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Forwarding Multilateral Space Governance: Next Steps for the International Community

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Abstract

Over the past decade, concerns about ensuring sustainability and security in outer space have led the international community to pursue a range of governance initiatives. Governance issues regarding the use of space are complicated because of the physical realities of the space environment and because of the legal status of space as a global resource. As the number of space users grows and the types of activities in space expand, competition for access to space will only continue to grow. Different space actors have different priorities and perceptions regarding space challenges. As more and more militaries around the world turn to space assets, the potential development of counterspace weapons also increases tensions.

Ongoing multilateral work on space governance has concentrated primarily on voluntary measures. There have been three major multilateral governance initiatives in the field. The three—the EU Code of Conduct, the COPUOS Working Group on the Long-term Sustainability of Outer Space Activities, and the UN Group of Governmental Experts (GGE) on transparency and confidence-building measures—were related to each other, but each aimed to address slightly different aspects of the governance problem. This paper reviews these initiatives and elucidates ways to forward their progress, for instance, by fully implementing the GGE recommendations, the establishment of national focal points for data exchange, and by fully implementing the UN Registry of Outer Space Objects. It also looks to identify additional steps beyond current activities at the multilateral level for establishing a foundational space governance framework, including institutionalizing the UN Space Debris Mitigation Guidelines; establishing a public space situational awareness database; and examining ways to move forward discussion on active debris removal, national legal obligations regarding military activities, and space traffic management.

Introduction

Over the past decade, concerns about ensuring sustainability and security in outer space have led the international community to pursue initiatives to improve the governance of outer space activities. This reflects the increasing importance of satellites and space services to everyday life on Earth. At a global level, banking, communications, transportation, and the Internet are all underpinned by access to space, as is weather prediction, natural disaster mitigation, and sustainable farming. Militaries around the world are also increasingly reliant on space operations. There are now nearly 1,900 active spacecraft on orbit, and more than 80 states and commercial/civil entities own and/or operate satellites.[1] Barriers to entry have fallen so that even non-governmental organizations (NGOs) and universities can operate satellites. Unfortunately, increasing activity in space has engendered increasing congestion of the space environment and increasing competition for access.

Governance issues regarding the use of space are complicated because of the physical realities of the space environment and because of the legal status of space as a global resource. As private sector space operators eclipse government operators in both number and in economic importance, governments are struggling to find regulatory solutions that balance between the need for space innovation and the need to ensure a sustainable and secure space environment.

In particular, as the number of space users grows and the types of activities in space expand, competition is growing for access to the most productive orbital bands in near-Earth orbit and to the most useful parts of the radio-frequency spectrum for satellite operations. Different space actors have different priorities and different perceptions regarding even known problems such as space debris, for example, with some newer space powers reluctant to take mitigation actions that increase the costs of space operations. Deliberate interference with satellite broadcasts for political purposes also has been on the rise, despite the fact interference is prohibited by the Outer Space Treaty (OST) of 1967 and the treaty-based regulations of the International Telecommunication Union (ITU), which governs access to spectrum—both of which have broad adherence by States.[2]

Countries also confront questions regarding the extent to which military operations in space, including the use of force, can be justified. Disparities in capabilities, particularly with regard to the ability to track and identify space objects (so-called space situational awareness), have also raised suspicions about the intentions of military space actors.

As more and more militaries around the world turn to space assets to improve military and national security operations, the potential development of counterspace weapons, including debris-creating anti-satellite systems, also increases tensions. Given the somewhat opaque nature of national security space operations, one of the critical foundations for better multilateral

[1] "UCS Satellite Data Base," Union of Concerned Scientists, http://www.ucsusa.org/nuclear_weapons_and_global_security/solutions/space-weapons/ucs-satellite-database.html#.VbqNxZNViko

[2] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html

governance will be improved transparency—a fact widely recognized by the international community.

Ongoing multilateral work on space governance has concentrated primarily on voluntary measures, reflecting the widespread recognition that obtaining a legally binding treaty for space security is unachievable at present. While the Russian Federation and the People's Republic of China long have been advocating a treaty approach to prevent an arms race in outer space and ban the placement of weapons in space, the United States, in particular, has been loathe to move forward on legally binding measures that might restrict its space activities—with particular concerns about spill over to missile defense. Indeed, there is an argument to be made that multilateral voluntary approaches, such as codes of behavior and transparency and confidence building measures, are a useful first step toward any legal resolutions. There have been three major multilateral initiatives in the field, related to each other but each aimed at a slightly different aspect of the governance problem.

In 2008, the European Union (now comprising 28 members) released a draft code of conduct for outer space activities. The draft code, designed as a voluntary but politically binding instrument, was primarily a norm-setting exercise that looked to distinguish between responsible and irresponsible behavior in space. The code thus straddled the (somewhat blurry) line between space security issues and space safety/sustainability, addressing both norms for behavior in peacetime and times of conflict. The EU revised draft is dated March 31, 2014,[3] and, after three rounds of international discussions, it was put forward for negotiations and signature at a July 2015 meeting in New York.[4] However, the effort was derailed by objections from the so-called BRICS countries (Brazil, Russia, India, China, and South Africa), joined by the members of the Non-Aligned Movement (NAM) in the developing world. These countries insisted that any negotiations regarding outer space should be held by the United Nations. Much of the objections stemmed from the heavy-handed EU approach to diplomacy, which early in the drafting process cut out non-EU members. Substantive objections were much less clear, although a primary concern was that the EU code would have been voluntary and many of the BRICS and NAM nations long have preferred legally binding instruments.[5] Russia further argued that the EU "ad hoc" process was undercutting the efforts of the United Nations to address many of the same issues.

In 2010, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) established the Working Group on the Long-term Sustainability of Outer Space Activities (LTS) under the COPUOS Scientific and Technical Subcommittee (STSC) to develop a set of voluntary "best-practices" for space activities.[6] (It should be noted that the COPUOS, which now

[3] "Draft International Code of Conduct for Outer Space Activities," (here after European Draft Code) European Union External Action Service, http://www.eeas.europa.eu/non-proliferation-and-disarmament/pdf/space_code_conduct_draft_vers_31-march-2014_en.pdf

[4] "European Union convened Multilateral Negotiations on an International Code of Conduct for Outer Space Activities," United Nations Secretariat, 27-31 July 2015, https://papersmart.unmeetings.org/secretariat/codeofconductforouterspace/documents/

[5] Paul Meyer, "Star-crossed: An international code of conduct for outer space," OpenCanada.org, Aug. 31, 2015, https://www.opencanada.org/features/star-crossed-an-international-code-of-conduct-for-outer-space/

[6] "Terms of reference and the methods of work of the Working Group on the Long-Term Sustainability of Outer Space Activities of the Scientific and Technical Subcommittee, Working Paper submitted by the Chair," Committee on the Peaceful Uses of Outer Space, February 28, 2011, A/AC.105/C.1/L.307/Rev.1, http://www.unoosa.org/pdf/limited/c1/AC105_C1_L307Rev01E.pdf

comprises 92 Member States, also includes non-governmental organizations and private industry as observers.) While the long-term sustainability exercise was not officially aimed at dealing with space security or military uses of space, the guidelines, if followed by states, would by their nature have an effect on the conduct of national security space activities. However, after eight years of work and agreement on 21 draft guidelines, the negotiations fell apart in June 2018 due to objections from Russia. In particular, Moscow objected to the fact that some seven of their proposals were not accepted by the group. This included a proposed draft guideline to define "self defense" in space, despite the fact that Moscow had been warned that the issue was considered a non-starter, partially because COPUOS does not deal with military space issues.[7]

Finally, in 2011, the General Assembly's First Committee (which is the UN body responsible for international security affairs) called upon the Secretary-General to establish a Group of Governmental Experts (GGE) on transparency and confidence-building measures (TCBMs) in space. The 15-member GGE began deliberations in 2012 and issued a report in July 2013, which was adopted by the General Assembly at its 68th session.[8] The work of the GGE is most directly related to space security, seeking to create mutual understanding and build trust among nations in order to reduce risks of misperceptions, miscalculations, and conflict. The report lays out basic TCBMs that could be undertaken by states unilaterally, bilaterally, or multilaterally. The GGE report is important, since it is the first UN agreement in many years directly to focus on improving space security. The question remains how, or even if, this agreement will be taken up UN Member States.

This paper reviews these initiatives and elucidates ways to forward their progress. For example, governments could unilaterally begin implementing the recommendations of the GGE, including the creation of focal points to serve as points of contact and policy coordinators. They could also move to incorporate those best-practice guidelines agreed by COPUOS into their own national regulations governing space operations. Further, as recommended by all three initiatives, countries could move to improve their compliance with the 1975 Convention on the Registration of Objects in Outer Space.[9] Similarly, states could be more aggressive in requiring national space operators to comply with the UN Space Debris Mitigation Guidelines.

This paper also looks to identify additional steps beyond current activities at the multilateral level for establishing a foundational space governance framework. One idea that is being discussed widely among experts and industry is the possibility of an international effort to support technologies designed to remove debris from orbit (active debris removal). A nongovernmental organization or organizations could also develop a publicly available and

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[7] "Achievement of a uniform interpretation of the right of self-defence in conformity with the United Nations Charter as applied to outer space as a factor in maintaining outer space a safe and conflict-free environment and promoting the long-term sustainability of outer space activities: Working paper submitted by the Russian Federation," Committee on the Peaceful Uses of Outer Space, Scientific and Technical Subcommittee, Fifty-second session, February 2, 2015, A/AC.105/C.1/2015/CRP.22, http://www.unoosa.org/pdf/limited/c1/AC105_C1_2015_CRP22ER.pdf

[8] "Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer-Space Activities," United Nations General Assembly, Sixty-eighth session, A/68/189*, July 29, 2013, (hereafter, GGE Report) http://www.unidir.org/files/medias/pdfs/outer-space-2013-doc-2-a-68-189-eng-0-580.pdf

[9] "Convention on Registration of Objects Launched into Outer Space," United Nations Office of Outer Space Affairs, http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introregistration-convention.html

easily accessible space-object database to improve space situational awareness (SSA). Governments could move to support the ongoing efforts by non-government legal experts from around the world to establish a baseline understanding of acceptable and unacceptable military practices. The overall goal for initiatives like these would be to help illuminate a pathway forward on space governance that capitalizes on previous gains and builds momentum in what is arguably a deteriorating geopolitical context. In the near- to medium-term, space-faring states could also take unilateral steps to shore up multilateral approaches. Space actors should actively look to consolidate gains already made toward defining a space governance framework, as limited as it may be, so that they are not lost to increasing tensions among them.

EU Code of Conduct

The UN First Committee in 2009 endorsed the effort by the European Union to draft a "Code of Conduct on Outer Space Activities"—which was adopted by the EU Council of Ministers in 2008. The proposed code, which was presented to the Conference on Disarmament in 2009 and which was revised several times after, was aimed at reinforcing and expanding norms of behavior that define acceptable and unacceptable actions in space. Rather than a legally binding treaty, the EU shaped the proposed code as a politically binding set of commitments. Key principles enshrined in the proposed code include:

- The freedom of all states "to access, to explore and to use outer space for peaceful purposes, without harmful interference, fully respecting the security, safety and integrity of space objects, and consistent with internationally accepted practices, operating procedures, technical standards and policies associated with the long term sustainability of outer space activities …"[10]

- "The responsibility of states to refrain from the threat or use of force against the territorial integrity or political independence of any state, or in any manner inconsistent with the purposes of the Charter of the United Nations, and the inherent right of states to individual or collective self-defense as recognized in the Charter of the United Nations."[11]

- "The responsibility of states, in the conduct of scientific, civil, commercial and military activities to promote the peaceful exploration and use of outer space for the benefit, and in the interest, of humankind and to take all appropriate measures to prevent outer space from becoming an arena of conflict."[12]

In particular, the draft code would pledge signatories to:

> "Refrain from any action which brings about, directly or indirectly, damage, or destruction, of space objects unless such action is justified:

[10] European Draft Code, http://www.eeas.europa.eu/non-proliferation-and-disarmament/pdf/space_code_conduct_draft_vers_31-march-2014_en.pdf
[11] Ibid
[12] Ibid.

- by imperative safety considerations, in particular if human life or health is at risk; or
- in order to reduce the creation of space debris; or
- by the Charter of the United Nations, including the inherent right of individual or collective self-defense.

And where such exceptional action is necessary, that it be undertaken in a manner so as to minimize, to the greatest extent practicable, the creation of space debris."[13]

While this does not clearly stake out a prohibition against the testing and use of debris-creating antisatellite weapons (ASATs), it does represent a call for restraint.

The draft code would also commit states to a number of notification measures, including when scheduled maneuvers might result in "dangerous proximity to space objects," as well as to adhere to the existing legal framework governing space. Currently, there is no legal or regulatory requirement for States to report on maneuvers.

In order to dampen complaints from non-EU governments that the development of the draft code had not been inclusive, the EU held three rounds of multilateral open-ended consultations in Kiev (May 2013), Bangkok (November 2013), and Luxembourg (May 2014). Overall, 95 UN Member States participated in the consultation process, and 61 countries were present in each round of consultations. In addition, the United Nations Institute for Disarmament Research (UNIDIR) organized, on behalf of the EU, regional seminars in Malaysia, Ethiopia, Mexico, and Kazakhstan and helped with the preparation of the open-ended consultations.[14]

Those consultations, however, failed to convince a number of states—most importantly Brazil, Russia, India, China, and South Africa—of the worthiness of the proposed code. Part of the problem was strictly political, in that these countries felt that they were not properly consulted in the code's drafting. Russia took the position that support for the proposed code would undermine the ongoing COPUOS efforts—reflecting a general discomfort among some states about negotiating an international agreement outside of the UN structure. Russia noted that many precepts in the draft code fall within COPUOS's purview and should be a part of the latter's ongoing discussions. China also expressed concerns that acceptance of a code of conduct would have undermined the goal of achieving a legally binding treaty to prevent an arms race in outer space, a text of which China and Russia first proposed to the Conference on Disarmament in 2008.[15] In addition, many African and Latin American countries objected to the draft's references to a right to self-defense and worry that the code's precepts would restrict their future space activities. On the other hand, the United States, Australia, Canada, and Japan were supportive of the draft code and opposed Russia's suggestions that the code be wound into the COPOUS effort.

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[13] Ibid.
[14] "Facilitating the Process for Development of an International Code of Conduct for Outer Space Activities," United Nations Institute for Disarmament Research, http://www.unidir.org/programmes/emerging-security-threats/facilitating-the-process-for-the-development-of-an-international-code-of-conduct-for-outer-space-activities
[15] "Draft Text On The Placement Of Weapons in Outer Space, Submitted by Russia and China," Acronym Institute, http://www.acronym.org.uk/official-and-govt-documents/draft-text-placement-weapons-in-outer-space-submitted-russia-and-china

Despite the obvious storm clouds around the text that emerged from the international discussions, the EU decided to open the draft code for international negotiations in July 2015, under the chairmanship of Australia (as a non-EU, but supportive, state). As predicted by many observers and participants in the lead-up talks, the BRICS nations—and the developing nations of the Non-Aligned Movement—were not prepared to sign on. Instead, the meeting was torpedoed by those objecting to its status outside of the United Nations.[16] It is debatable as to whether the lack of participation by the BRICS, all of whom are substantial space actors, would have rendered the code politically inert if those supporting it decided to go forward with it anyway. There is precedent (such as the Ottawa Treaty on landmines and the Hague Code of Conduct on ballistic missiles) for multilateral agreements by like-minded states to set norms that eventually are accepted by others, whether formally or informally. However, that did not happen. Despite some political back-and-forth about trying a different tactic, the draft code was quietly left to die.

COPUOS LTS Working Group

The COPUOS LTS Working Group was in some ways an outgrowth of the EU code initiative, in that it sought to improve space transparency and establish principles of safe operations in space—thereby reducing risks. There are 87 Member States in the Vienna-based COPUOS, and a large number of non-governmental and intergovernmental organizations are observers. However, COPUOS's mandate does not include military space activities, which has meant that discussions of space weapons traditionally have been ceded to the Conference on Disarmament in Geneva. COPUOS activities are divided between two subcommittees, the Legal Subcommittee and the Scientific and Technical Subcommittee. While no new space treaties have emerged from the Legal Subcommittee since the mid-1980s, COPUOS has made progress in addressing space safety and security within the Scientific and Technical Subcommittee.

In 2007, for example, COPUOS adopted a set of voluntary guidelines for space debris mitigation based on technical guidelines developed by the Inter-Agency Debris Coordinating Committee (IADC) and subsequently endorsed by the General Assembly in January 2008.[17] The accord is a significant achievement for space safety and also helps to underpin space security, especially regarding Guideline 4, which pledges nations to avoid the intentional break-up of space objects and the creation of long-lived debris. While a good number of nations have moved or are moving to incorporate the guidelines into their regulatory systems, problems remain with implementation. Nonetheless, the COPOUS work sets a norm that is increasingly being followed.

Building on the success of the debris mitigation effort, COPUOS in February 2010 initiated a new working group under the Scientific and Technical Subcommittee on the "long-term sustainability of outer space."

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[16] Michael Krepon, "Space Code of Conduct Mugged in New York," *ArmsControlWonk,* Aug. 4, 2015, https://www.armscontrolwonk.com/archive/404712/space-code-of-conduct-mugged-in-new-york/

[17] "Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space," United Nations Office of Outer Space Affairs, found at http://orbitaldebris.jsc.nasa.gov/library/Space%20Debris%20Mitigation%20Guidelines_COPUOS.pdf

The group was empowered to:

> "[E]xamine the long-term sustainability of outer space activities in all its aspects, consistent with the peaceful uses of outer space, and avail itself of the progress made within existing entities, including but not limited to the other working groups of the Subcommittee, the Conference on Disarmament, the International Telecommunication Union, the Inter-Agency Space Debris Coordination Committee, the International Organization for Standardization, the World Meteorological Organization and the International Space Environment Service."[18]

The subcommittee agreed that the working group should avoid duplicating the work being done within those bodies and instead identify areas of concern for the long-term sustainability of outer space activities that are not covered by them. [The subcommittee also agreed that the working group should consider organizing an exchange of information with the commercial space industry to understand the views of that community.]

The working group considered new measures to enhance the sustainability of space activities and a possible set of "best practice guidelines."[19] The guidelines, for example, elaborate on the UN Space Debris Mitigation Guidelines; would create new notification schemes for on-orbit activities; and improve space situational awareness data sharing. Some of these eventual guidelines in effect fall under the rubric of "space traffic management"—i.e., processes, procedures, and new regulations for how spacecraft are launched, operated, and disposed of at the end of their working lifetimes.

According to the group's terms of reference (established by General Assembly Resolution A/AC.105/C.1/L.307/Rev.1, published Feb. 28, 2011), the objective of the working group was the production of "a set of guidelines that could be applied on a voluntary basis by international organizations, non-governmental entities, individual States and States acting jointly to reduce collectively the risk to space activities for all space actors and to ensure that all countries are able to have equitable access to the limited natural resources of outer space."[20]

The working group's deliberations were divided among four expert groups:

A — Sustainable space utilization supporting sustainable development on Earth
B — Space debris, space operations, and tools to support space situational awareness sharing
C — Space weather
D — Regulatory regimes and guidance for new actors in the space arena

The scope section noted that topics to be studied included several items that overlap or expand upon the UN GGE's recommendations:

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[18] "Report of the Scientific and Technical Subcommittee on its forty-seventh session, held in Vienna 8-19 February 2010," Committee on the Peaceful Uses of Outer Space, fifty-third session, March 11, 2010, A/AC.105/958, http://www.unoosa.org/pdf/reports/ac105/AC105_958E.pdf
[19] Ibid.
[20] "Terms of reference and the methods of work of the Working Group on the Long-Term Sustainability of Outer Space Activities of the Scientific and Technical Subcommittee, Working Paper submitted by the Chair," Committee on the Peaceful Uses of Outer Space, February 28, 2011, A/AC.105/C.1/L.307/Rev.1, http://www.unoosa.org/pdf/limited/c1/AC105_C1_L307Rev01E.pdf

1. Collection, sharing, and dissemination of data on functional and non-functional space objects, and the creation of contact points responsible for timely communications;

2. re-entry notifications regarding substantial space objects, and also on the re-entry of space objects with hazardous substances on board;

3. capabilities to provide a comprehensive and sustainable network of key data in order to observe and measure space weather phenomena adequately in real or near-real time;

4. pre-launch and maneuver notifications; and

5. adherence to existing treaties and principles on the peaceful uses of outer space, including the Registration Convention and consideration of supplying enhanced information to the registry.[21]

The working group's work plan initially stretched from 2011 through 2014, only to be extended twice more through June 2018.

All four of the expert groups submitted their reports to the STSC at its 51st session on February 10-21, 2014.[22] In total, the expert groups recommended 31 guidelines.[23] At the STSC's 52nd session, held February 2-13, 2015, a draft working group report was submitted by the chair based on the expert group findings, which also looked at issues for possible future consideration.[24] The working group's deliberations were complicated at the 2015 meeting when proposals for either new guidelines or amendments were made by Belgium, Brazil, Germany, Iran, Russia, and the United States. Indeed, the host of proposals from the Russian Federation—including several that were controversial—and a less than productive attitude on the part of Moscow meant that a 2016 wrap up was impossible. The key disagreements centered on the status of the proposed EU Code of Conduct versus the COPUOS LTS guidelines; although, in reality, most of the problems were essentially political and not about the actual substance of the guidelines.

In June 2016, after a year of contentious debate, COPUOS at its 59th session endorsed 12 guidelines agreed by the LTS Working Group[25] and agreed to continue the mandate of the LTS

[21] Ibid.
[22] See: Expert Group A, http://www.unoosa.org/pdf/limited/c1/AC105_C1_2014_CRP13E.pdf; Expert Group B, http://www.unoosa.org/pdf/limited/l/AC105_2014_CRP14E.pdf; Expert Group C, http://www.unoosa.org/pdf/limited/c1/AC105_C1_2014_CRP15E.pdf; Expert Group D, http://www.unoosa.org/pdf/limited/c1/AC105_C1_2014_CRP16E.pdf
[23] "Compilation of proposed draft guidelines of expert groups A to D on the Long-Term Sustainability of Outer Space Activities, as at the fiftieth session of the Scientific and Technical Subcommittee, held in February 2013," Committee on the Peaceful Uses of Outers Space, Fifty-sixth session, March 26, 2013, A/AC.105/1041, http://www.unoosa.org/pdf/reports/ac105/AC105_1041E.pdf
[24] "Draft Report of the Working Group on the Long-Term Sustainability of Outer Space Activities: Working paper by the Chair of the Working Group," Committee on the Peaceful Uses of Outer Space Scientific and Technical Subcommittee, Fifty-second session, December 10, 2014, A/AC.105/C.1/343, http://www.unoosa.org/pdf/limited/c1/AC105_C1_L343E.pdf
[25] "Guidelines for the Long-Term Sustainability of Outer Space Activities: Conference Room Paper by the Chair of the Working Group on the Long-Term Sustainability of Outer Space Activities," A/AC.105/2016/CRP.17, 16 June 2016, Committee on the Peaceful Uses of Outer Space, Fifty-ninth session, Vienna, 8-17 June 2016,

Working Group until June 2018 to finalize a fully agreed set. In February 2018, the COPUOS Scientific and Technical Subcommittee at its 55th session approved a second set of nine guidelines agreed by the LTS Working Group.[26] The 21 guidelines in total specifically include, according to an April 4, 2018, article in *Breaking Defense*:

- enhancing the registration of space objects;
- sharing contact information and space situational awareness data on space objects and events;
- performing conjunction assessment during launch and on-orbit operations to find potential collisions;
- designing satellites to increase their trackability;
- addressing the risks of uncontrolled atmospheric re-entries;
- strengthening national regulatory and oversight frameworks to implement international treaties;
- sharing space weather data and forecasts; and,
- promoting awareness of space sustainability.[27]

Unfortunately, the LTS Working Group was unable to agree to a consensus document for the 61st session of COPUOS, which met in Vienna on June 20-29, 2018.[28] The impasse was caused by the objection of Russia, backed by Iran; COPUOS decisions require consensus.

Russia's veto was based on insistence that the LTS group accept, in their entirety, the seven proposed guidelines submitted by Russia in 2017. Delegates had been hopeful that Russia would be willing to allow the 21 agreed guidelines to go forward if work would be continued on the remaining proposals within a different COPUOS mechanism. Indeed, the Working Group Chair, Peter Martinez of South Africa, had drafted a report that recommended further work on these seven proposals in a subsequent forum under the COPUOS Scientific and Technical Subcommittee (STS).[29]

In line with the Chairman's efforts, Switzerland at the June 2018 meeting proposed the creation of a new working group on Safety and Transparency in Space Activities that would have a mandate to consider the remaining Russian guideline proposals as well as other issues raised in

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http://www.unoosa.org/res/oosadoc/data/documents/2016/aac_1052016crp/aac_1052016crp_17_0_html/AC105_2016_CRP17E.pdf

[26] "Working Group on the Long-Term Sustainability of Outer Space Activities: Conference Room Paper by the Chair of the Working Group on the Long-Term Sustainability of Outer Space Activities," A/AC.105/C.1/2018/CRP.18/Rev.1, 8 February 2018, Conference on the Peaceful Uses of Outer Space Scientific and Technical Subcommittee, Fifty-fifth session, Vienna, 29 January – 9 February 2018, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_105c_12018crp/aac_105c_12018crp_18rev_1_0_html/AC105_C1_2018_CRP18Rev01E.pdf

[27] Brian Weeden and Victoria Samson, "New UN Guidelines For Space Sustainability Are A Big Deal," *Breaking Defense*, 4 April 2018, https://breakingdefense.com/2018/04/new-un-guidelines-for-space-sustainability-are-a-big-deal/

[28] "Draft Report, Chapter III," Committee on the Peaceful Uses of Outer Space, Sixty-first session, Vienna, 20-29 June 2018, A/AC.105/L.134/Add.7, 28 June 2018, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_105l/aac_105l_314add_7_0_html/AC105_L314Add07E.pdf

[29] "Report of the Working Group on the Long-term Sustainability of Outer Space Activities: Working paper by the Chair of the Working Group," Committee on the Peaceful Uses of Outer Space, June 27, 2018, A/AC.105/2018/CRP.22, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_22_0_html/AC105_2018_CRP22E.pdf

the LTS Working Group as ripe for future consideration such as active debris removal.[30] Russia rejected the proposal after the other working group members refused to commit such a new working group to acceptance of the seven remaining draft LTS guidelines. According to participants at the meeting, Canada's efforts to find compromise language on at least two of the Russian proposals were similarly rebuffed.

In the wake of the Russian veto of a LTS Working Group consensus report, the COPUOS Draft Report urged states and international government organizations to nonetheless "consider implementing guidelines for the long-term sustainability of outer space activities on a voluntary basis, and to share their experiences with implementation under the Subcommittee's agenda item on the long-term sustainability of outer space activities." Further, Australia, Canada, France, Germany, Israel, Italy, Japan, Netherlands, New Zealand, the United Kingdom, and the United States put forward a proposal that the compendium of agreed guidelines crafted by the LTS Chair be adopted by COPUOS and put forward to the UN General Assembly despite the lack of consensus on a formal COPUOS document.[31] This proposal was not accepted by COPUOS, and it is expected that the sponsoring states will offer such a resolution at the next General Assembly meeting in September 2018, where consensus is not required.

GGE

The work of the GGE, unlike that of the EU and COPUOS, was focused on issues of space security and took place under the auspices of the UN First Committee, which deals with disarmament and global challenges to peace and security. The First Committee also oversees the work of the Geneva-based Conference on Disarmament.

TCBMs have long been a part of multilateral statecraft, enshrined in United Nations resolutions as potentially useful for improving mutual understanding, reducing misunderstandings and tensions, and promoting a more favorable climate for arms control and nonproliferation. In the case of space, TCBMs can be seen as a foundation stone to future multilateral approaches to governance of space as a global resource.

The GGE on Space Activities met in three sessions: July 23-27, 2012, in New York; April 1-5, 2013, in Geneva; and July 8-12, 2013, in New York. The GGE was chaired by Russia and comprised representatives of 15 UN Member States.[32] Despite the GGE's inclusivity, some major space players were not involved, such as India. GGE representation is decided by the UN

[30] "Non-Paper by Switzerland: Proposal for the establishment of a new working group on Safety and Transparency of Space Activities," LTSSA informal meeting, 26 June 2018, http://www.unoosa.org/documents/pdf/copuos/stsc/LTS/Switzerland_Non-paper_COPUOS61_20180626.pdf

[31] Long-term sustainability of outer space activities: Proposal to adopt and refer to the General Assembly for endorsement the Compendium of Guidelines for the Long-term Sustainability of Outer Space Activities," Committee on the Peaceful Uses of Outer Space, June 29, 2018, A/AC.105/2018/CRP.26/Rev.2, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_26rev_2_0_html/AC105_2018_CRP22Rev02E.pdf

[32] GGE Members were: Brazil, Chile, China, France, Italy, Kazakhstan, Nigeria, Republic of Korea, Romania, Russian Federation, South Africa, Sri Lanka, Ukraine, United Kingdom of Great Britain and Northern Ireland, and United States of America. The GGE was chaired by Victor L. Vasiliev of the Russian Federation.

Secretary-General based on geographic considerations and representation in other ongoing GGEs (although the five permanent members of the Security Council always have a seat). GGEs work by consensus, and the group's consensus final report was transmitted by the Secretary-General to the First Committee in October 2013.

The GGE focused on TCBMs that "could be adopted voluntarily by states on a unilateral, bilateral, regional or multilateral basis." The group laid out its recommendations in five broad categories: enhancing the transparency of outer space activities; international cooperation; consultative measures; outreach; and coordination.

Recommended transparency measures included information exchanges on: space policies; military space spending and national security space activities; orbital parameters of satellites and conjunction potentials; and forecasts of natural hazards.

Specifically, the report called for "Exchanges of Information on the orbital elements of space objects and the provision, to the extent practicable, of notifications of potential orbital conjunctions involving spacecraft to affected government and private sector spacecraft operators."[33] Currently, only the United States (through its Space-Track program) routinely shares notifications of potential collisions with other governments and the private sector. Russia, China, France, and a number of other European countries have space-tracking capabilities but do not routinely share that information. In addition, the European Union has for a number of years been seeking to establish a European space surveillance capability.

The GGE noted the need for improved compliance with current agreements. Compliance with the Registration Convention has been uneven. There is a lack of standardization regarding what data is actually registered; confusion over the term "launching state," and administrative issues. According to Dr. Jonathan McDowell, an astrophysicist at the Harvard-Smithsonian Center for Astrophysics, about 95% of the satellites launched between 1957 and 2013 were registered (although sometimes with faulty data sets), and about 21% of satellites launched between 2013 and 2015. The states with the most unregistered satellites launched prior to end-December 2013 were the United States, the People's Republic of China, Israel, and Saudi Arabia.[34]

Thus, the GGE report calls for improved compliance with the 1976 Convention on Registration of Objects Launched into Outer Space. Fifty-six UN Member States have ratified the Convention and another four have signed it. The Convention provides that "launching States should furnish to the United Nations, as soon as practicable, the following information concerning each space object:

- Name of launching State;
- An appropriate designator of the space object or its registration number;
- Date and territory or location of launch;
- Basic orbital parameters, including:

[33] GGE Report, paragraph 39(a), http://www.unidir.org/files/medias/pdfs/outer-space-2013-doc-2-a-68-189-eng-0-580.pdf
[34] "Adherence to the 1976 Convention on Registration of Objects Launched into Outer Space," Jonathan McDowell, *Jonathan's Space Page*, http://planet4589.org/space/un/un_paper1.html

    - Nodal period (the time between two successive northbound crossings of the equator - usually in minutes);
    - Inclination (inclination of the orbit - polar orbit is 90 degrees and equatorial orbit is 0 degrees);
    - Apogee (highest altitude above the Earths surface - in kilometers);
    - Perigee; (lowest altitude above the Earths surface - in kilometers);
- General function of the space object."[35]

Several types of notifications by states regarding space activities also are recommended, including notification of planned launches; scheduled maneuvers that might result in risk to other space objects; uncontrolled "high risk" re-entries; emergency situations, and orbital breakups. Finally, in pursuit of transparency, the report recommends that states make opportunities for site visits and technology demonstrations.

The recommendation on notification of maneuvers is especially important, as one of the lacunae in the Registration Convention is that maneuvers are not required to be registered. The recommendation reads: "States should notify, in a timely manner and to the greatest extent practicable, potentially affected States of scheduled maneuvers that may result in risk to the flight safety of the space objects of other States."[36]

Regarding international cooperation, the GGE report notes, "the disparity in the space capabilities of States, the inability of most States to participate in space activities without the assistance of others, uncertainty concerning sufficient transfer of space technologies between States and the inability of many States to acquire significant space-based information are factors contributing to a lack of confidence." The report thus notes technical and capacity building cooperation should be undertaken and endorses "an open satellite data collection and dissemination policy for sustainable economic and social development."

Timely and routine consultations through bilateral and multilateral government-to-government exchanges further are endorsed, as well as outreach to international organizations and NGOs. Coordination among states and multilateral organizations also is encouraged, including the development of national focal points (serving as both points of contact and as policy coordinators within their respective governments) and stronger coordination among UN entities. Regarding focal points, the GGE report recommends that this practice should be put into place not only by states but also by international organizations and private sector actors.

Specifically, the GGE report recommended a joint meeting of the UN First Committee and the Fourth Committee (which deals with scientific issues and the Vienna-based COPUOS) on challenges to space security and sustainability—a meeting that was held in 2015, to little substantive outcome. Indeed, since the report was issued, few states have taken actions to implement its recommendations, and no direct follow-up GGE on TCMBs was agreed.

[35] "Registration of Objects Launched into Outer Space," United Nations Office of Outer Space Affairs, http://www.unoosa.org/oosa/SORegister/regist.html
[36] GGE Report, paragraph 42, http://www.unidir.org/files/medias/pdfs/outer-space-2013-doc-2-a-68-189-eng-0-580.pdf

Moving forward

The establishment of the EU, GGE, and COPUOS initiatives underscores the consensus that multilateral solutions are necessary to confront the challenges in maintaining stability, sustainability, and security. The overlap between their efforts emphasizes this point. However, overall progress toward establishing a framework of norms and TCBMs for space activities remains achingly slow.

Part of the current problem is the deepening chill between Russia and the West. Russian-U.S. cooperation was a major driver of multilateral progress on space governance. Tensions over Ukraine, though, have affected Moscow's attitude and willingness to cooperate in almost every international forum. In space-related issues, Russia also has assiduously courted the developing world to its stance of skepticism about Western intentions for military uses of space and dominance of the environment to the detriment of emerging space users. The space arena is not immune from long-standing North-South political and economic tensions; indeed, issues such as access to orbital slots and radio frequency for communications satellites has long been an area of North-South dispute.

China, interestingly, has sometimes sided with Russia on space-related issues and sometimes has aligned itself with the West despite deep-seated mutual suspicions in Beijing about U.S. intentions regarding military space activities (and vice versa). For example, China continues to promote a new treaty to prevent the stationing and use of space-based weapons based on a Russian-Chinese draft, "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects" (PPWT), first proposed in 2008 and most recently updated in 2014.[37] It also is the key cosponsor with Russia of the GGE on the Prevention of an Arms Race in Outer Space that met for the first time on August 6-17, 2018, in Geneva – a GGE whose establishment the United States and several other Western countries opposed. On the other hand, according to numerous officials involved, China was actively and constructively involved in the LTS Working Group, sometimes even taking Moscow to task for its intransigence, and was supportive of reaching a compromise for a consensus document on the 21 agreed guidelines.

U.S. concern about Russian and Chinese efforts to develop and test offensive counterspace capabilities has also negatively impacted progress. Given U.S. military reliance on space assets, and the reluctance of Moscow and Beijing to discuss their somewhat suspicious testing activities, these concerns are understandable. Unfortunately, while U.S. strategy under the Obama administration focused on the need for both multilateral dialogue and restraint in space regarding military activities, the Trump administration has shifted to a more aggressive approach, including reverting to Bush-era rhetoric on the need for space "dominance" and accusing Moscow and Beijing of already weaponizing space.[38]

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[37] "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (Draft)," Ministry of Foreign Affairs of the People's Republic of China," 16 June 2014, http://www.fmprc.gov.cn/mfa_eng/wjb_663304/zzjg_663340/jks_665232/kjfywj_665252/t1165762.shtml, accessed 26 July 2018

[38] "Remarks by Vice President Pence on the Future of the U.S. Military in Space," White House website, Aug. 9, 2018, https://www.whitehouse.gov/briefings-statements/remarks-vice-president-pence-future-u-s-military-space/

This overall dynamic is worrisome, as it undercuts the ability of states to use diplomatic tools to reduce tensions and risks of conflict in space.

Further, as the number of space actors grows, the growing diversity in priorities, rationales, and perspectives on the use of space poses another obstacle to progress. Differences exist on issues such as potential constraints on space activities, especially constraints that increase the cost of entry, such as a requirement for specific technical measures to mitigate debris creation. There are also deep differences among actors regarding what constitutes legitimate military or self-defense activities in space. Resolving these tensions and developing mutual understanding about the threats and solutions to space security requires goodwill and concerted diplomatic engagement to avoid the creation of political "blocks" that impede progress.

The following sections outline concrete steps that individual states, coalitions of the willing, regional groups, multilateral fora, and NGOs can take to ensure that past progress is not lost and the groundwork for future action is laid.

Implementing agreements, a first step

Given that the GGE reached consensus on a number of recommendations, it would be logical to maintain the initiative's momentum and implement its recommendations. The fact that the GGE calls on states to adopt the recommendations on a voluntary, unilateral, bilateral, regional, or multilateral basis opens the path for leadership by the major space-faring states, especially the United States, but also Russia and China. The GGE also lobbies for more government interaction and cooperation with the private sector and NGOs, which would support the necessary cross-sector engagement. No longer are nation-states the only space actors: Private commercial space activities have eclipsed government activities in economic value, and barriers of entry have fallen to the point that even universities and NGOs can undertake space operations. These space NGOs should be engaged and educated about the value of a multilateral space governance framework. Commercial operators and space entrepreneurs, who have a natural skittishness regarding regulation, must also be brought into the large space security conversation.

While the LTS Working Group failed to agree on a final set of recommendations, the group did agree to 21 highly specific guidelines for best practices by space operators, whether government or commercial. Several of these best practices are already under consideration by some nations as part of their regulatory regimes. COPUOS further has urged Member States to voluntarily implement the agreed guidelines on an individual basis and to report on their actions to help provide models for others.[39]

The EU Code of Conduct is not likely to be resuscitated, but many of its provisions overlap with the recommendations of the GGE and the LTS Working Group. It of course would be possible

[39] "Draft Report, Chapter III," Committee on the Peaceful Uses of Outer Space, Sixty-first session, Vienna, 20-29 June 2018, A/AC.105/L.134/Add.7, 28 June 2018, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_105l/aac_105l_314add_7_0_html/AC105_L314Add07E.pdf

for the EU Member States to seek to establish the code's tenets through other instruments such as UN resolutions, via an internal EU agreement, or in national policy documents.

Given the overlap among the three initiatives, the following actions could be taken immediately.

Contacts and focal points

One of the first and relatively easy steps that could be taken unilaterally by any number of states would be to enact the GGE and LTS working group recommendation that states create focal points and contacts for data exchange, particularly in the case of potential collisions. Likewise, the EU draft code called for each subscribing state to establish a "central point of contact" responsible for reporting to the code's management organization of subscribing states. That state contact would not only provide notifications to the group but also be responsible for serving as a conduit for consultations.[40]

Indeed, the United States and China in 2015 stepped up political and military bilateral efforts to enhance dialog and improve mutual understanding. This includes China for the first time agreeing to direct military-to-military contact regarding potential satellite collisions.

The value of setting up contact nodes within organizations responsible for spacecraft management, including the private sector, is manifold. First, it forces national governments to identify and create linkages to all stakeholders and sets up channels for both internal and external communication. Identifying individuals as contact points creates ownership within stakeholder organizations. And finally, the creation of an international "space phonebook" lays the foundation for the development of easily accessible dispute resolution methods. Once a network of contacts is developed at the national level, information about the points of contact and about the information they exchange could be reported to various UN bodies, including the First and Fourth Committees, COPUOS, the Conference on Disarmament, the Office of Outer Space Affairs, and the International Telecommunication Union.

Indeed, the UN Office of Outer Space Affairs (OOSA) already has established a Registration Information Submissions Form (as part of its responsibility for managing the UN Registry of Outer Space Objects), which allows states to provide additional information when registering launched objects, including contacts for satellite operators.[41] Further, General Assembly Resolution 62/101, "Recommendations on Enhancing the Practice of States and International Intergovernmental Organizations in Registering Space Objects," adopted in December 2007, calls on OOSA to make public on its website known focal points within countries— although this has not yet occurred.[42]

Improving compliance and enhancement of the UN Registry

[40] European Draft Code, section 9, http://www.eeas.europa.eu/non-proliferation-and-disarmament/pdf/space_code_conduct_draft_vers_31-march-2014_en.pdf

[41] "Registration Submission Information Form, as of 1 January 2010, United Nations Registration Of Objects Launched Into Outer Space, United Nations Office of Outer Space Affairs, http://www.unoosa.org/pdf/misc/reg/regformE.pdf

[42] "Resolution adopted by the General Assembly on 17 December 2007, *on the Report of the Special Political and Decolonization Subcommittee (Fourth Committee) (A/62/403),* Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects," General Assembly Sixty-second session, agenda item 31, January 10, 2008, A/RES/62/101, http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/62/101

States could also undertake unilateral and multilateral initiatives to improve compliance with, and enhancement of, the UN Registry of Space Objects. Again, both the GGE and the LTS guidelines called for universal adherence to and implementation of the Registration Convention, as did the EU code. The COPUOS chair's draft working group 2014 report noted: "The lack of comprehensive information on objects launched into orbit results in a patchy and incomplete picture of what is in orbit and where. This affects space situational awareness, and ultimately safety too, if a potentially hazardous situation arises and inadequate information is available to identify a space object and/or its operators, or it is unclear under whose control or jurisdiction the object falls."[43]

In particular, the final report of Expert Group B, made to the Scientific and Technical Subcommittee in June 2014, explained in some detail that there are a number of gaps in satellite registration—including the fact that a number of nations are not parties to the Registration Convention.[44] Individual or groups of states parties should begin raising awareness and lobbying non-parties to join—through bilateral or multilateral consultations, Track 1 or Track 1.5 conferences, etc. This area is one where NGO advocacy could be of assistance.

Compliance is the responsibility of individual states and is an issue on which the United States could lead. Russia and China, major space actors and fellow laggards in registration compliance, could also become more active. The lack of U.S. compliance seems to be a consequence of poor oversight and accountability rather than a policy choice—thus a relatively simple problem to fix. All states parties should review their standing vis-a-vis the Registration Convention's obligations and fix any shortcomings as soon as possible.

One of the thorny issues impeding registration is the failure of states to agree on the rules for establishing the "responsible launching state" for a space object. This makes it difficult to assign responsibility for registering an object, particularly for payloads launched by one state on behalf of another, an increasingly common practice. According to McDowell, "The tradition that 'launching state' is to be interpreted as 'owner state' is now being challenged by some states."[45] Indeed, Switzerland has refused to register any of the satellites that it operates, arguing that this is the job of the state in which the launch vehicle operator is located. Part of this issue revolves around establishing liability in case a satellite malfunction causes damage to another operator or on the ground upon re-entry. This definitional matter needs to be squarely addressed and resolved. The LTS guidelines seek to create a pathway to doing so in Guideline A.5, which urges states to cooperate more closely when more than one state could be considered the launching state.[46]

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[43] "Draft Report of the Working Group on the Long-Term Sustainability of Outer Space Activities," Working paper by the Chair of the Working Group, Committee on the Peaceful Uses of Outer Space Scientific and Technical Subcommittee, Fifty-second session, 10 December 2014, A/AC.105.C.1/L.343, para. 50-53, http://www.unoosa.org/pdf/limited/c1/AC105_C1_L343E.pdf

[44] "Working report of expert group B: Space Debris Space Operations and Tools to Support Collaborative Space Situational Awareness," (hereafter Expert Group B report) Committee on the Peaceful Uses of Outer Space," Fifty-seventh session, 11-20 June 2014, June 16, 2014, A/AC.105/2014/CRP.14, p. 26, http://www.unoosa.org/pdf/limited/l/AC105_2014_CRP14E.pdf

[45] McDowell, "Adherence to the 1976 Convention … ."

[46] "Guidelines for the Long-Term Sustainability of Outer Space Activities: Conference room paper by the Chair of the Working Group on the Long-Term Sustainability of Outer Space Activities," Committee on the Peaceful Uses of Outer Space, Vienna, 20-29 June 2018, A/AC105/2018/CRP.20, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf

States could also unilaterally decide to include additional or more detailed information in their registrations—details such as: the final destination orbit of a satellite, its initial insertion orbit, loss of functionality, maneuvers (including movement to a disposal orbit), expected re-entry, and a change of ownership/operation authority. All of this data would improve space situational awareness and communication regarding potential collisions. Indeed, Resolution 62/101 calls upon states to provide additional information, such as the date of change in supervision; the identification of the new owner or operator; any change in orbital position; and any change of function of a space object.[47] Most of this data is easily available from space operators, whether they are governmental bodies or private sector actors, due to ongoing operational requirements.

Harmonizing data reporting to the registry would require multilateral consultations. One critical problem is establishing a fixed set of metadata on space objects. Currently, states provide differing data sets (sometimes not even completing those required by the convention), which makes it hard to undertake comparative analysis. The COPUOS Expert Group B notes with some dismay "the absence of internationally established and maintained system (sic) of registration of orbital launches …."[48] Such consultations could be established via a COPUOS Scientific and Technical Subcommittee working group and could be initiated by an individual state or a group of like-minded states. Another route would be for a state to propose an UNGA resolution to establish a working group under the Fourth and First Committees.

Other notifications

While the UN Registry is not set up to provide the other specific notifications recommended by the GGE, it could be modified to do so by expanding the current OOSA-developed submission form. States also have other options for doing so—both to UN bodies, such as the Secretariat and OOSA, as well as to other states. Developing a network of focal points, of course, would ease this process. These notifications include:

- pre-launch notifications
- notifications and monitoring of predicted high-risk re-entry
- notifications of emergency situations such as an out-of-control object on a collision course with another space object
- notifications of any intentional orbital break-ups

Indeed, Guideline A.5.7 of the LTS guidelines urges states to consider the recommendation of UN Resolution 62/101 on providing information about "any change of status" (such as malfunction), and/or changes in an object's orbital position.[49]

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[47] "Resolution Adopted by the General Assembly," *on the Report of the Special Political and Decolonization Subcommittee (Fourth Committee) (A/62/403),* United Nations General Assembly, Sixty-second session, (agenda item 31), January 1, 2008, A/RES/62/101, http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/62/101

[48] Expert Group B report, p. 26, http://www.unoosa.org/pdf/limited/l/AC105_2014_CRP14E.pdf

[49] "Guidelines for the Long-Term Sustainability of Outer Space Activities: Conference room paper by the Chair of the Working Group on the Long-Term Sustainability of Outer Space Activities," Committee on the Peaceful Uses of Outer Space, Vienna, 20-29 June 2018, A/AC105/2018/CRP.20, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf

The GGE report noted that the Hague Code of Conduct Against Ballistic Missile Proliferation (HCOC) provides a model for instituting a new reporting methodology. The 2002 HCOC, which was a U.S. initiative, has 137 signatories and includes Russia but not China and India, both of whom are major space-launching States.[50] While the HCOC is not universally considered to be a success, the actual reporting methodology could be copied—either by expanding the Registration Convention or via an ad hoc arrangement.

As for intentional orbital break-ups, the GGE recommends that a state informs others when it destroys an on-orbit object, including informing them of "measures that will be taken to ensure that intentional destruction is conducted at sufficiently low altitudes to limit the orbital lifetime of resulting fragments."[51] In addition, the report stresses that all such actions should conform to the UN Space Debris Mitigation Guidelines endorsed by the General Assembly in 2008.[52]

Developing a notification process would require multilateral consultations and agreement, yet such discussions could be kick-started by one or more states. The United States, by virtue of its leadership role in HCOC, would be a logical choice to galvanize this process. Another possibility is for regional organizations, such as the European Union, NATO, or ASEAN, to begin sharing such information among their memberships. It would be suboptimal, however, if these organizations conceived of different notification regimes; as such, coordination between them would be required.

Potential new multilateral initiatives

States could go beyond implementation of current treaties, resolutions, and the GGE/COPUOS LTS recommendations and launch new multilateral initiatives and approaches. Indeed, the COPUOS LTS Working Group identified a handful of important issues of space governance that it believes require more in-depth study before guidelines can be developed, including active debris removal.

Institutionalization and implementation of the Debris Mitigation Guidelines
Space-faring states could also discuss ways to institutionalize the UN Space Debris Mitigation Guidelines—first through national legislation and licensing procedures for satellite operators, and perhaps later through a legally binding instrument. This process could include suggestions for how emerging space powers could build capacity, which would be useful for stabilizing the space environment and creating trust.

The agreed LTS guidelines address debris mitigation at length in Guidelines B.1-B.5, which could serve as a template for both for individual state activity and for a binding multilateral agreement. Those guidelines are:

[50] "Hague Code of Conduct Against Ballistic Missile Proliferation (HCOC)," U.S. Department of State, http://www.state.gov/t/isn/trty/101466.htm
[51] GGE Report, paragraph 45, http://www.unidir.org/files/medias/pdfs/outer-space-2013-doc-2-a-68-189-eng-0-580.pdf
[52] "Space Debris Mitigation Guidelines of the Committee for the Peaceful Uses of Outer Space," United Nations Office for Outer Space Affairs, 2010, http://orbitaldebris.jsc.nasa.gov/library/Space%20Debris%20Mitigation%20Guidelines_COPUOS.pdf

B.1. "Provide updated contact information and share information on space objects and orbital events."

B.2. "Improve accuracy of orbital data on space objects and enhance the practice and utility of sharing orbital information on space objects."

B.3. "Promote the collection, sharing and dissemination of space debris monitoring information."

B.4. "Perform conjunction assessment during all orbital phases of controlled flight."

B.5. "Develop practical approaches for pre-launch conjunction assessment."[53]

The EU draft code explicitly would have committed subscribing states to implementing the UN Guidelines. By integrating the UN Space Debris Mitigation Guidelines into regulatory processes, governments could ensure operator compliance.

Unfortunately, not all states have incorporated the debris mitigation guidelines or, just as importantly, the IADC's technical guidelines, which flesh out the UN principles, into their practices or their regulatory systems for space launch and satellite operations. In its 2015 annual report, "Classification of Geosynchronous Objects," the European Space Agency (ESA) notes that 17 years after adoption of the IADC guidelines for geosynchronous (GEO) operations, "there is widespread compliance," but there are also problems. In 2014, 18 satellites in GEO reached the end of their lives, but only 13 were moved to the graveyard orbit set by the IADC technical guidelines.[54] In addition, at least four rocket bodies were left adrift in orbits close to or crossing through GEO. A review of recent European Space Operations Center (ESOC) reports shows that even major spacefaring states are re-orbiting objects too low, and, disconcertingly, satellites continue to simply be abandoned in GEO.[55] While the latest ESA Classification Report is less clear in reporting compliance statistics, it nonetheless indicates that compliance levels for GEO disposal in 2016 continued to hover at about 80 percent.[56] In addition, a study by the French space agency CNES found that 40 percent of all satellites and rocket bodies launched into low earth orbit (LEO) between 2000 and 2012 were abandoned in orbits too high for them to re-enter the Earth's atmosphere within the 25-year window specified in the space debris mitigation guidelines.[57] While governments and UN organizations have been loath to "name and shame"

[53] "Guidelines for the Long-Term Sustainability of Outer Space Activities: Conference room paper by the Chair of the Working Group on the Long-Term Sustainability of Outer Space Activities," Committee on the Peaceful Uses of Outer Space, Vienna, 20-29 June 2018, A/AC105/2018/CRP.20, http://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf

[54] "CLASSIFICATION OF GEOSYNCHRONOUS OBJECTS, Produced with the DISCOS Database," ESA European Space Operations Center (ESOC), 28 March 2015, Issue 17, http://www.astronomer.ru/data/0128/ESAclassification_Issue17.pdf

[55] For access to the ESOC reports going back to 2005, see: http://www.astronomer.ru/reference.php

[56] "CLASSIFICATION OF GEOSYNCHRONOUS OBJECTS, Produced with the DISCOS Database," ESA European Space Operations Center (ESOC), 28 May 2018, unavailable online but via request from ESOC

[57] "Cubesat Revolution, Spotty Compliance with Debris Rules Fuel Dangerous Congestion in Low Earth Orbit," Peter B. deSelding, *Space News,* Oct. 3, 2014, http://spacenews.com/4207665th-international-astronautical-congress-cubesat-revolution-spotty/

offenders, some space actors are clearly less concerned with abiding by the Debris Mitigation Guidelines than others. A thorough study of compliance with the guidelines over the past five to 10 years (based on ESA data, as well as observational data from amateurs) would put political pressure on outliers.

Adopting the COPUOS LTS guidelines would provide additional motivation for states. These guidelines would reinforce and augment the current UN Space Debris Mitigation Guidelines, and reporting on implementation would be established, thus putting pressure on governments to comply or risk being seen as irresponsible. Still, more work will be needed for states to agree about how to implement those guidelines—something that COPUOS could continue in future expert group meetings. If implementation agreements can be found, they could eventually be put into a legally binding instrument. Above all, emerging actors need to raise their awareness of debris mitigation and to build capacity to deal with the problem. Likeminded states, through OOSA or with select collaboration with NGOs and research universities, could put together a campaign for debris mitigation education that includes presentations at regional fora.

Public SSA database

As noted above, the GGE report cites lack of access by many states to "space-based information" as contributing to a deficit of trust and confidence at the international level. The recommendations by the GGE and LTS guidelines to share orbital data suggest a need for an internationally accessible database of space objects. The draft EU code also called for better orbital data sharing.

In addition, Russia has proposed that the COPUOS study a UN-managed space object database. Its proposal states: "The Russian Federation, having proposed for consideration the basic elements of the concept of establishing a unified Centre for Information on Near-Earth Space Monitoring under the auspices of the United Nations … is of the view that an in-depth examination of the feasibility of a UN-centric information hub gathering information on objects and events in outer space from different sources as a tentatively promising means of meeting general needs and aspirations, in particular, the needs of emerging space-faring States, would be reasonable."[58] Russia foresees the database being managed by UNOOSA and initially gathering data from states. A later stage might see OOSA providing conjunction analysis.

While the proposal for a UN database has been met with a chilly reception from Western states (which often are leery of creating new UN bodies for both political reasons and concerns about budgetary resources), there is widespread acknowledgement that better access for all space operators to SSA data is a crucial transparency and safety measure. The COPUOS Expert Group B report emphasizes this requirement, as well as the need for more accurate data and uniform standards of data collection and processing. There have been discussions within U.S. policy circles about the possibility of creating a new informal international group, along the lines of the International Committee on Global Navigation Satellite Systems (ICG), which was created in

[58] "Proposal on the review and consideration of the concept of a United Nations information platform serving common needs in collecting and sharing information on Near-Earth space monitoring in the interests of safety of space operations, and its architectural and programmatic aspects: Working paper submitted by the Russian Federation," Committee on the Peaceful Uses of Outer Space Scientific and Technical Subcommittee, February 9, 2015, A/AC.105/C.1/2015/CRP.32, http://www.unoosa.org/pdf/limited/c1/AC105_C1_2015_CRP32E.pdf

2005 under the auspices of the UN to promote voluntary cooperation on commercial satellite navigation issues and to discuss the challenges to space object data sharing and find ways to overcome them.[59] The creation of such a body would be an excellent first step and would increase "buy in" by a wide range of space actors. Any such body should include commercial operators in its membership.

In the meantime, space observers still lack a widely accessible space object catalog. The United States should be commended for its efforts to share SSA data and conjunction warnings with other states and private-sector actors. Yet, because the U.S. space object catalog and data analyses are the province of the U.S. military, there are limits on what data is shared. For example, the United States does not share raw observational data but rather data analysis regarding potential conjunctions. It also does not provide information regarding U.S. spy satellites that have malfunctioned and pose potential risks to other satellites. The military nature of the U.S. program has also engendered concern from non-U.S. actors regarding the reliability and availability of data. For example, the 2008 European Union decision to pursue SSA capability was predicated on the need for independence from the U.S. network. Indeed, it is because of these issues with data sharing – and the expense of providing a growing number of commercial providers with conjunction warnings – that the Pentagon proposed to shift responsibilities for commercial and foreign SSA data sharing to a civilian agency. President Donald Trump in Space Policy Directive 3 (SPD-3), signed on June 18, 2018, named the Commerce Department as the agency to take over those tasks.[60] However, that cannot be done without authorizing legislation in Congress, which is currently held up in a fight between the House and Senate about whether Commerce or the Department of Transportation should be in charge.

A broader issue is that the U.S. Space Surveillance Network (SSN) faces both technical and budgetary challenges to providing 24/7 space-tracking capacity for U.S. national security requirements, much less for use by the international community and global space operators. For example, most radar facilities used to track space objects are located in the Northern Hemisphere, making continuous coverage of an orbital object impossible.[61] In addition, the conjunction warnings provided by the U.S. military are advisory in nature and, according to satellite operators, often inaccurate and not reliable for decision-making about collision avoidance. "We discovered that the majority of conjunctions, or close approaches, were missed by the Joint Space Operations Center, and the majority of conjunction summary messages that went out advising us of close approaches were wrong," Richard DalBello, then vice-president of Intelsat General for legal and governmental affairs, told a February 23, 2012, conference audience.[62]

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[59] "International Committee on Global Satellite Navigation Systems (ICG)," United Nations Office of Outer Space Affairs, http://www.unoosa.org/oosa/SAP/gnss/icg.html

[60] "Space Policy Directive-3, National Space Traffic Management Policy," the White House, June 28, 2018, https://www.whitehouse.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/

[61] "USSTRATCOM Space Control and Space Surveillance," U.S. Strategic Command, http://www.stratcom.mil/factsheets/11/Space_Control_and_Space_Surveillance/

[62] "USAF Satellite-Conjunction Advisories Called Inaccurate," Frank Morring Jr., *Aviation Week*, February 24, 2012, http://aviationweek.com/space/usaf-satellite-conjunction-advisories-called-inaccurate. Note bene: the conjunction summary messages were replaced in 2014 by conjunction data messages based on an improved and internationally agreed data format.

It is for this reason that industry players decided to take matters into their own hands and create the Space Data Association (SDA) in 2009. Industry operators, after all, have the best telemetry on their own satellites. The non-profit SDA collects telemetry data from space operators who join and provides conjunction analysis to members.[63] There are some 21 members, including from the Arab states. No Russian or Chinese operators are yet members, although SDA is open to all. (SDA officials say working with Chinese and Russian operators might pose problems with U.S. export control regulations, but that, if any wanted to join, SDA would work with the U.S. government to allow them to do so.) SDA conjunction analysis is limited by its need for U.S. SSN tracking data on debris, which was arranged under an August 2014 agreement.[64] And while any space operator is welcome to join the group, data is not shared outside of the group. In April 2015, SDA and U.S. Strategic Command reached an agreement to stand up a "commercial prototype cell" whereby chosen space industry officials would work onsite with U.S. military personnel to better share SSA information and to allow industry data to be used by the military.[65]

Another SSA effort was launched in March 2014 by the U.S. firm Analytical Graphics, Inc. (AGI). AGI's Commercial Space Operations Center (ComSpOC) provides operators with highly accurate space object detection, tracking, and characterization. ComSpOC uses its sensor network of 28 optical telescopes and one passive radar to update observations hourly, with the overall goal of providing better quality conjunction analysis than can currently be provided by the U.S. SSN.[66]

While industry efforts are to be welcomed, they too are inadequate to provide truly internationally accessible data. Space operators from developing nations may not be able to "pay to play" and participate in these initiatives. Secondly, initiatives such as SDA and ComSpOC may be constrained in sharing data with some entities (such as Chinese space operators) due to their close, contractual connections to the U.S. military. The creation of an independent, publicly accessible space data catalog could fill this gap by compiling industry SSA data and observations of space objects provided publicly by amateur space watchers and space scientists.

Groups and individuals currently maintain several existing publicly available SSA databases; however, these have shortcomings, as well. The astronomical research arm of AGI, the Center for Space Standards & Innovation, runs the website CelesTrak, which monitors active satellites, as a public database for space scientists and astronomers. CelesTrak, managed by T. S. Kelso, features an online satellite catalog of active and decayed satellites based on data pulled from the U.S. public catalog.[67] Using CelesTrak requires a certain amount of technical expertise, however. McDowell also maintains an online list of satellites, as well as a separate list of geostationary satellites. Like CelesTrak, McDowell's data requires technical competency to use.[68] The Union of Concerned Scientists (UCS), a U.S.-based NGO, maintains a more lay-person friendly satellite

[63] Space Data Association website, http://www.space-data.org/sda/
[64] "Space Data Association and USSTRATCOM Reach Data Sharing Agreement," Marcia S. Smith, *SPACEPOLICYONLINE.com*, August 11, 2014, http://www.space-data.org/sda/
[65] "US JPoC to Create 'Commercial Cell Prototype' In Coming Months," Caleb Henry, *ViaSatellite*, April 10, 2015, http://www.satellitetoday.com/regional/2015/04/10/us-jspoc-to-start-commercial-cell-prototype-in-coming-months/
[66] "ComSpoc, Commercial Space Operations Center" website, AGI, http://comspoc.com/
[67] Celestrak website, https://celestrak.com/
[68] See Jonathan's Space Home Page, Dr. Jonathan McDowell, http://www.planet4589.org/space/

database of operational satellites.[69] While all of these sources provide information on civil and military satellites globally and are updated relatively frequently, they do not provide information on debris, and some do not provide information on the orbital positions of space objects.

Amateur sky-watchers also share satellite observation and tracking data through informal networks. One network, Heavens Above, maintains a satellite database on its website based on input from Strategic Command.[70] Another, SeeSat-L, is a mailing list for satellite observers.[71] Observer networks have proven important in tracking phenomena such as failed and drifting satellites, including the undisclosed failure of U.S. DSP-23 reconnaissance satellite in 2008, as well as keeping tabs on the U.S. Air Force's secret space plane, the X-37B.[72] Indeed, the U.S. Defense Advanced Research Projects Agency (DARPA) experimented with a small program called Orbit Outlook, designed to find a methodology for integrating amateur observations into the U.S. catalog, although the Air Force did not pick up the program for further development.[73]

Many states conduct research specifically on space debris, primarily using optical telescopes optimized for astronomical observations. As noted, the United States has the most comprehensive space object catalog including debris, but the Russian Space Surveillance System (which, like the U.S. SSN, doubles as an early-warning radar network) also tracks both satellites and debris.[74] The European Space Agency also keeps a space object catalog, the Database and Information System Characterizing Objects in Space (DISCOS).[75] One of the most important organizations for multilateral work on the debris problem is the Inter-Agency Debris Coordinating Committee (IADC), an intergovernmental body comprising 13 space agencies, including those from China, Russia, and the United States.[76] The IADC functions as a platform to share debris observations and research and promote collaborative efforts. The UN Space Debris Mitigation Guidelines came out of an IADC exercise, and the IADC continues to refine its own, more technical guidelines that can be voluntarily taken up by member agencies and other states. The IADC reports on its activities ever year at the annual meeting of COPUOS STSC.[77]

Another informal body, the International Scientific Optical Network (ISON), based at the Russian Academy of Sciences' Keldysh Institute of Applied Mathematics, specializes in observations of both satellites and debris in geosynchronous orbit and highly elliptical orbits.[78]

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[69] UCS Satellite Database, Union of Concerned Scientists, http://www.ucsusa.org/nuclear_weapons_and_global_security/solutions/space-weapons/ucs-satellite-database.html#.VTArNWTBzGc

[70] Heaven's Above website, http://www.heavens-above.com/

[71] SeeSat-L Home Page, http://www.satobs.org/seesat/seesatindex.html

[72] See "The On-Going Saga of DSP Flight 23," Brian Weeden, *The Space Review*, January 19, 2009, http://www.thespacereview.com/article/1290/1 "Secret X-37B Space Plane Spotted Again by Amateur Skywatchers," Joe Rao, *Space.com*, March 28, 2011, http://www.space.com/11240-video-secret-x37b-space-plane-skywatchers.html

[73] See http://www.darpa.mil/Our_Work/TTO/Programs/OrbitOutlook.aspx

[74] "Early Warning," *Russian strategic nuclear forces*, http://russianforces.org/sprn/

[75] "space debris" fact sheet, European Satellite Agency, http://www.esa.int/Our_Activities/Operations/Space_Debris/Analysis_and_prediction

[76] Interagency Space Debris Coordinating Committee (IADC) website, http://www.iadc-online.org/

[77] The reports can be found here: http://www.iadc-online.org/index.cgi?item=docs_pub

[78] Geosynchronous Orbit is roughly 36,000 kilometers above the Earth's equator, where satellites move in such a way as to remain over the same spot on Earth. This orbit is the key band for large communications satellites. Highly Elliptical Orbits have a perigee at very low altitudes (often under 1,000 kilometers) and an apogee at very high altitudes (often in the GEO band).

The ISON network is made up of 35 facilities in 15 countries (primarily in the Northern Hemisphere) utilizing more than 80 telescopes of various sizes and types.[79] ISON is well known for its work discovering faint objects in GEO. However, ISON's work is not publicly available, with findings released sporadically at various expert meetings.

Each of these systems and networks uses different methodologies for collecting, reporting, and analyzing orbital data. There is no "one-stop shop" that integrates them. An initiative that would bring all of this data together and provide a "master" catalog in the process would be provide a public service and arguably enhance ongoing government efforts. A crowd-sourced database, run by an independent organization, could serve as a kind of "halfway house" between what is publicly available today and the higher quality data kept by the United States and other states for national security purposes. In particular, an independently operated space object catalog could provide much needed transparency to those states and space operators that have little or no SSA capacity.

Active debris removal and on-orbit servicing

The COPUOS Expert Group B report of 2014 identifies active debris removal (ADR) and on-orbit servicing of satellites (i.e., for refueling or repair) as issues that should be raised to the Scientific and Technical Subcommittee for consideration. However, this is one of the issues that the LTS Working Group decided was too complicated to address during its deliberations. Both ADR and on-orbit servicing represent serious technical, political, and legal challenges. In addition, some observers are concerned—with reason—that these technologies could be applied to create space-based ASAT weapons. Developmental efforts by individual states could thus raise suspicions about intentions and contribute to space instability.

The scientific community agrees that even if strong mitigation measures are adopted by all space actors, the debris population is likely to grow, raising serious concerns about the safety and security of future space activities. The possibility of deploying ADR concepts to curb this problem has been studied for decades, but until recently there has been little impetus to seriously explore and develop the technology. While over the last several years a handful of commercial firms have set their sights on developing technologies, the technical challenges are complex and differ for removal of small debris versus large debris and for debris in LEO versus GEO. The Expert Group B report states: "Numerous independent robotic concepts, ranging from classical space-based propulsive tugs to momentum and electrodynamic tethers, drag augmentation devices, solar and magnetic sails, and ground- and space-based lasers have also been considered."[80] In addition, a DARPA study, called "Catcher's Mitt," in 2011 found that while medium-sized debris (5mm to 10cm) is the greatest threat to satellites, there is no feasible way to remove it at this time. The study recommended that any future development projects focus on removing large debris from LEO and GEO as a preventive measure (i.e., to prevent it from fracturing into smaller, more lethal pieces).[81]

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[79] "Current status of the ISON optical network," Igor Molotov, Vladimir Agapov, et al, abstract presented to the 40th COSPAR Scientific Assembly, August 2-10, 2014, Moscow, http://adsabs.harvard.edu/abs/2014cosp...40E2157M

[80] Expert Group B report, p. 27. http://www.unoosa.org/pdf/limited/l/AC105_2014_CRP14E.pdf

[81] "Threats to U.S. National Security Interests in Space: Orbital Debris Mitigation and Removal," Stephen A. Hildreth and Allison Arnold, Congressional Research Service, January 8, 2014, p. 11. https://www.fas.org/sgp/crs/natsec/R43353.pdf

In addition, there are legal questions surrounding how to ensure that ADR methods are compliant with the Outer Space Treaty and the Liability Convention, among other international legal instruments. One general problem is the lack of a legal definition of space debris. Further, under the Outer Space Treaty, it would be illegal for a state or commercial entity to remove a piece of debris without obtaining permission from the "owner" of that object—a fact that is complicated by the problem of identifying who owns what pieces of debris.

On-orbit servicing concepts rely on so-called rendezvous and proximity operations (RPO)—the ability to maneuver a vehicle into an orbit that is closely matched with another satellite and/or "dock" with that satellite to perform refueling or repairs. The ability to re-fuel and repair satellites would extend their lifetimes and potentially slow the growth of debris. NASA's Goddard Space Flight Center in 2010 did a comprehensive study of the value of on-orbit servicing and necessary technologies and called for a dedicated U.S. program.[82] This study, as have various others, found that technologies to conduct on-orbit services exist, although there are no active systems. The Expert Group B report notes: "However, other than NASA's Hubble Space Telescope, experience with on-orbit servicing (OOS) is very limited, and if done incorrectly OOS could create debris instead of reducing it."[83] In addition, the ability to maneuver close to and/or physically connect with a non-cooperative satellite would also enable an operator to disable or destroy it. This makes development projects politically fraught.

However, in the United States, there is an ongoing public-private partnership, sponsored by DARPA, to develop technical standards for on-orbit satellite servicing missions including remote proximity operations (RPO) that involve two space objects operating in close proximity (such as inspection of a faulty satellite) and those that involve physical contact (such as re-fueling of a large satellite, or active debris removal). Called the Consortium for Execution of Rendezvous and Servicing Operations (CONFERS), the initiative began in October 2017. The group is first reviewing existing standards for such space activities, then will recommend an initial set of new standards that the consortium hopes to be taken up by national and international industry standards organizations such as the International Standards Organization (ISO). These standards would be voluntary, rather than regulatory, and the aim is to grow CONFERS into a self-regulation body for RPO operators.[84] If the organization is successful, there is no reason that states could not move to incorporate these standards into their regulatory regimes as part of a space traffic management framework, or COPUOS could use the U.S. effort as a starting point for a new expert group. COPUOS could also create a working group under the Legal Subcommittee to examine the legal and political challenges to implementing ADR and on-orbit servicing systems, with an eye toward enabling and encouraging international cooperative development (or at a minimum establishing processes to ensure transparency regarding national developments).

Review of legal obligations regarding military activities

One of the foundational issues for multilateral space governance is the lack of clarity surrounding both space law, and, in particular, the application of the laws of armed conflict

[82] "On-Orbit Satellite Servicing Study: Project Report," National Aeronautics and Space Administration Goddard Space Flight Center, October 2010, http://ssco.gsfc.nasa.gov/images/NASA_Satellite%20Servicing_Project_Report_0511.pdf
[83] Expert Group B report, p. 28. http://www.unoosa.org/pdf/limited/l/AC105_2014_CRP14E.pdf
[84] CONFERS Fact Sheet, found at: https://swfound.org/media/206094/confers_onepager_jan2018.pdf

(LOAC) to military space activities. The COPUOS Legal Subcommittee has for years been debating foundational issues of space law, such as a definition of where outer space begins, with little progress. In addition, states have differing interpretations of how LOAC are to be applied in space. For example, how does one define the principle of "proportionality" of a response to an attack, especially a less than destructive attack, on a satellite? What restraints, if any, are inherent in LOAC on "space war?" Is radio frequency jamming a use of force, or an "armed attack" as legally defined? How do you distinguish "legitimate" military targets when most of the world's militaries use commercial satellites for communications, mapping, and other key functions?

The Australian government submitted a paper in 2012 to the GGE chair that sought to identify some key principles of international law that might be applicable to space activities, particularly debris, including LOAC, environmental law, and international telecommunications law. The paper noted that: "Acknowledgement of and commitment to these obligations by states could be expected to generally discourage the development and use of kinetic counter-space weapons."[85]

The Australian paper suggested that the GGE include in its report:

- "a reaffirmation of the applicability of international law to outer space, recognition of the contribution that working toward a common understanding of how international law applies to outer space can make to confidence-building and international security, and
- a recommendation that States consider potentially applicable international law obligations and principles when planning their space activities."[86]

The GGE did not take up the Australian suggestions, as legal issues were and remain contentious, as witnessed by the Russian proposal on self-defense during the COPUOS discussions. While discussions of constraints on military space operations are uncomfortable (indeed, unwelcome) for many states, the current situation where military space powers espouse differing interpretations of legitimate activities causes misunderstanding and tension. Reaching international understandings regarding what is and is not acceptable behavior by military forces regarding the use of space, and developing transparency and confidence-building measures around military activities, will be critical to ensuring international peace and security not just in space but also on Earth.

To elucidate these issues, two groups of independent legal scholars have been working to develop a common understanding of the legal framework that applies to military space activities.

The first is a project, led by McGill University in Montreal, to develop a legal "manual" to clarify "the fundamental rules applicable to the military uses of outer space, in times of peace, in periods of rising tension, and during armed conflict."[87] The Manual on International Law

[85] "Submission by the Government of Australia on building confidence through transparency on international law applicable to international security issues in outer space, submitted to the Chairman of the Group of Governmental Experts during the Plenary Session of the Conference on Disarmament in August 2012, found in "Disarmament Series 34, Transparency and Confidence Building in Outer Space Activities," UN Office of Disarmament Affairs, 2013, p. 79, http://www.un.org/disarmament/publications/studyseries/en/SS-34.pdf

[86] Ibid p. 80

[87] See "The MILMOS Project," McGill University website: https://www.mcgill.ca/milamos/

Applicable to Military Uses of Outer Space (MILAMOS) Project was launched in May 2016 and involves 35 independent legal scholars from around the world (including China, Russia, and the United States). There is a long precedent for the development of such legal manuals that have been subsequently adopted by national militaries to guide their actions, such as: the San Remo Manual on International Law Applicable to Armed Combat at Sea, the Harvard Manual of International Law Applicable to Air and Missile Warfare, and the Tallinn Manual on International Law Applicable to Cyber Warfare. The MILAMOS Project has three more international workshops currently planned prior to completing the manual: October 2018 in Beijing, November 2018 in Montreal, and February 2019 in Moscow.

Similarly, the University of Adelaide is leading an effort to develop the Woomera Manual On The International Law Of Military Space Operations that "objectively articulates and clarifies existing international law applicable to military space operations" with a focus on times of crisis and conflict. The effort, which is sponsored by the University of Adelaide, the University of Exeter, the University of Nebraska College of Law, and the University of New South Wales in Canberra, is expected to be completed in 2020. The project hopes to attract buy-in by states through a peer review process.[88]

The new GGE on PAROS will provide an opportunity for states to discuss their deep differences on military-related issues, even if at this moment it is hard to imagine a consensus document emanating from the exercise. Still, GGE could, for example, review the progress made by the two independent working groups on international law in space with regard to what consensus is emerging about current legal constraints on certain types of action placed by various laws. Further, discussions could be productive on how different nations interpret Article 51's right of self-defense. Before any agreements can be reached, it will be necessary for nations to understand each other's viewpoint on what is considered acceptable and unacceptable for use of military force in space. Moreover, agreement on any new legal instruments will be difficult, if not impossible, without baseline multilateral agreement of how current international law applies to space activities.

Space traffic management and small satellites

For decades, the COPUOS Legal Subcommittee has found consensus elusive, including on the question of what issues should be on its agenda. However, at its most recent meeting, April 13-24, 2015, the subcommittee agreed to two new agenda items for discussion with relevance to future space governance:

- "General exchange of views on the legal aspects of space traffic management," and,
- "General exchange of views on the application of international law to small satellite activities."[89]

[88] "The Woomera Manual On The International Law Of Military Space Operations," University of Adelaide website, https://law.adelaide.edu.au/woomera/sites/default/files/docs/Womera_Manual_CLIENT-MAY.pdf

[89] "Draft Report (Addendum 4)," Legal Subcommittee, Committee on the Peaceful Uses of Outer Space, 23 April 2015, A/AC.105/C.2/L.296/Add.4, http://www.unoosa.org/pdf/limited/c2/AC105_C2_L296Add04E.pdf

Germany proposed discussing space traffic management (STM) and suggested that the discussions "reflect on the concept of STM, on what it entails and on what consequences it would have for the organization and governance of space activities. In particular, the contribution of STM to the safety of space operations benefitting all users of outer space (whether they are established users or recent and future users) could be investigated. The item would also provide the opportunity to discuss the status of academic research in that field and to possibly invite presentations on the technical as well as legal background of this issue."[90]

The German proposal was built off of discussions held on the margins of an April 2015 meeting on STM.[91] While there is no accepted definition of STM or its scope, a 2006 study conducted by the International Academy of Astronautics (IAA), "Cosmic Study on Space Traffic Management," defined it as follows: "Space traffic management means the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio-frequency interference."[92] The study, while asserting a need for STM, also recognized that: "Space traffic management, however, will limit the freedom of use of outer space. Therefore an international consensus on internationally binding regulations will only be achieved, if states identify certain urgency and expect a specific as well as collective benefit—including an economic benefit—from this."

The agenda item on STM has been debated by the Legal Subcommittee every year since, with no consensus on how to proceed. The nub of the problem is that while some states (including Russia) believe an international body needs to be developed immediately to work out STM rules at the global level, other states (including the United States) believe that national rules should be developed first.

The 2006 Cosmic Study laid out a regulatory framework that covered all phases of space operations, from launch to end-of-life disposal, including: a process for provision of orbital data; a notification system including pre-launch and maneuver notifications; "zoning," "right of way" rules for maneuvering; safety provisions for launches, human spaceflight including tourism, and re-entries; debris mitigation and environmental pollution measures; and liability laws. Many studies since—including the 2007 report of the International Association for the Advancement of Space Safety (IAASS) that called for a new international agency to manage space traffic similar to the International Civil Aviation Organization—have elaborated on these ideas.

The IAA in 2017 finished a three-year follow-up study to the 2006 Cosmic Study that focuses on how to implement both technical rules and develop an international regulatory framework, and it argues for a "comprehensive, top down approach" to ensure coherence at the global level.[93] That

[90] "Proposal for a Single Issue/Item for discussion at the fifty-fifth session of the Legal Subcommittee in 2016 on: Exchange of views on the concept of Space Traffic Management," Proposal by Germany, Legal Subcommittee, Committee on the Peaceful Uses of Outer Space, Fifty-fourth session, 14 April 2015, A/AC.105/C.2/2015.CRP13, http://www.unoosa.org/pdf/limited/c2/AC105_C2_2015_CRP13E.pdf
[91] "Legal Subcommittee 2015, Fifty-fourth Session (13-24 April 2015," United Nations Office of Outer Space Affairs, http://www.unoosa.org/oosa/en/COPUOS/lsc/2015/symposium.html
[92] "Cosmic Study on Space Traffic Management," International Academy of Astronautics, 2006, https://iaaweb.org/iaa/Studies/spacetraffic.pdf
[93] "The IAA Cosmic Study on Space Traffic Management," IAA Study Management Team, presentation to COPUOS 6 April 2017, http://www.unoosa.org/documents/pdf/copuos/lsc/2017/tech-10.pdf

study, published in June 2018, is not yet available on the IAA website. However, a copy obtained by the author argues that the current "incremental, bottom up" approach to STM, while a more flexible process that can allow a more timely approach to key issues, comes at the cost of "fragmentation" leading to "possible incoherence" at the international level. The study recommends that a comprehensive approach be sought, with three layers:

> "Level 1. An Outer Space Convention (OSC). This would constitute the highest level of regulation, incorporating current international treaty law pertaining to space activities. The OSC would gather the principles of the corpus *iuris spatialis*, tackle the current difficulties in the interpretation and application of space law and provide for an adequate decision making mechanism.
>
> Level 2. Outer Space Traffic Rules (OSTR). The OSTR would be comparable to the ITU Administrative Regulations, i.e. rules of technical nature and treaty status at the same time, complementing and completing the OSC, binding on States parties to the OSC and governing STM at a global level. OSTR would be adopted by the States Parties to the OSC and be reviewed and updated in the context of international conference that would take place every 3 to 4 years, again similar to the ITU system.
>
> Level 3. Outer Space Traffic Technical Standards (OSTTS). This part of the comprehensive STM regime would be dedicated to the development and continuous review of technical standards for all elements of the Outer Space Traffic Rules. The function of OSTTS would be to enable the interoperability of space systems, to facilitate the international commercialisation of space technologies and to ensure a sustainable development of space traffic. OSTTS would be widely accepted standards that would support the certification and licensing activities of national and regional licensing authorities. The proposal, development and review of the OSTSS would be coordinated and supervised by an OSTSS Conference, which would take place very 3 to 4 years."[94]

By contrast, the Trump administration's "Space Policy Directive-3, National Space Traffic Management Policy" reflects the view that the United States, as the leading space power, should develop its own regime first, and then pursue the task of persuading other nations to follow. There is widespread agreement among U.S. government and industry officials that an international effort, much less the establishment of an international body, is premature and likely to postpone reforms that are needed by U.S. industry now. Japan, too, is studying how to craft its own STM regime. The Space Policy Directive-3 includes options for future regulation of new missions and new safety requirements for very small satellites and large satellite constellations.

Major satellite operators have become increasingly concerned about the proliferation of small and very small satellites in recent years. They have focused on four key issues related to the satellites:

- Very small satellites are difficult to track, especially when several are simultaneously

[94] Schrogel, Kai-Uwe et al (Eds.), "Space Traffic Management: Towards a roadmap for implementation," International Academy of Astronautics, June 2018, p. 17

released into orbit.

- Many of these satellites work at radio frequencies that do not require registration and coordination with the ITU; as such, they fall between the regulatory cracks (including at the national level).
- Most of these satellites are not capable of de-orbiting in line with the COPUOS and IADC Debris Mitigation Guidelines; at the end of their lives, they become de facto debris.
- Many operators of small satellites are new to space activities and are not well versed in their obligations under international law and regulatory regimes.

According to UNOOSA and the ITU, in a newly developed set of guidelines for small satellite operators:

> "Satellites may be grouped into different categories based on their mass (for example, mini satellites <1000 kg, micro satellites < 100 kg, nano satellites < 10 kg, pico satellites < 1 kg, femto satellites < 0.1 kg). However, as of today, there is no consensus or universally accepted standard on the definition of a small or very small satellite. A small satellite is not necessarily physically small as it may have deployable structures, it is not necessarily low-weight and neither does it have to be less complex or less capable compared to a satellite that is not considered to be small. Typical characteristics of small satellite missions include: a) reasonably short development times; b) relatively small development teams; c) modest development and testing infrastructure requirements; and d) affordable development and operation costs for the developers, in other terms "faster, cheaper and smaller". Some other characteristics often seen in small satellite missions are: a) they o0en involve actors new to space activities mainly non-governmental actors (academic institutions, private companies etc.); b) for various reasons, very often due to inexperience or unfamiliarity with the national and international regulatory framework, they are not always conducted in full compliance with international obligations, regulations and relevant voluntary guidelines (authorization, supervision, registration, ITU radio regulations, space debris mitigation guidelines etc.); and c) they have raised concerns to worsening the space debris situation."[95]

The COPUOS small satellites agenda item was proposed by the Group of Latin American and Caribbean states (GRULAC). According to the proposal, the purpose of the discussion is "to allow Member States and organizations that participate in the COPUOS Legal Subcommittee (LSC) to exchange views on and discuss the implications of the growth in small satellite activities in order to ensure these devices can fulfill their role in supporting the development of space programs. The discussion will illuminate whether Member States wish to undertake further work on this topic."[96] In addition, the GRULAC submission noted, "While regulations for the small satellite segment seems to be required, this activity should also be protected from over regulation" because of the satellites' role in fostering emerging space actors.

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[95] "Guidance on Small and Very Small Satellite Registration and Frequency Management," United Nations Office of Outer Space Affairs and the International Telecommunication Union, presented to the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, Fifty-fourth session, April 13-24, 2015, A/AC.102/C.2/2015/CRP.17, 13 April 2015, http://www.unoosa.org/pdf/limited/c2/AC105_C2_2015_CRP17E.pdf

[96] "Proposal for a Single Issue/Item for discussion at the fifty-fifth session of the Legal Subcommittee in 2016 on: 'Exchange of views on the application of international law to small satellite activities,' Submission by GRULAC, Legal Subcommittee, Committee on the Peaceful Uses of Outer Space, Fifty-fourth session, 13-2 April 2015, A/AC.105/C.2/2015/CRP.23/Rev.1, http://www.unoosa.org/pdf/limited/c2/AC105_C2_2015_CRP23Rev01E.pdf

The continued discussion of this issue within the COPUOS Legal Subcommittee is to be welcomed. Creating a level playing field for operators will require multilateral agreement on best practices and/or regulatory regimes. At the same time, individual states should find ways of incorporating these operators into their national regulatory and licensing regimes. Even if such satellites are not registered with the UN or ITU, under the Outer Space Treaty, states are responsible for national activities in space and are required to supervise activities by nongovernmental actors. Further, under the Liability Convention, states are responsible for damage caused by national actors. At a March 3, 2015, ITU Symposium on Small Satellite Regulation and Communication Systems in Prague, participants issued a declaration that confirmed "the importance of implementing national legal and regulatory frameworks in conformity with the above international instruments, clearing defining rights and obligations of every stakeholder participating in small satellite initiatives."[97]

The Prague Declaration, while urging the small satellite community to figure out how to comply with applicable laws, also recommended capacity-building for small satellite operators—both in the area of technological capabilities related to, for example, space debris mitigation and in the area of legal obligations. NGOs and academic research communities could contribute to progress on space governance by organizing and holding seminars, workshops, and training activities in these areas. Major governmental and commercial space actors should support such independent activities, because it is in the interest of both to ensure the growth of the small satellite sector and to prevent harm to the space environment.

After more than 10 years of debate, there is a growing international consensus that a STM regime is necessary but not about exactly what it would entail or whether establishing an STM regime is primarily the job of national governments or of an international body. Yet, because some of the foundational concepts of STM dovetail with recommendations from the GGE, the COPUOS LTS work, the COPUOS Legal Subcommittee discussion, and the EU draft code, STM is a ripe issue for near-term decision-making.

Further, there is no reason that work both at the "bottom up" level by individual and groups of states, as well as by industry and academia, could not progress in tandem with work to flesh out a roadmap for a comprehensive international framework. Given that there is an enormous amount of technical work to be done before reasonable policies can be set, a first step could be to parcel out different pieces of the technical problem to different subgroups, such as the IADC, the COPUOS Scientific and Technical Subcommittee, academic and industry organizations, the International Standards Organization (ISO), and any new inter-governmental group on orbital objects and activities as mentioned above, among others.

Meanwhile, policy development could continue at both national and multinational levels. Policies and regulations on very small satellite operations and the use of large multi-satellite constellations are already being considered by a number of states, given the vast amount of attention dedicated to the problem over the past several years by states and space operators. As

[97] "Prague Declaration on Small Satellite Regulation and Communication Systems," http://www.itu.int/en/ITU-R/space/workshops/2015-prague-small-sat/Documents/Prague%20Declaration.pdf

noted, in 2015, UNOOSA and the ITU developed a set of voluntary guidelines for small satellite operators to follow in registering their satellites and frequencies.[98] In the United States, as part of the ongoing debate within the administration and Congress about STM, the concept of equipping small and very small satellites with active tracking devices to improve on-orbit detection and tracking is gaining support. The Federal Communications Commission, which regulates access to radio frequency spectrum in the United States, in April 2018 proposed new legislation that would require very small satellites to carry a "unique telemetry marker" to allow them to be distinguished from each other and debris in space. Further, the FCC has proposed that very small satellites in LEO be required to de-orbit within five years.[99] Starting with debris-mitigation regulations for small satellites thus seems to be low-hanging fruit for national actions, followed by international coordination.

At the multilateral level, COPUOS members should be encouraged to follow through on the creation of an expert working group under the Scientific and Technical Subcommittee on issues related to new types of space operations, such as: very small satellites, mega-constellations, RPO, and active debris removal. The Legal Subcommittee could take up discussions of the legal requirements to implement the roadmap put forward by the new IAA study.

Commercial property rights on asteroids, the Moon, and celestial bodies
The question of property rights on, and exploitation of, celestial bodies has long been a highly contentious arena of international space law. But only in the past few years, as the activities of several commercial ventures have become more viable, has the issue gained immediacy, particularly in the United States. In particular, the plans by Bigelow Aerospace to develop lunar habitats, and the goals of commercial companies, such as Planetary Resources and Deep Space Industries, to develop technology to mine asteroids have pushed the U.S. government and Congress to focus on the legal and regulatory issues surrounding commercial access to the Moon and asteroids.

Bigelow Aerospace, founded by billionaire Robert Bigelow in 1999, is under contract by NASA to test its expandable space habitat technology on the International Space Station in 2015, but its ultimate goal is to deploy these habitats on the Moon beginning in 2025.[100] In late 2013, Bigelow made a formal request to the FAA's Office of Commercial Space Transportation asking for a so-called "payload review request" and making a case that the company has a right, under the Outer Space Treaty, to base its habitats on the Moon and should be protected by the U.S. government from interference.[101]

Bigelow's legal team argues in essence that, while Article II of the 1967 Outer Space Treaty

[98] "Guidance on Small and Very Small Stelllite Registration and Frequency Management," United Nations Office of Outer Space Affairs and the International Telecommunication Union, 2015, http://www.unoosa.org/documents/pdf/psa/bsti/2015_Handout-on-Small-SatellitesE.pdf, accessed 7 August 2018
[99] Chip Yorkgitis, "Tailor-Made: FCC Recognizes Need for Bespoke Rules for Smallsats," *CommLaw Monitor*, 22 April 2018, https://www.commlawmonitor.com/2018/04/articles/federal-state-regulatory/tailor-made-fcc-recognizes-need-for-bespoke-rules-for-smallsats/, accessed 7 August 2018
[100] "The FAA: Regulating business on the moon," Irene Klotz, *Reuters*, Feb. 3, 2015, http://www.reuters.com/article/2015/02/03/us-usa-moon-business-idUSKBN0L715F20150203
[101] "Hard Cheese," by K.R., *The Economist*, Feb. 16, 2014, http://www.economist.com/blogs/babbage/2014/02/lunar-property-rights

prohibits "national appropriation" of property on the Moon and other celestial bodies, it does not specifically prohibit commercial companies from doing so. Other space law scholars beg to differ. [102] As long ago as 2004, the International Institute of Space Law (IISL) issued a statement asserting that there can be no private ownership of celestial bodies, due to Article VI of the Outer Space Treaty, which makes nations responsible for the activities of private sector actors and ensuring that those actors are in compliance with the treaty.[103] The IISL stated:

> "Article VI of the Outer Space Treaty provides that 'States bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities,' that is, private parties, and for 'assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.' Article VI further provides that 'the activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.'
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> Therefore, according to international law, and pursuant to Article VI, the activities of non-governmental entities (private parties) are national activities. The prohibition of national appropriation by Article II thus includes appropriation by non-governmental entities…"

The FAA, in a December 2014 letter of response to Bigelow, agreed to the review, stating that the agency will "leverage the FAA's existing launch licensing authority to encourage private sector investments in space systems by ensuring that commercial activities can be conducted on a non-interference basis."[104] The FAA was quick to clarify that this did not represent an endorsement of Bigelow's claims to commercial property rights on the Moon but was instead a first step toward developing a U.S. government framework to clarify regulatory and international legal obligations regarding such proposed activities.[105] Such a review requires input from the plethora of U.S. agencies involved in space governance, including the White House Office of Science and Technology Policy, the State Department, the Defense Department, the Federal Communications Commission, and NASA. Indeed, the State Department has already signaled concern about the Article VI obligations involved, according to officials. It is therefore unclear how, and when, Bigelow's petition will be handled.

Meanwhile, the U.S. Congress—at the urging of space exploitation activists and Planetary Resources—has seriously taken up the issue of asteroid mining for resources such as water, oxygen, platinum, and other rare-Earth minerals. Planetary Resources, the firm founded by space entrepreneurs Peter Diamandis and Eric Anderson, in April 2015 launched its first technology demonstrator aimed at asteroid mining.[106] The company's most recent test satellite, a cereal-box

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[102] Article II of the Treaty on the Principles Governing the Activities of States in the Exploration and User of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty) states that: "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, nor by any other means." See: http://www.unoosa.org/pdf/publications/ST_SPACE_061Rev01E.pdf

[103] "Statement of the Board of Directors of the International Institute of Space Law (IISL) On Claims to Property Rights Regarding The Moon and Other Celestial Bodies," 2004, http://www.iislweb.org/docs/IISL_Outer_Space_Treaty_Statement.pdf

[104] Klotz, op cit.

[105] "FAA Moves to Establish Framework for Commercial Lunar Operations," Douglas Messier, *Parabolic Arc*, Feb 7, 2015, http://www.parabolicarc.com/2015/02/07/faa-moves-establish-framework-commercial-lunar-operations/

[106] "Akryd 3 Reflight (A3R) Launches from Cape Canaveral on Space X CRS-6," Planetary Resources website, April 14, 2015, http://www.planetaryresources.com/2015/04/arkyd-3-reflight-a3r-launches-from-cape-canaveral-on-spacex-crs-6/

sized craft called Arkyd-6, successfully tested the key instrumentation for controlling an asteroid-removal spacecraft in April 2018.[107] The company has since then faced serious financial troubles, however, and its fate is somewhat in doubt.

On April 13, 2015, the House Committee on Science, Space and Technology passed H.R. 1508, "The Space Resource Exploitation and Utilization Act of 2015," which sought to "establish and protect property rights for commercial space exploration and utilization of asteroid resources," according to its sponsor, Rep. Bill Posey of Florida.[108] The legislation asserted that asteroid resources are the property of the entity that obtains them and called on the Obama Administration to within 180 days issue recommendations on the responsibilities of various federal agencies with regard to space exploitation.[109] In the end, H.R. 1508 was folded into a larger bill on commercial space activities, H.R. 2262, passed by the House and Senate in November 2015 and subsequently signed by President Barak Obama to become Public Law 114.9.[110] The bill defines asteroid resources that can be extracted by commercial operators so as not to include living things, and gives companies the right to own, sell, transport, and use these resources in compliance with other U.S. laws. Legal scholars widely agree, however, that the law is controversial and that in future the United States will have to find a convincing legal argument to show that it is in compliance with U.S. obligations under the Outer Space Treaty and international law.[111] Indeed, already other OST Member States have raised challenges to the U.S. law, as many are concerned with the possibility of a "gold rush" for space resources in which most states cannot currently compete.

The exploitation of space resources promises many potential benefits, including to economic and social development on Earth, as well as to the enabling of space exploration and even the advent of space-based solar power. Yet, it also poses many risks to international stability and security. Unregulated commercial competition in space could lead to interstate rivalries and even conflicts over access. Given the enthusiasm with which commercial space entrepreneurs are pushing these activities, it behooves the international community to begin a serious discussion. The COPUOS Legal Subcommittee could, and should, add this item to its agenda—as resolving these questions will be critical to future space governance. In the meantime, the U.S. government needs to act quickly to establish its own legal and regulatory policies, because of its responsibilities and potential liability under Article VI of the Outer Space Treaty. The academic community could contribute to this debate by convening an international panel of legal scholars to study the issues and make recommendations.

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[107] Mike Wall, "Asteroid Miner's Arkyd-6 Satellite Aces Big Test in Space," Space.com, April 25, 2018, https://www.space.com/40400-planetary-resources-asteroid-mining-satellite-mission-accomplished.html

[108] "House Science Committee Approves Posey's Bipartisan Legislation to Promote Commercial Space Ventures," Office of U.S. Congressman Bill Posey press release, April 13, 2015, http://posey.house.gov/news/documentsingle.aspx?DocumentID=394237

[109] "H.R. 1508 – Space Resource Exploration and Utilization Act of 2015," (114 Congress 2015-2016), Congress.gov, https://www.congress.gov/bill/114th-congress/house-bill/1508/text

[110] For a history of the bill, see: https://www.congress.gov/bill/114th-congress/house-bill/2262

[111] Michael Dodge, "Public Law 114-90: Governing Commercialization and Space Resource Utilization," American Bar Association, https://www.americanbar.org/content/dam/aba/images/air_space/course/16-update/uc16-spl-space-act.pdf

Conclusion

As the number and diversity of space actors grows, the challenges to multilateral approaches to space governance are increasing. Established space powers have different priorities than do emerging space powers; military space powers have fundamentally conflicting goals (i.e., to do harm to each other if considered necessary) and different understandings of their legal constraints; and capacity to uphold international legal and political commitments varies widely. While there is widespread (if not universal) agreement on the problems facing the space domain, there is not consensus on what should be done or what should be done first.

The explosion in the number of commercial space actors—who have less stake in (indeed even some antipathy to) current or future governance regimes—complicates interactions between states. A growing commercial presence will require states to put in place new or modified national laws, policies, and regulatory regimes to ensure against chaos. The priorities of commercial actors—such as would-be asteroid mining ventures and micro-sat operators—are already forcing states to re-examine existing regulatory and legal regimes (both national and multilateral) with an eye to potential adaptation.

The stovepiped nature of multilateral fora and their sometimes-conflicting priorities and needs complicate addressing these challenges, which are by and large cross-cutting. Certain issues fall through the cracks, and others are debated through such a narrow lens that discussions fail to take into account potential second-order or cross-sectoral consequences. This is apparent, for example, in the Cold War-created mandates of COPUOS and the Conference on Disarmament, which seek to create a separation from issues of peaceful uses of space and military ones—despite the fact that those uses and functions have largely converged. Private and civil sector actors are also largely absent from these fora (with the exception of the ITU). Instead, these actors have sought and gained influence directly with their national governments regarding legal and regulatory regimes to support their own priorities, which may not coincide with international security needs.

These factors in part account for the international community's current focus on voluntary measures, norms of behavior, and transparency and confidence-building measures. The current environment is simply not ripe for the pursuit of legally binding treaties, nor, given the uptick in tensions among the three major space powers—China, Russia, and the United States—is it likely to be any time soon.

Despite these growing tensions, there are still steps that states or groups of states could—and should—take to move toward improved multilateral governance of outer space activities. The first should be endorsing and enacting the already-agreed-upon recommendations of the UN GGE on transparency and confidence building and the agreed LTS guidelines. Transparency and confidence-building measures are likely to be necessary precursors to an eventual multilateral accord. Unilateral actions by states would also create forward momentum and establish the foundation for future multilateral agreements.

States could commit to developing lists of contacts and focal points for space governance issues, in order to underpin transparency and provide avenues for discussion when worrisome situations

arise. States can also commit to improving compliance with the Registry Convention, especially major space-faring states who have little excuse for failing in their obligations. The registry could also be expanded, or an ad hoc process could be developed, to broaden notification of specific space activities such as pre-launch notifications and notification of satellite maneuvers.

Other opportunities include states committing to putting flesh on the emerging skeleton framework of space governance based on the work of the GGE, the EU draft code, and the COPUOS LTS Working Group, as well as in the legal arena. As a first step, states could move to institutionalize and implement the UN Space Debris Mitigation Guidelines to their fullest extent. Each state can do this unilaterally. COPOUS could also place on its agenda active debris removal and on-orbit servicing, as both will require multilateral accord to move forward. Other issues that could be elevated to COPUOS include space traffic management, with a particular emphasis on establishing controls on small satellite activities, and commercial property rights on the Moon and other celestial bodies, including resource extraction.

NGOs and the private sector could also take steps to move forward on multilateral space governance in a manner that encourages the expanding utilization of space, while protecting against risks to a safe and stable environment. Near-term initiatives could include the creation by a group of NGOs and private-sector actors of a public space situational awareness database and/or a review by independent legal scholars of the legal obligations regarding space resource extraction.

Additional paths to establishing multilateral space governance undoubtedly exist. What is needed at present is political will and leadership. It would be a pity if existing efforts are allowed to stagnate, or worse, erode.

About the Author

Theresa Hitchens is a senior research scholar at CISSM, where she focuses on space security, cyber security, and governance issues surrounding disruptive technologies. Prior to joining CISSM, Hitchens was the director of the United Nations Institute for Disarmament Research (UNIDIR) in Geneva from 2009 through 2014.