticalwill.org/legal/paros/DebrisMitigationGuidelines.pdf. (last visited on Aug. 9, 2011).

5 Cosmos 2251, a Russian Non-Functional Satellite, and Iridium 33, a US Functional Satellite Crashed at the 789km altitude of North Siberia. *See Collision Between Two Satellites in Orbit: Iridium 33 and Cosmos 2251, available at* http://www.n2yo.com/collision-between-two-satellites.php (last visited on Aug. 9, 2011).

6 National Aeronautics and Space Administration ("NASA"), *Chinese Debris Reaches New Milestone*, 14 ORBITAL DEBRIS QUARTERLY NEWS 3 (Oct., 2010), *available at* http://www.orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv14i4.pdf (last visited on Aug. 9, 2011).

7 Gerard Brachet, *Long-Term Sustainability of Space Activities, in* SECURITY IN SPACE: THE NEXT GENERATION PROC. (UNIDIR ed., Mar. 31 - Apr. 1, 2008).

activities[8] and compare it to the international regime of sustainable development. Part III will analyze norms and principles applied in the two documents: The Draft Code of Conduct for Space Activities ("EUCoC") of the EU[9] and the Long Term Sustainability of Space Activities("LTSSA").[10] This part will then compare the results of this analysis and the concept of the STM which would provide driving norms and principles for international dialogue. Part IV will describe what kinds of principles should be applicable to the space activities of today and the near future.

II. International Regime of Sustainable Space Activities

In order to understand the "international regime of sustainable space activities" as an operational phase, the "international regime of sustainable development"[11] should be adopted as a model due to their similar implications.

A. A Model of International Regime of Sustainable Development

Environmental protection was globally recognized among the international community in the Stockholm Declaration in 1972.[12] In this Declaration, the international community admitted that economic development must be "compatible with the need to protect and improve the environment."[13] Since the ratification of the Stockholm Declaration, the international community has gradually recognized the necessity to harmonize economic development with environmental protection. Many treaties have been adopted in pursuance of this doctrine.[14]

8 For details, *see* STEPHEN D. KRASNER (ed.), INTERNATIONAL REGIME 2 (1983).

9 Council of the European Union, The Revised Draft Code of Conduct for Space Activities (14455/10), *available at* http://www.consilium.europa.eu/uedocs/cmsUpload/st14455.en10.pdf (last visited on Aug. 9, 2011).

10 COPUOS, Terms of Reference and Methods of Work of the Working Group on the Long Term Sustainability of Outer Space Activities of the Scientific and Technical Subcommittee, U.N. Doc. A/AC.105/C.1/L.307/Rev.1 (Feb. 28, 2011), *available at* http://www.oosa.unvienna.org/pdf/limited/c1/AC105_C1_L307Rev1E.pdf (last visited on Aug. 9, 2011).

11 This conceptual model was introduced many times. *See, e.g.,* Motoko Uchitomi, *Sustainable Development in Outer Space: Applicability of the Concept of Sustainable Development to Space Debris Problems,* 42ND COLLOQUIUM ON THE LAW OF OUTER SPACE PROC. (2000).

12 Declaration of the United Nations Conference on the Human Environment (June 16, 1972).

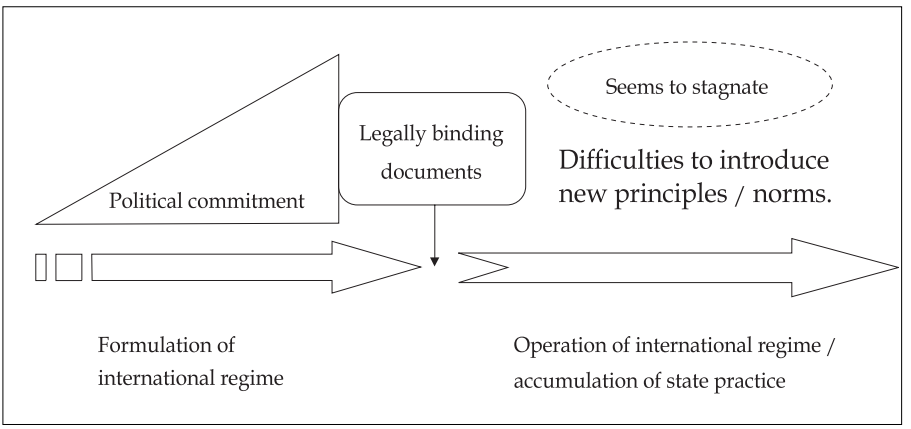
13 *Id.* princ. 13.

14 The international conventions and treaties are as follows: The Vienna Convention for the Protection of the Ozone Layer adopted in 1985; the Convention on Biological Diversity ("CBD") in 1987; the UN Framework Convention on Climate Change ("UNFCCC") in 1992; The Rio Declaration on Environment and Development (the Rio Declaration) and the Agenda 21 (adopted in the Rio Conference as its roadmap); the Millennium Development Goals ("MDGs") in 2000.

The Rio Declaration allowed the formation of the Convention on Biological Diversity("CBD") and the UN Framework Convention on Climate Change("UNFCCC"), which serve as the legal foundation for the "international regime of sustainable development." The regime is based on the following four inherent principles: (1) integration of the environment and development; (2) application of equity between States; (3) consideration of the needs of future generations and the non-exhaustion of renewable natural resources; and (4) the five supporting principles including each State's sovereignty over its natural resources, the responsibility not to cause environmental damage, common but differentiated responsibility, the precautionary principle, and the polluter-pay principle.[15]

After formulating the international regime as shown above, the operational phase begins. During the operational phase, the international community accumulates State practices which would eventually become binding. The newly developing principles or norms would become difficult to enlarge or introduce into the regime during this phase. As for the international regime of sustainable development, the difficulties of further fostering the activities of the Millennium Development Goals ("MDGs") might be explained by this notion. The MDGs are trying to tackle the issue of poverty. However, there seems to be a kind of stagnation among this international regime. Figure 1 shows the process of the international regime of sustainable development.

Figure 1: International Regime of Sustainable Development



Source: Compiled by the author

15 *Supra* note 11, at 75.

B. Development of International Regime for Sustainable Space Activities

1. Formulation Phase

Outer space development began with the successful launch of Sputnik in 1957 by the former Soviet Union. Following these first space activities, the UN General Assembly adopted Resolution 1148(XII) in November 1957.[16] This resolution declared that the use of outer space should be "exclusively for peaceful and scientific purpose." Next year, the General Assembly established the COPUOS as the central forum of the international talks of space activities in 1959 and started discussions about outer space development internationally.[17] In 1966, the COPUOS adopted the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies ("OST"),[18] which used to be called "the constitution of space activities." The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space ("Rescue Convention")[19] was adopted the next year; the Convention on International Liability for Damage Caused by Space Objects ("Liability Convention")[20] in 1971; and the Convention on Registration of Objects Launched into Outer Space ("Registration Convention")[21] in 1974. This period was the golden age for international legislation concerning space activities. The last treaty adopted by the COPUOS was the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies ("Moon Agreement")[22] in 1979. Unfortunately, the Moon Agreement was ratified by only thirteen non-spacefaring countries, while the other four treaties have been ratified by almost all of the countries conducting space activities.[23]

The international regime of sustainable space activities began formalizing by that

16 G.A. Res. 1148 (XII).

17 G.A. Res. 1472 (XIV).

18 G.A. Res. 2222 (XXI).

19 G.A. Res. 2345 (XXII).

20 G.A. Res. 2777 (XXVI).

21 G.A. Res. 3235 (XXIX).

22 G.A. Res. 34/68, U.N. Doc. A/34/664.

23 The reason of this is often explained as the following. The Moon Agreement tried to define the Moon and the other celestial bodies as "the province of all mankind." This *id*ea recalled the significant trouble concerning the UN Convention on the Law of the Sea ("UNCLOS") regarding the control procedure of deep-sea bed. UNCLOS defined deep-sea bed as the common heritage of mankind ("CHM") and bring all exploration and exploitation of the seabed under the control of International Seabed Authority. This system was taken in order to achieve the equal distribution of the natural resources of the deep-sea bed, which are CHM as well. This idea in the UNCLOS was not recognized affirmatively among developed countries, because it led them difficult to reach the domestic process and the treaty standstill for 12 years for obtaining the necessary number of ratification to make it in effect.

time. It set the following seven principles as its main pillars: Free use and exploration of outer space;[24] no claim of sovereignty;[25] arms control in outer space;[26] environmental protection of outer space;[27] the liability of the launching State;[28] rescue and return of astronauts and the returned objects;[29] and registration of space objects and notification to the UN.[30] The regime failed to introduce two discussed principles at the formulation phase. The first is that the natural resources of the Moon (including the other celestial bodies) shall be for the common heritage of mankind ("CHM") and controlled under international regime. The second was for the comprehensive disarmament of outer space. The international community has been discussing for more than thirty years, especially at the Conference of Disarmament ("CD"), the prohibition of conventional weapons in space, but have yet to resolve the issue.

2. Operation Phase

Today, the number of the COPUOS member States brings substantial difficulties in reaching a consensus. However, the international community has tried to further develop principles as soft law such as the UN General Assembly Resolutions. Seven principles have been reached, such as the Broadcasting Principles,[31] the Remote Sensing Principles,[32] the Space Benefit Declaration,[33] the Application of Launching States,[34] and the UN Space Debris Mitigation Guidelines.[35] These principles try to match the technical development based on the UN space treaties established during the formulation phase.

In the meantime, the discussion in CD was stagnant. Since 1981, the former Soviet Union submitted proposals for a draft convention of comprehensive disarmament of

24 Outer Space Treaty ("OST") art. 1.

25 *Id.* art 2.

26 *Id.* art 4.

27 *Id.* art 9.

28 *Id.* art 7; Liability Convention arts 2 & 3.

29 OST art. 5; Rescue Agreement.

30 OST art. 8; Registration Convention.

31 Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, G.A. Res. 37/92, U.N. Doc. A/37/646 (Dec. 10, 1982).

32 Principles Relating to Remote Sensing of the Earth from Outer Space, G.A. Res. 41/65, U.N. Doc. A/41/751 (Dec. 3, 1986).

33 Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States: Taking into Particular Account the Needs of Developing Countries. G.A. Res. 51/122, U.N. Doc. A/51/590 (Dec. 13, 1996).

34 Application of the Concept of the 'Launching State,' G.A. Res. 59/115, U.N. Doc. A/59/469 (Dec. 10, 2004).

35 Others are as follows: Principles Relevant to the Use of Nuclear Power Sources in Outer Space, G.A. Res. 47/68, U.N. Doc. A/47/610 (Dec. 14, 1992); Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects, G.A. Res. 62/101, U.N. Doc. A/62/403(Dec. 17, 2007).

outer space, but the United States objected to it because the proposal implied a packaged deal including nuclear disarmament. Despite ten years of consideration of the Prevention of Arms Race in Outer Space ("PAROS"), the ad hoc committee never reached a final conclusion.

When the stagnation was finally over with the end of the Cold War, the main target of arms control was transformed into non-proliferation. The Missile Technology Control Regime ("MTCR"), which was the security export control regime among the western countries, drafted the International Code of Conduct against Ballistic Missile Proliferation ("HCoC"). It was eventually adopted in The Hague by both the MTCR countries and non-MTCR countries in 2002.[36] The subscribing States of the HCoC commit not only to observe non-proliferation of ballistic missiles, but also to provide vigilance when assisting other countries' Space Launch Vehicle programs so as to prevent the proliferation of delivery systems for weapons of mass destruction. This political code of conduct for Transparency and Confidence Building Measures ("TCBM") contributes to maintaining safety in space with 130 subscribing States.

In 2002, the Space Debris Mitigation Guidelines of the Inter-Agency Space Debris Coordination Committee ("IADC Guidelines")[37] were formulated. The IADC Guidelines were the result of efforts by the international community to add some norms or principles to the seven pillar principles of the international regime of sustainable space activities.

C. Recent Development

The space debris issue can be seen as the cornerstone for the protection of the space environment. However, recent times dictate a stronger focus on much more comprehensive questions in order to ensure the safety of spacecrafts, not only from space debris, but also from collision with other spacecrafts or hazardous natural phenomena.

The international regime of sustainable space activities is now entering a new stage of discussion. The regime will provide a stable structure to reach a solution to elaborate additional principles. The goal of this advancement would be to suggest a preliminary STM.

[36] U.N. Doc. A/57/724 (Feb. 6, 2003), *available at* http://disarmament.un.org/library.nsf/1eba87b71da2aad685256bdb0074cffe/b6844bed104a8bdd85256cd2007790ef/$FILE/ga57.724.pdf (last visited on Aug. 9, 2011).

[37] IADC, Space Debris Mitigation Guidelines (IADC-02-01), *available at* http://www.iadc-online.org/index.cgi?item=docs_pub (last visited on Aug. 9, 2011).

III. Basic Concept of Space Traffic Management: The EUCoC & The LTSSA

A. Overview

The EUCoC and the LTSSA are being discussed in a different forum; diplomatic channels for the former and the COPUOS/STSC for the latter; even the contributing members have somewhat different positions. The differences may be also found in the estimated outcomes of these two discussions. The EUCoC clearly set up a series of norms or principles, though they are not legally binding on the subscribing States as is the case with the HCoC. The EUCoC declares that its main purpose is to "enhance the security, safety and sustainability of all space activities."[38] Meanwhile, the LTSSA remains as a guideline of technical practice and "collect[s] information in a set of voluntary recommended guidelines that could be applied by all operators of spacecrafts acting jointly to reduce collectively the risk to space operations."[39] There are several views that the LTSSA would be a set of best practice guidelines under the EUCoC. However, there remains no consensus yet in the international community. The EUCoC maintains this possibility by indicating that it "contributes to transparency and confidence-building measures and is complementary to the existing framework regulating space activities."[40] One must also recognize that the current status of these concepts is different. The EUCoC was adopted by the second preliminary draft on October 11, 2010; the EU intended to consult with other States and conclude the agreement with their signature in a few years,[41] while the LTSSA has just agreed to start its discussions in the Working Group in mid-2011. Its conclusions are expected to be published in 2014.[42]

B. Differences and Similarities between the EUCoC and the LTSSA

1. Differences

38 EUCoC art. 1.1.

39 *Supra* note 10, Operative Clause ("O.C.")14.

40 EUCoC art. 1.3.

41 Frank Rose, *U.S. Supports European Union "Code of Conduct for Outer Space Activities,"* NEWSROOM MAGAZINE (US State Dept., Apr. 5, 2011), *available at* http://newsroom-magazine.com/2011/executive-branch/state-department/u-s-supports-european-union-code-of-conduct-for-outer-space-activities/ (last visited on Aug. 9, 2011).

42 *Supra* note 10, O.C. 23.

Two significant differences between the EUCoC and the LTSSA come from the national security and consultation measures. Since the EUCoC aims to achieve a code of conduct among the governments, it clearly includes national security issues and sets itself up as a responsibility of States. Article 2 of the EUCoC proclaims that subscribing States shall "keep the inherent right of individual or collective self-defence in accordance with the UN Charter." From this perspective, the EUCoC also provides that the States resolve "to take all appropriate measures to prevent space from becoming an area of conflict."[43] Because the LTSSA remains as a series of best practice guidelines of the space operators, it does not mention the relationship to national security. Instead, it provides that: "States bear international responsibility for national activities in space conducted by governmental and non-governmental entities."[44]

The EUCoC introduces consultation mechanisms in order to promote discussions when problems occur.[45] The LTSSA does not contain this kind of process.

Meanwhile, space weather issues were only included in the LTSSA. There is still a possibility for the EUCoC to include these issues in endorsing it as a best practice. This could be a consequence of the technical nature of space weather issues.

Table- III-1 : Comparison between the EUCoC and the LTSSA on Space Debris

EUCoC	**LTSSA**
Article 5	O.C. 16(b)
In order to limit the creation of space debris and reduce its impact in space, the Subscribing States commit to: - refrain from the intentional destruction of any on-orbit space object or other activities which may generate long-lived space debris; - adopt and implement the appropriate policies and procedures or other effective measures in order to implement the UN Space Debris Mitigation Guidelines.	(b) Space debris: (i) Measures to reduce the creation and proliferation of space debris; (ii) Collection, sharing and dissemination of data on functional and non-functional space objects; (iii) Re-entry notifications regarding substantial space objects, in particular with regard to the re-entry of space objects with hazardous substances on board.

43 EUCoC art. 2.

44 *Supra* note 10, O.C. 12.

45 EUCoC art. 9.1.

Source: Compiled by the author

2. Similarities

Similarities between the EUCoC and the LTSSA may be found in the current legal framework of sustainable use of outer space.[46] This means that both initiatives are generally based on common rules and regulations as well as the international regime of sustainable space activities. Both documents recognize space debris mitigation and collision avoidance as the main priority to be resolved. This similarity is shown at Table III-1.

Articles 4.2 and 4.3 the EUCoC provide the commitments of subscribing States in relation to avoiding collisions.[47] The LTSSA also recognizes this necessity by pointing out the "collision avoidance processes and procedures" in O.C.16 (d).[48]

To address these issues, the EUCoC and the LTSSA have adopted the same measures, which is notification among operators and information sharing. There are some proposals to remove space debris by using electrodynamic tethers or capture satellites. All of them are, however, only under discussion or development. Realizing these safety goals would remain difficult because those kinds of satellites are capable of removing other satellites from their original orbit. Thus, the most realistic and simplest ways would be to notify about the maneuvers of satellites to the other operators and to share information among the States conducting space activities in order to maintain transparency and confidence building. It is laid down at Article 6.1 of the EUCoC and O.C. 16 of the LTSSA. They are shown at Table III-2.

3. Findings

Space debris and collision avoidance are two primary issues which have to be resolved initially by the international community. In order to achieve this goal notifications among the operators and information sharing have to be ensured at an early date. Despite slight differences between the recognition of space weather issues and the treatment of national security, the EUCoC and the LTSSA seem to point in the same direction to practically manage space traffic. These concerns already appeared on the "Report of Cosmic Study on Space Traffic Management"[49] ("STM Report") of 2006 which was drafted by the International Academy of Astronautics("IAA") study group. The STM was already accepted as an ideal concept when the STM Report was

46 EUCoC arts. 2, 3 & 4.4; LTSSA O.C. 13 & 15(b).

47 Article 4.2 provides that States commit to take appropriate measures to minimize the risk of collision. Article 4.3 provides that States confirm their intention to take all reasonable measures to minimize the risks of collision when maneuvering.

48 *Supra* note 10, O.C. 16(d).

49 International Astronautical Association, Cosmic Study on Space Traffic Management (2006), *available at* http://www.iaaweb.org/iaa/Studies/spacetraffic.pdf (last visited on Aug. 9, 2011).

Table III-2 : Comparison between the EUCoC and the LTSSA on Transparency and Confidence Building

EUCoC	LTSSA
Article 6.1	O.C. 16
States commit to notify, in a timely manner, to the greatest extent feasible and practicable, all potentially affected Subscribing States on the space activities, inter alia: - maneuvers which may result in dangerous proximity to other space objects; - pre-notification of launch; - destruction generating measurable debris; - high-risk re-entry (including possibility to cause radioactive contamination); - and malfunctioning with potential high risk re-entry or collision.	(b) Space debris (iii) Re-entry notifications regarding substantial space objects, in particular with regard to the re-entry of space objects with hazardous substances on board; (d) Space operations (ii) Pre-launch and pre-maneuver notifications;

Source: Compiled by the author

published.[50] Principles of the STM concept have been widely discussed among the international community as an implied manner through the EUCoC and the LTSSA.

B. Space Traffic Management

1. Recommendations of STM Report

The STM Report set an obvious goal for a safer space operation system in Section 4.2, by indicating the Outline of Comprehensive Space Traffic Management Regime.[51] It carefully outlines the principles incorporated in the existing space treaties. The Report presents a model for the future international regime of sustainable space activities up until the year 2020.

Part I of the model regime defines the necessary information for safe space operations. Part II proposes a combined notification system for more precise information than currently exists. Part I provides that "[establishing] a database and distribution mechanism for data (format of the database, access to data on request, collision warning

50 Kai-Uwe Schrogl et al., *The IAA Cosmic Study on space traffic management*, 22 SPACE POLICY (Nov. 2006); William H. Ailor, *Space Traffic Management: Implementations and Implications*, 58 ACTA ASTRONAUTICA 279-286 (2006); Hayder Cukurtepe, et al. *See also* Haydar Cukurtepe, *Towards Space Traffic Management System*, 65 ACTA ASTRONAUTICA (2009).

51 *Supra* note 49, at 91-92.

as a service)" is one of the three needs to secure the information. It then states "[establishing] an information services on space weather" is also needed.[52] As for the notification system, Part II attracts a great attention because of its similarities to the EUCoC.[53] The idea and the content of Part II are very similar to those of the Article 6.1 of the EUCoC. In Part III, the model regime defines a set of necessary rules for traffic management and Part IV proposes the preferable structure of an international organization for STM.[54]

2. Guiding Principles of STM toward Future Space Activities

From the above analysis, the following principles can be extracted:

1. The primary issues in order to maintain sustainable space activities are space debris, collision avoidance and space weather;
2. The measures to be taken in the early stage for securing three above-mentioned issues are to promote notification and information sharing system; and
3. A consultation mechanism among the countries conducting space activities is necessary.

These three principles which are commonly stated by the EUCoC and the LTSSA are recognized by the international community; they are the additional principles of the international regime of sustainable space activities. Furthermore, there are some other requirements raised in the STM Report which can be resolved in the rulemaking process of the international community including establishing: a comprehensive harmonized safety standard, including launch, in-orbit, reentry, human spaceflight, and space tourism;[55] zoning of the orbit and setting right of way; and prioritization rules for maneuvers.[56] The necessity to clarify the definitions of 'space object,' 'fault,' 'liability,' and 'launching State,' urges a harmonized framework of national licensing system as well as international dispute settlement procedures.[57] These efforts have already started among several actors such as "Trilateral Safety and Mission Assurance Conference" ("TRISMAC"), an agreement between the Japan Aerospace Exploration Agency ("JAXA"), the NASA and the European Space Agency ("ESA"),[58] which addresses

52 *Id.* at 91-92, sec. 4.2, 1.

53 *Id.* at 91-92, sec. 4.2, 2.

54 *Id.* at 91-92, sec. 4.2, 3 & 4.

55 *Id.* at 91, sec. 4.2, 1.

56 *Id.* at 91, sec. 4.2, 3.

57 *Id.* at 92, sec. 4.2, 3.

58 NASA Safety Center, *Experience and Challenges from Inplementing Safety and Mission Assurance in Project*, 2010 TRISMAC PAPER (Oct. 26-28, 2010), *avilable at* http://pbma.nasa.gov/trismac2010/index.php (last visited on Aug. 9, 2011).

safety standards, information exchange of national legislation as an agenda item of the COPUOS/LSC.[59] or consultation for arbitration procedure in air and space law.[60] The requirements raised in the STM Report would be virtual guiding principles for the rule-making process applied to the current space activities as well as the international regime for sustainable space activities in the near future.

IV. A Few Issues relating to the STM Guiding Principles

A. Is the STM Customary International Law?

As the international community recognizes the importance of maintaining the safe operation of space activities, the author would argue that space debris mitigation or sustainable space activities could be crystallized as a rule of customary international law. In order to be customary international law, the States conducting space activities should recognize the necessity to mitigate space debris; most of the spacefaring nations should establish their own space debris mitigation requirements.[61] The State practices of debris mitigation have accumulated to such an extent that these practices could be used as the evidence for international custom. It is getting more difficult, however, to recognize sustainable space activities because this concept is being explored in various manners in the early 21st century. There is no State yet which declares its sustainable space activity practices. No equivalent regulations or measures have so far appeared concerning sustainable space activities.

In addition, the other requirement for customary international law, *opinio juris*,[62] might be much more difficult to meet not only for the STM but also for space debris mitigation. The International Court of Justice, signifying a high threshold for meeting this requirement, adjudicated in the case concerning the Military and Paramilitary Activities in and against Nicaragua (Nicar. v. U.S.) that:

> Either the States taking such action or other States in a position to react to it must have behaved so that their conduct is "evidence of a belief that this practice is

59 COPUOS, Report of the Legal Subcommittee on its Forty-Ninth Sess., U.N. Doc. A/AC.105/942 (June 9-18, 2010), *available at* http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_942E.pdf (last visited on Aug. 9, 2011).

60 The International Bureau of the Permanent Court of Arbitration, Arbitration in Air, Space and Telecommunications Law: Enforcing Regulatory Measures (2002); D. H. Kim, *Proposal for Establishing an International Court of Air and Space Law*, German J. Air & Space L. 362-371 (2010).

61 Toshio Kosuge & Yu Takeuchi, *From Guideline to International Treaty for Rule of Law Concerning Mitigation of Space Debris*, 52ND Colloquium on the Law of Outer Space Proc. (2010).

62 Peter Malanczuk, Akehurst's Modern Introduction to International Law 44-5 (7th ed. 1997).

> rendered obligatory by the existence of a rule of law requiring it. The existence of a subjective element is implicit in the very notion of the *opinio juris sive necessitates*."[63]

With respect to space debris mitigation, States implement the UN Space Debris Mitigation Guidelines as their respective domestic requirements. At the same time, however, "states presented information on their national mechanisms governing space debris mitigation and the ways in which they were implementing the [IADC] Space Debris Mitigation Guidelines and the [UN] Space Debris Mitigation Guidelines"[64] at the COPUOS/LSC. This means that States at least consider their domestic requirements as national mechanisms 'governing' space debris mitigation to implement the IADC Space Debris Mitigation Guidelines and the UN Space Debris Mitigation Guidelines. Thus, it could be said that opinio *juris* exists for space debris mitigation.

For sustainable space activities, meanwhile, the highest obstacle must be the expression "legally non-binding." It means that the States are clearly expressing their rejection of *opinion juris*. The EUCoC was drafted as a Code of Conduct. It is generally the expression of political will, but not legally binding in itself. The LTSSA clearly states that: "Any recommended guidelines ... should be voluntary and not be legally binding."[65] It is inconsistent to argue, however, that the documents or recommendations shall be legally non-binding while simultaneously recognizing them as obligatory by the existence of a rule of law. It is thus appropriate to opine that States do not recognize these documents as obligatory.

In spite of several difficulties remaining in each case, space debris mitigation could be said to have some possibilities to be crystallized as customary international law in the future.

B. STM as State Liability?

Unless sustainable space activities are easily crystallized as customary international law, what would be the nature of this concept in the context of international law? In what sense can these principles be legally binding in the future? First, these activities currently represent a legal obligation to States. It is thus difficult to demonstrate State responsibility against the breach of these principles.[66] Inconsistent acts of States in

63 MALCOLM N. SHAW, INTERNATIONAL LAW 82 (5th ed., 2003). *See* Military and Paramilitary Activities (Nicar. v. U.S.), 1986 I.C.J. 108-109 (June 27).

64 U.N. Doc. A/AC.105/942, O.C. 132. (Apr. 16, 2010).

65 *Supra* note 10, O.C. 15(b).

66 This paper has no intention to discuss the liability issue in detail. For the liability question, *see* James P. Lampertius, *The Need for an Effective Liability Regime for Damage Caused by Debris in Outer Space*, 13 MICH. J.

regards to these principles, however, will be criticized. These criticisms may be due to transboundary damages. In other words, those criticisms[RIG3]are for potentially illegal activities.

This type of 'State liability'[67] often occurs especially in the area of environmental protection, as based on general international law. Shaw explained that: "No State has the right to use or permit the use of territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence."[68] Recently, international liability has been extended to increase the obligation of one State to prevent damage to other States conducting legal activities that lead to a hazardous outcome.[69] Eventually, the States are obliged to a 'reasonable' duty of care, because it is not realistic to require more of them.[70] In order to secure the damage coming from ultra-hazardous activities including space exploration or a nuclear power plant, another liability system with no-fault or strict liability of the conducting State would be necessary.[71] Pursuant to Article 2 of the Liability Convention, the State conducting ultra hazardous activities has only an obligation to maintain reasonable duty of care in the context of general international law. A problem may arise if the comprehension of 'reasonability' fully depends on the States and judicial opinions.[72]

One more question regarding the international regime of sustainable space activities is how to ensure the State practice. Damage to foreign territories can be mitigated by 'State liability,' but ensuring the obligations to maintain sustainable space activities remain as another issue.

As the international regime of sustainable space activities is under the operational phase, it would be another solution to set a consultation mechanism such as what the EUCoC proposes.[73] This mechanism is a legally non-binding measure, however, there is a possibility of becoming a *de facto* dispute settlement process.

INT'L L. 447-468 (1992); Carl Q. Christol, *International Liability for Damage Caused by Space Objects*, 74 AM. J. INT'L L. 346-371(1980).

67 The International Law Commission, Discussions on International Liability for Injurious Consequences Arising out of Acts not Prohibited by International Law from 1974 to 1997, *available at* http://untreaty.un.org/ilc/texts/9.htm (last visited on Aug. 9, 2011). For the final report, *see* G.A. Res. 62/68, U.N. Doc. A/62/452 (Nov. 21, 2007).

68 *Supra* note 64, at 761. *See also* J.E. Read, *The Trail Smelter Arbitration*, 1 CAN. Y.B. INT'L L. 213 (1963).

69 Kimio Yakushiji, *Ekkyo-songai to Kokka-no Kokusai-tekihou-koui-sekinin* 越境損害と国家の国際適法行為責任 (Transboundary Harm and State Liability for International 'Lawful Act'), 93 J. INT'L L. & DIPL. (際法外交雑誌) 363-417 (1994).

70 *Supra* note 68, arts 3, 6, 9 and 10.

71 Liability Convention art. 2.

72 *Supra* note 70. *See also* J.WILLISCH, STATE RESPONSIBILITY FOR TECHNOLOGICAL DAMAGE IN INTERNATIONAL LAW 281 (1987).

73 EUCoC art. 9.

V. Conclusion

This paper has attempted to develop a Space Traffic Management system as a guiding principle for preventing conflicts among space activities in the international community. The author has examined the current international legal regime governing space activities, comparing it to the international regime of sustainable development. He has also analyzed norms and principles applied in the EUCoC and the LTSSA and compared those principles to the STM.

The international regime of sustainable space activities is in the operational phase. It is currently introducing three additional principles to the regime. The regime is actively maintaining and deepening the seven basic principles by accumulating State practices and providing a stable forum for the discussion. This paper has also defined the concept of the STM, which provides a set of guiding principles for further development of the international regime of sustainable space activities. Though the EUCoC and the LTSSA have already contained these guiding principles, the following should be necessary to improve safe space operations: (1) space debris, collision avoidance and space weather must be the primary considerations; (2) notification and information sharing systems must be promoted as a requirement; and (3) recognizing the necessity of a consultation mechanism among the countries conducting space activities.

Finally, one should recognize the law as a tool for securing international issues - no more and no less. We should recognize that our needs are a necessary predicate to establishing the laws designed to protect those needs. Hard law, soft law, customary law or even quasi-law has its own advantages and disadvantages. There are various types of law guiding us to an effective international regime. Considering that the international regime of sustainable space activities is currently in the operational phase, gradual introduction of the new principles into the regime through legally non-binding documents will be much more effective. As a consequence, this gradual introduction would contribute to progressive development of international law.